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INTRODUCTION

In year 2006 the Antarctic Station “Concordia” stayed open for the second consecutive wintering.

The Station is located on the polar plateau at a site known as Dome C (74°06’S, 123°21’E, height above sea level 3230 m). Concordia is a Station jointly owned and operated by the French Polar Institution IPEV and the Italian Antarctic Programme PNRA.

The wintering referred to in this document began conventionally on 8 February 2006, when the aircraft, a Twin Otter, made the last flight from Concordia to the Antarctic coast, leaving the Concordia’s party effectively isolated from the rest of the world. It ended on 5 November 2006 when the first flight of the new season reached Concordia.

The winter-over 2006 has been coded as DC 02. With reference to the Italian Antarctic Expeditions it takes its place between the XXI and the XXII Expedition. With reference to the French Antarctic Expeditions it takes its place between CE 05/06 and CE 06/07.

The Concordia’s wintering staff 2006 was composed of 10 persons:
Ly Phan Ming, Medical Doctor and Expedition Leader;
Lucia Agnoletto, atmospheric and geoscience observatories scientist;
Eric Aristidi, astrophysicist;
Omar Cerri, glaciologist;
Eliseo D’Eramo, mechanical engineer;
Shaun Jones Deshommes, Head Technical Services;
José Dos Santos, electrician;
Michele Impara, computer engineer;
Loic Le Bechet, cook;
Miguel Ravoux, plumber.

The present document ANT 06/11 contains the reports on the technical activities; the atmospheric physics and earth sciences; the glaciology and the astrophysics. The contributions have been left in their original languages, i.e. French the first and English the others.

At the moment of closing and printing this document the contribution on the medical activities is still missing. If made available, it will be enclosed in the next Concordia’s activity report, relevant to 2007 winter-over.
Winter-over 2006

From left to right: José Dos Santos, Michele Impara, Miguel Ravoux, Omar Cerri, Loic Le Bechec, Eliseo D’Eramo, Ly Phan Minh, Lucia Agnoletto, Eric Aristidi; lying down: Shaun Oliver Jones Deshommes.
STATION CONCORDIA

HIVERNAGE 2006 - DC02

RAPPORT DES ACTIVITÉS TECHNIQUES

SHAUN OLIVER JONES DESHOMMES

Date de création : le 21/10/05
Date de mise à jour : le 08/02/2007
PREAMBULE

Ce document est un résumé des activités du service technique de la station Concordia au cours du deuxième hivernage en 2006, DC02, entre le 8 février 2006, départ du dernier avion de la CE 05/06 et le 05 novembre 2006, arrivée du premier avion de la CE 06/07.

En tant que tel, il fait bien évidemment référence aux différents rapports établis tout au long de l’année :

- Rapport quotidien d’activités (mails)
- Rapport hebdomadaire (RHA SEMXX)
- Bilan mensuel des activités techniques (CRAM)

Ainsi, le détail des travaux se trouve dans ces différents rapports.
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1 COMPOSITION DE L’EQUIPE TECHNIQUE ET HORAIRES DE TRAVAIL

1.1 Composition

L'équipe technique de l'hivernage 2006 - DC02 à la station CONCORDIA est composée des 4 personnes suivantes :

<table>
<thead>
<tr>
<th>Nom</th>
<th>Poste</th>
</tr>
</thead>
<tbody>
<tr>
<td>D'ERAMO Eliseo</td>
<td>Mécanicien véhicules</td>
</tr>
<tr>
<td>DESHOMMES JONES Shaun</td>
<td>Responsable du service technique-Chef centrale</td>
</tr>
<tr>
<td>DOS SANTOS Jose</td>
<td>Electrotechnicien</td>
</tr>
<tr>
<td>RAVOUX Miguel</td>
<td>Plombier-chauffagiste</td>
</tr>
</tbody>
</table>

Remarques :
- Il est important de souligner la motivation tout au long de l'hivernage de la majorité des membres de l'équipe technique : cet esprit volontaire a permis de conduire les travaux d'hiver à leur terme.
- Une erreur de recrutement a été commise concernant l'électrotechnicien : n'ayant aucun intérêt pour le projet Concordia, cette personne a démissionné de son poste dès le début de l'hivernage. La plupart des travaux électriques a ainsi été gérée par le reste du personnel technique.

1.2 Horaires de travail

Les horaires de l'équipe technique ont été les suivants :
- Du 8 février au 6 novembre :
  - 8h-11h45 puis 13h30-17h30, du lundi au vendredi
  - 8h-11h45 le samedi avec manip pour 6 personnes (déchets, nettoyage) l’après midi

Tous les lundis à 8h00 : réunion de l’équipe technique

2 DEBUT D’HIVERNAGE

- Ce deuxième hivernage a débuté sans soucis majeur : les passations de consigne ayant durées près d’un mois, chacun avait eu le temps de connaître les installations en place ainsi que les modes de conduite nécessaire.
- Après la campagne d’été, il a fallu une semaine pour faire du rangement sur la plate forme, dans la base, et prendre pleinement possession des locaux.
- Le camp d’été a été définitivement clôturé le 14 février : échappements des groupes bouchés, aérothermes bâchés, tentes bouclées, conteneurs et futs rangés, nettoyage des locaux.

3 ORGANISATION GENERALE

3.1 Communications des activités

La communication des activités du service technique vers l’extérieur se sont réalisées au moyen de :
- Compte-rendu d’activités quotidien :
  - Mail
  - ENEA : direction, Carlo Malagoli
  - IPEV : infrapol
- Rapport hebdomadaire d’activités :
  - Rapport transmis au chef de mission chaque fin de semaine, qui établit le rapport pour toutes les activités de la station
  - Rapport final établi par le chef de mission, comprenant toutes les activités du site (techniques et scientifiques) adressé à ENEA : direction et IPEV : direction
- Compte-rendu mensuel des activités techniques :
  - Rapport chiffres des activités techniques du mois
  - ENEA : direction, Carlo Malagoli
  - IPEV : infrapol
- Sur des points spécifiques, mails ou téléphone

3.2 Organisation de la vie collective

En cours d’hivernage, le service (ménage, service à table, vaisselle, déchets …) s’est organisé de 2 façons :
- Service journalier : 1 personne
  - Ménage des sanitaires
  - Service à table et vaisselle (midi et soir)

Le cuisinier assure le ménage quotidien au 3 BB dans le salon, le couloir et le restaurant.
• Service hebdomadaire : 6 personnes (3 aux déchets et 3 au ménage), le samedi après midi
  - Collecte et traitement des déchets de la station, descente de ceux-ci dans les conteneurs dédiés
  - Approvisionnement en vivres
  - Ménages des parties communes : couloirs, escaliers, salle mail, salle de sport et salle vidéo

Il faut noter que durant tout le mois d’octobre un nettoyage intensif de la base (cloisons et sols des lieux communs et techniques, faux-plafonds et vides-sanitaire) a été fait impliquant tout le personnel de la base (technique, scientifique et médical) : En effet, après un an d’occupation, les locaux se salissent énormément.

3.3 Documentation du bureau technique

La documentation technique est rangée selon la grille de classement du service Logistique polaire de l'IPEV.

Par ailleurs, certains documents relatifs au site de Concordia mis en place pendant DC01 ont été complétés en cours d’année.

Cette documentation porte sur :
  • Cahiers de fonctionnement et fiches de suivi du matériel
  • Enregistrements pour le suivi des installations (relevés, fiches …)
  • Procédures / consignes pour l'exploitation de la station

Les procédures précisent l’organisation qui a été mise en place pour assurer le bon fonctionnement de la station et la bonne marche des différentes installations

3.4 Incendie

L’organisation en cas d’incendie s’est largement inspirée de celle mise en place lors du précédent hivernage. Quelques modifications ont néanmoins été apportées :

  • Installation d’un nouveau poste d’équipement incendie en face de la salle mail (BC) en redondance de celui ayant un local GWTU pour permettre une lutte plus efficace dans le bâtiment calme.
  • Mise en place d’une procédure pour les manches incendie : 2 rôles essentiels, 1- connaître précisément le matériel nécessaire en fonction du lieu d’intervention, 2- chaque personne de l’équipe des manches est désignée pour prendre le matériel nécessaire.

L’ensemble des hivernants a été formé au cours du mois de février, chacun ayant un rôle bien précis

Le premier exercice a eu lieu le 3 mars. Les suivants ont été faits tous les mois avec ou sans blessé.

Le système actuel de lutte incendie est opérationnel mais peut rapidement poser des problèmes (difficulté à amorcer la pompe, bouchon de glace dans la manche extérieure…). L’installation de la colonne sèche raccordée aux RIA facilitera grandement la lutte anti-incendie.

3.5 Déchets

La gestion des déchets est organisée en fonction des réglementations applicables en Antarctique et dans les pays par où les déchets vont transiter (Australie et France). Elle est aussi organisée pour créer le moins de manutention et désagréments possibles lors des différents transferts (raid, DDU, Astrolabe).

La gestion des déchets s’est normalement organisée dès le début de l’hivernage, chaque hivernant ayant préalablement été formé au tri, au conditionnement et au stockage des différents déchets

En pratique, 2 personnes désignées parmi l’ensemble des hivernants est en charge du compactage et broyage chaque semaine, le samedi après midi avec pour consigne de maintenir le local propre et rangé tout le temps et d’évacuer en cours de semaine si nécessaire (odeurs, écoulements) les déchets organiques. Les déchets sont tous descendus après ramassage dans toute la station. Les machines (compacteurs et broyeur) et le local sont ensuite nettoyées.

4 CENTRALES ELECTRIQUES

4.1 Centrale du camp d’été

- Au cours de l’hivernage, 3 essais de démarrage du camp d’été ont eu lieu (avril, juin, septembre). La procédure de démarrage est dans le classeur de consignes du site. Aucune difficulté majeure n’a été rencontrée, la procédure étant très clair a ce sujet.
- Un chauffage de 2kw a été laissé en service de façon permanente dans le conteneur ALSTOM ainsi que le CUMMINS de manière a faciliter un démarrage en cas d’urgence.
- Pendant la période nocturne, l’éclairage azimutal sur la centrale a été disposé pour un repérage plus aisé de Concordia.
- RQ :
  a) Par des températures de –70°C, le fuel dans les caisses journalières de la centrale ou du Cummens est figé.
  b) L’échangeur a plaques eau refroidissement groupe/eau chauffage a été démonté et intégralement nettoyé a cause de fuites constatées du cote primaire.
4.2 Centrale de Concordia

4.2.1 Fonctionnement des groupes

Le GE1 a tourné 2085h, le GE2 532h, le GE3 6176h et enfin le GES 51 heures. La priorité de fonctionnement a été celle du GE3 de manière à préparer sa visite de 18 000h pendant la campagne d'été 2007.

Le GE de secours a été démarré et mis en débit sur tout ou partie des applications une fois par mois au minimum et systématiquement après chaque intervention (mécanique ou électrique) sur le GES.

Le contrôle de la régulation des groupes(1/2/3) a été effectué pendant la campagne d'été : Chaque groupe ayant été testé à sa charge maximum :135 kW.

Des essais infructueux de câblage du régulateur manuel de tension ont été fait sur le GE3. Sur les autres groupes ces fameux boîtiers sont hors service, les interrupteurs 3 positions étant cassés.

4.2.2 Fuel

La caisse journalière des GEx est remplie 1 fois par jour à partir de la cuve en service F02. Celle de la chaudière a été rarement réapprovisionnée étant donné le peu de fonctionnement de celle-ci. Environ une fois par mois, il est nécessaire d'effectuer un transfert de fuel d'une cuve mis en réchauffage vers la cuve en service.

L'isolation des caissons extérieurs a été repris de manière à éviter de figer le GO lors des transferts

Le GES dispose de sa propre caisse journalière (maintenue pleine) et de sa cuve de fuel maintenue à la température de –25°C.

4.2.3 Alimentation électrique du camp d'été

Au cours de l'hivernage, en fonctionnement normal, les locaux suivants ont été alimentés ou chauffés au camp d'été depuis la station Concordia :

- Local radio (alimentation du shelter radio pour l'antenne HF 2kw)
- Conteneur du groupe électrogène Cummins (chauffage 2kw)
- Conteneur du groupe électrogène Alsthom (chauffage 2kw)

5 VEHICULES

5.1 Etat au 08/02/06, fin de la campagne d'été

Véhicules hivernés avant la fin de campagne d'été

- Kässbohrer PB270 (zone d'hivernage extérieure)
- Kässbohrer Flexmobil (zone d'hivernage extérieure)
- Grue Heila (zone d’hivernage extérieure)
- Nacelle (zone d’hivernage extérieure)
- -1 skidoo Polaris Frontier touring (joint de culasse HS)

Véhicules en fonctionnement au début de l'hivernage

- Toyota, -Merlot, -Bull D4D, -Chargeuse 953, -3 skidoos Aktiv, -1 skidoo Polaris, Transport Indy

5.2 Mise en hivernage des véhicules

<table>
<thead>
<tr>
<th>Véhicules</th>
<th>Date</th>
<th>Commentaires</th>
</tr>
</thead>
<tbody>
<tr>
<td>Merlot</td>
<td>06/02/06</td>
<td>• Mise en hivernage en raison de fuites d'huile hydraulique importantes, de manque d'huile et de pièces de rechange</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Zone d'hivernage extérieure</td>
</tr>
<tr>
<td>Bull D4D</td>
<td>06/02/06</td>
<td>• Garage du camp d'été</td>
</tr>
<tr>
<td>Toyota</td>
<td>06/02/06</td>
<td>• Problème d'alimentation en diesel avec les basses températures</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Garage du camp d'été</td>
</tr>
<tr>
<td>Aktiv :</td>
<td>06/02/06</td>
<td>• Garage du camp d'été</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Les Skidoos ont été disposés dans le garage et ensuite dans la tente temps libre, de manière a les visiter intégralement durant l'hiver</td>
</tr>
<tr>
<td>Skidoo Polaris transport indy</td>
<td></td>
<td>• Il a été utilisé durant tout l'hiver grâce a un certain nombre de modification pour supporter le froid ; prise d'air raccordée proche de l'échappement, résistance sous la courroie, isolation thermique du capot moteur, direction modifiée pour plus de souplesse. Tente Garage de Concordia</td>
</tr>
<tr>
<td>Traîneaux</td>
<td></td>
<td>• Extérieur à côté du garage de Concordia</td>
</tr>
<tr>
<td>Chauffage soufflants à essence sur traîneau</td>
<td></td>
<td>• Extérieur à côté du garage de Concordia</td>
</tr>
</tbody>
</table>
5.3 Vehicules au cours de l’hivernage
- La chargeuse 953B a été utilisée au cours de l’hivernage pour :
  • Mettre de la neige dans le fondoir
  • Déneiger la plate forme
Elle fonctionne de manière convenable mais montre de nettes difficultés passés les –65°C/-70°C (chenilles).
- Le Bull a été testé par –63°C : Son fonctionnemement a des températures très froides confirme l’idée qu’il peut remplacer la chargeuse en cas de soucis majeur.
- Le skiddo Polaris a permis de réaliser un grand nombre de déplacement tout au long de l’hivernage vers le camp d’été et les shelters scientifiques. En cela , il a été très utile.

5.4 Remise en service des vehicules
Avant l’arrivée du premier avion et pour préparer la campagne d’étë, les véhicules suivants ont été remis en service. Cependant, les skidoos ne sont pas en libre service.

<table>
<thead>
<tr>
<th>Véhicules</th>
<th>Commentaires</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grue Heila</td>
<td>• Pas de remise en service</td>
</tr>
<tr>
<td>Nacelle</td>
<td>• Pas de remise en service</td>
</tr>
<tr>
<td>Kässbohrer PB270</td>
<td>• Remise en service le 10/10/06 (chauffage sous bâche pendant au moins 24h)</td>
</tr>
<tr>
<td></td>
<td>• La chenille gauche a cassé le 25/10 lors de la préparation de la piste d’avion. Ceci est essentiellement du à l’ancienneté du matériel.</td>
</tr>
<tr>
<td>Kässbohrer Flexmobil</td>
<td>• Pas de remise en service</td>
</tr>
<tr>
<td>Merlot</td>
<td>• Remise en service début novembre avec nombreuses difficulté(problème hydraulique, de commande..)</td>
</tr>
<tr>
<td>Bull D4D</td>
<td>• Remise en service le 22/10/06.</td>
</tr>
<tr>
<td></td>
<td>• Fuite au niveau des vêrins</td>
</tr>
<tr>
<td>Toyota</td>
<td>• Pas de remise en service</td>
</tr>
<tr>
<td></td>
<td>• Attente de déneigement du camp d’été</td>
</tr>
<tr>
<td>Skidoos Aktiv</td>
<td>• Remise en service des 3 skidoos des le début de la campagne d’étë</td>
</tr>
<tr>
<td>Skidoo Polaris frontier touring</td>
<td>• Pas de remise en service.</td>
</tr>
<tr>
<td></td>
<td>• Attente de pièces pour réparation</td>
</tr>
<tr>
<td>Skidoo Polaris transport indy</td>
<td>• Pas de remise en service.</td>
</tr>
<tr>
<td></td>
<td>• Attente de pièces pour réparation</td>
</tr>
<tr>
<td>Chauffage soufflants à essence sur traîneau</td>
<td>• Extérieur à côté du garage de Concordia</td>
</tr>
</tbody>
</table>

6 TRAVAUX ACCOMPLIS
Les enjeux du deuxième hivernage étaient :
De valider les choix techniques retenus lors du premier hivernage
De poursuivre la finition des travaux déjà entrepris

6.1 Etat des lieux a l’interieur de la station fin octobre 2006
Le tableau suivant dresse l’état des lieux ainsi que les travaux réalisés, pièce par pièce, de la station Concordia à la fin de l’hivernage, fin octobre 2006.

1. CENTRALE ELECTRIQUE

<table>
<thead>
<tr>
<th>Chaufferie</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>• Les deux chaudières sont opérationnelles :elles sont testées chaque mois pendant quelques heures</td>
</tr>
<tr>
<td></td>
<td>• L’armoire transfert de gasoil a été modifiées pour faciliter la mise en route des pompes</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Partie atelier</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>• L’atelier est désormais bien équipé pour des travaux de type soudure et ceux liés a la centrale</td>
</tr>
<tr>
<td></td>
<td>• Un rangement du local a été effectué</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Partie centrale électrique</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>• Les trois groupes sont opérationnels et sont munis de leur extinction incendie automatique (CO2 10kg). L’essai de déclenchement CO2 est périodiquement fait pour vérifier la disjonction automatique sur les armoires de groupe ainsi que la signalisation sonore et visuelle correcte</td>
</tr>
<tr>
<td></td>
<td>• Des éclairages de secours ont été rajoutés au niveau des accès principaux.</td>
</tr>
<tr>
<td></td>
<td>• Mise a jour des voyants des armoires électriques de la centrale</td>
</tr>
<tr>
<td></td>
<td>• Pose de boutons « tests voyants » sur les armoires</td>
</tr>
<tr>
<td></td>
<td>• Armoire fondoir : séparation de la commande des résistances et de la vanne 3 voies, câblage de l’alarme température basse fondoir</td>
</tr>
<tr>
<td></td>
<td>• Confection de carter de protection pour les batteries des groupes</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Couloir (conteneur avec l'escalier d'accès à la centrale)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>• Le courant d’air glacial présent à la jonction entre les conteneurs de la centrale électrique et ceux de l’étage a été réduit en reprenant l’isolation sur l’arrière de la porte « produits chimiques »</td>
</tr>
<tr>
<td></td>
<td>• Une partie du matérier incendie (manches, lances …) est stockée au fond du couloir.</td>
</tr>
</tbody>
</table>
**Local de collecte des eaux usées (grises et noires) et GWTU**
- Le système de traitement des eaux grises, GWTU, ainsi que le système Evac sont opérationnels.
- Reprise de l’alimentation des différents bacs en eau avec du tuyau tricloair
- Le ventilateur du système de refroidissement de l’unité GWTU a du être remplacé : le nouveau a été modifié de manière à chauffer les roulements,
- Pose d’une tuyauterie fixe vers le bac a boues pour l’évacuation des eaux de retro lavage de l’UF
- Remplacement du glycol du circuit de refroidissement de l’unité par du CALTEX
- Pose d’une sirène pour la signalisation dans le local des alarmes techniques

**Local de stockage des produits chimiques:**
- Le conteneur doit être remplacé l’année prochaine en vue de la mise en place de l’unité de traitement des eaux noires, BWTU
- A noter que le conteneur aujourd’hui revêtu de bois (vaigrage) est inadéquat et trop petit pour le stockage des produits chimiques. Installation d’une étagère.
- Il est équipé d’un néon. Le chauffage est assurée par un radiateur électrique d’appoint, la porte extérieure n’est pas assez isolée et du fait du stockage des produits chimique, ne peut l’être. La température dans le local ne doit pas excéder les +4°C et doit passer sous zéro certaines nuit, malgré le chauffage. La température au sol est toujours sous zéro.

**2. TUNNEL ENTRE LA CENTRALE ELECTRIQUE ET LE BATIMENT BRUYANT**
- 2 urinoirs sont installés dans ce tunnel. Ils sont séparés par des panneaux en bois. Leur vidange ainsi que celle des boues produites par GWTU se déversent (via une canalisation tracée électriquement) dans le conteneur a boues. Ce système a montré son efficacité pendant l’hiver sous condition que les flexibles extérieurs soient suffisamment bien calorifugés. La cuve a boues étaient vidées approximativement toutes les 5 semaines

**3. BATIMENT BRUYANT**

**Monte charge**
- Le monte charge est opérationnel avec son casier de transport
- Un éclairage dans la trémie a été installé avec des boutons poussoirs à chaque étage
- Désormais un guidage de casier est absolument nécessaire pour éviter les chocs lors du déplacement du casier dans la trémie

**Vide sanitaire**
- Il est chauffé au moyen de 3 radiateurs,
- Des prises électriques ont été rajoutées au niveau des trappes d’accès.
- Etiquetage des panoplies de chauffage et des colonnes

**Niveau 1**

**Local sous-station de chauffage et groupe de secours :**
- Le groupe est opérationnel. L’aérotherme pour le refroidissement eau moteur a été installé et testé.
- Finalisation de l’extinction incendie autonome du GES ; câblage de la sécurité « arrêt du GES » en cas de déclenchement CO2 –
- Câblage du circulateur de secours de la boucle primaire
- Rangement du matériel plomberie derrière la sous station dans l’armoire près du GES
- Test du fonctionnement des résistances de secours VULCANIC
- Test du fonctionnement de la boucle primaire sur les 2 circulateurs des sous-stations

**Local déchets:**
- Les deux compacteurs et le broyeur sont opérationnels.
- La cuve journalière du groupe de secours est raccordée à la cuve extérieure : cette cuve a été déplacée car gênante pour la porte OTIS du 3BB
- Câblage des niveaux haut et bas de la caisse journalière du GES pour un fonctionnement en AUTO et un renvoi d’alarme sur CERBERUS

**Local bacs dégraisseurs:**
- Des étagères complémentaires ont été confectionnées pour le rangement de sachets INCINOLET et du matériel nécessaire au nettoyage périodique du bac

**Buanderie:**
- Deux machines à laver et deux sèches linges sont en fonction sur un rack confectionné pour gagner de la place. -Mise en place d’un petit plan de travail

**Incinolets :**
- Les trois appareils sont opérationnels. Ils fonctionnent par roulement, deux sur trois. Ces appareils ont été démontés pour nettoyage intégral a deux reprises,
- Essai non concluant de pose de plinthes en MONDO

**Local douche:**
- La douche et le lavabo sont opérationnels.
- Essai non concluant de pose de plinthes en MONDO

**Workshop:**
- Ce local sert actuellement de magasin pour le matériel technique (électricité, plomberie et autres).
- Ce local a été réaménagé avec des étagères supplémentaires, fixation de la fraiseuse, mise en place définitive du tour CELTIC.

**Local onduleur :**
- L’armoire ventilation BB a été installée au dos de la porte d’accès du local

**Bureau technique :**
- Le sol est très endommagé : un nouveau revêtement serait à prévoir dans ce local
- Pose d’étagères supplémentaires pour le matériel bureautique
<table>
<thead>
<tr>
<th>Niveau 1 et le niveau 2</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Escalier entre le niveau 1 et le niveau 2</strong></td>
</tr>
<tr>
<td>Le revêtement de sol est à faire.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Faux plafond entre le niveau 1 et le niveau 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Le circuit d’air comprimé vers les laboratoires a été tiré.</td>
</tr>
<tr>
<td>Ne reste que les joints à mettre en place. Des prises électriques ont été posées au niveau des trappes d’accès.</td>
</tr>
<tr>
<td>Étiquetage des tuyaux et peinture de la boucle primaire</td>
</tr>
</tbody>
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<table>
<thead>
<tr>
<th>Niveau 2</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Couloir</strong></td>
</tr>
<tr>
<td>RAS</td>
</tr>
<tr>
<td><strong>Toilette (cabine alla)</strong></td>
</tr>
<tr>
<td>Le WC ne sera ouvert que lorsque le traitement des eaux noires sera en place,</td>
</tr>
<tr>
<td><strong>Salle vidéo</strong></td>
</tr>
<tr>
<td>Des étagères complémentaires sont à prévoir. L’armoire actuellement en place a les vitres cassées.</td>
</tr>
<tr>
<td><strong>Salle de sport</strong></td>
</tr>
<tr>
<td>Réaménagement audio de la salle pour la diffusion musicale</td>
</tr>
<tr>
<td>- Mise en place d’une barre de traction</td>
</tr>
<tr>
<td><strong>Magasin sec et produits d'entretien</strong></td>
</tr>
<tr>
<td>- RAS</td>
</tr>
<tr>
<td>- Confection de nouvelles étagères pour du stockage et libérer une voie d’accès large jusqu’au différents rayonnages</td>
</tr>
<tr>
<td>- Du matériel médical d’intervention y est également entreposé comme les armoires de médicaments.</td>
</tr>
<tr>
<td><strong>Magasin vivres frais</strong></td>
</tr>
<tr>
<td>- Le sol n’est pas fait.</td>
</tr>
<tr>
<td>- Le magasin est actuellement rangé et presque vide en prévision de son futur aménagement,</td>
</tr>
<tr>
<td><strong>Magasin +4°C</strong></td>
</tr>
<tr>
<td>- Le magasin est rangé</td>
</tr>
<tr>
<td>- La régulation de température et brassage de l’air sont parfois parfois des vitres chaude, via les vitres cassées, dans le local. Il y fait donc régulièrement des températures negatives, provoquant des dégâts parmi la nourriture stockée !</td>
</tr>
<tr>
<td><strong>Local douche</strong></td>
</tr>
<tr>
<td>- Aménagement du local ; barre de douche, patères</td>
</tr>
</tbody>
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<table>
<thead>
<tr>
<th>Niveau 3</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Escalier entre le niveau 2 et le niveau 3</strong></td>
</tr>
<tr>
<td>RAS</td>
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</tbody>
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<table>
<thead>
<tr>
<th>Faux plafond entre le niveau 2 et le niveau 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nettoyage suite aux travaux et marquage des poteaux,</td>
</tr>
<tr>
<td>Des prises électriques ont été rajoutées au niveau des trappes d’accès.</td>
</tr>
</tbody>
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<table>
<thead>
<tr>
<th>Niveau 3</th>
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<tbody>
<tr>
<td><strong>Couloir</strong></td>
</tr>
<tr>
<td>RAS</td>
</tr>
<tr>
<td><strong>Toilette (cabine alla)</strong></td>
</tr>
<tr>
<td>Le WC ne sera ouvert que lorsque le traitement des eaux noires sera en place,</td>
</tr>
<tr>
<td><strong>Local plonge</strong></td>
</tr>
<tr>
<td>L’électronique de la machine à laver la vaisselle (neuve) est encore partiellement en panne, un Marche/Arrêt est nécessaire entre chaque lavage pour pouvoir lancer un nouveau cycle,</td>
</tr>
<tr>
<td><strong>Local stockage sec</strong></td>
</tr>
<tr>
<td>Ce local est aménagé et rangé,</td>
</tr>
<tr>
<td><strong>Local chambres froides</strong></td>
</tr>
<tr>
<td>Les frigos et congélateurs sont opérationnels,</td>
</tr>
<tr>
<td><strong>Cuisine/pâtisserie</strong></td>
</tr>
<tr>
<td>- Tous les accessoires et ustensiles nécessaires à son bon fonctionnement sont opérationnels.</td>
</tr>
<tr>
<td>- Une vitre articulée en poly carbonate a été posée au niveau du passe-plat du self afin de limiter les odeurs et la fumée dans le restaurant.</td>
</tr>
<tr>
<td>- Mise en place du poussoir de dérivation pour éviter l’utilisation du four a pain et le four</td>
</tr>
<tr>
<td>- Mise en place d’une grande trappe de visite sur la hotte aspirante pour faciliter son nettoyage</td>
</tr>
<tr>
<td><strong>Restaurant</strong></td>
</tr>
<tr>
<td>- Ce local est aménagé et fonctionnel,</td>
</tr>
<tr>
<td><strong>Local déchets dans la salle à manger</strong></td>
</tr>
<tr>
<td>- En hiver, ce local fut utilisé pour stocker du matériel,</td>
</tr>
<tr>
<td><strong>Salon</strong></td>
</tr>
<tr>
<td>- Ce local est aménagé et rangé.</td>
</tr>
<tr>
<td>- Une bibliothèque éclairée a été confectionnée pour le rangement des livres, revues et jeux.</td>
</tr>
<tr>
<td>- La machine à café est fonctionnelle. Un démontage intégral est nécessaire une fois par an.</td>
</tr>
<tr>
<td>Escalier colimaçon entre le niveau 3 et le toit</td>
</tr>
<tr>
<td>-----------------------------------------------</td>
</tr>
<tr>
<td>• La trappe de sortie sur le toit n’a pas été modifiée : il s’agit toujours d’une planche en bois.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Faux plafond entre le niveau 3 et le toit</th>
</tr>
</thead>
<tbody>
<tr>
<td>• RAS</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Toit du bâtiment bruyant</th>
</tr>
</thead>
<tbody>
<tr>
<td>• L’éclairage extérieur a bien fonctionné tout au long de l’hiver malgré les contraintes</td>
</tr>
<tr>
<td>• La trappe d’accès en bois n’a pas été isolée cet hiver. Une sortie de toit définitive est à poser</td>
</tr>
<tr>
<td>• Pose d’une sirène incendie dirigée vers les shelters scientifiques et test par très basse températures</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Escalier de secours du bâtiment bruyant</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Les escaliers sont glissants lorsque l’on porte des chaussures mouillées : prévoir une peinture antidérapante à poser</td>
</tr>
</tbody>
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<thead>
<tr>
<th>4. TUNNEL ENTRE LE BATIMENT BRUYANT ET LE BATIMENT CALME</th>
</tr>
</thead>
<tbody>
<tr>
<td>• La température au sol est en dessous de zéro, ce qui veut dire qui le nettoyage (lavage) est très difficile.</td>
</tr>
<tr>
<td>• Modification de l’alimentation électrique de l’éclairage et des prises : désormais démontable, l’escalier principal peut se déplacer plus facilement</td>
</tr>
<tr>
<td>• Mise en place d’un vestiaire suspendu en bois pour le séchage des combinaisons</td>
</tr>
<tr>
<td>• Mise en place des éclairages de secours pour la signalisation des sortie de secours</td>
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</tbody>
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<thead>
<tr>
<th>5. BATIMENT CALME</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Monte charge</th>
</tr>
</thead>
<tbody>
<tr>
<td>• La sécurité de fin de course du treuil est toujours HS et désactivées.</td>
</tr>
<tr>
<td>• Le casier de transport pour le bâtiment calme a été fabriqué,</td>
</tr>
<tr>
<td>• Un éclairage dans la trémie a été installé avec des boutons poussoirs a chaque étage</td>
</tr>
<tr>
<td>• Désormais un guidage de casier est absolument nécessaire pour éviter les chocs lors du déplacement du casier dans la trémie</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Vide sanitaire</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Il est chauffé au moyen de 3 radiateurs,</td>
</tr>
<tr>
<td>• Etiquetage des panoplies de chauffage et des colonnes</td>
</tr>
<tr>
<td>• Mise en place du matériel nécessaire pour le montage de la ventilation BC</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Niveau 1 :</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Couloir:</td>
</tr>
<tr>
<td>- La rénovation du revêtement de sol MONDO n’a pas été faite par manque des produits d’entretien adéquats.</td>
</tr>
<tr>
<td>- 2 armoires métalliques comprenant l’habillement et l’équipement d’un binôme de l’équipe pompier sont dans le couloir, près de la salle mail.</td>
</tr>
<tr>
<td>- L’autre partie du matériel incendie (manches, lances …) est stockée au fond du couloir.</td>
</tr>
<tr>
<td>- Le matériel médical d’intervention jadis entreposé a été déplacé de manière à libérer le passage pour un éventuel changement de porte sur le monte-charge.</td>
</tr>
<tr>
<td>• Zone Hôpital:</td>
</tr>
<tr>
<td>- L’hôpital a été réaménagé pour plus de fonctionnalité.</td>
</tr>
<tr>
<td>- Le local pilots prés de la salle de consultation a été aménagée( rangements, étagères, éclairage indépendant)</td>
</tr>
<tr>
<td>- Des détecteurs incendie ont été rajoutés dans ce dernier local ainsi que celui derrière la chaise dentaire</td>
</tr>
<tr>
<td>- Mise a la terre de la salle d’opération</td>
</tr>
<tr>
<td>• Douche de lourdes:</td>
</tr>
<tr>
<td>- RAS</td>
</tr>
<tr>
<td>• Toilette (cabine alla):</td>
</tr>
<tr>
<td>- Le lavabo est opérationnel. Le WC ne sera ouvert que lorsque le traitement des eaux noires sera en place.</td>
</tr>
<tr>
<td>- La cabine est fermée à l’utilisation pendant l’hivernage (moins de ménage à faire),</td>
</tr>
<tr>
<td>• Chambres médecin et Chef centrale:</td>
</tr>
<tr>
<td>- Pose d’étagères supplémentaires dans la sas de la chambre du chef centrale</td>
</tr>
<tr>
<td>• Salle mails et local onduleur :</td>
</tr>
<tr>
<td>- Le revêtement MONDO n’est pas encore protégé : de la moquette a été posée en attendant les produits adéquats.</td>
</tr>
<tr>
<td>- L’aménagement définitif de ce local est à prévoir.</td>
</tr>
<tr>
<td>- Pose d’un revêtement de sol étanche en tôle inox du local onduleur pour le stockage des batteries</td>
</tr>
<tr>
<td>- Éclairage indépendant du local mail</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Magasin technique:</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Le sol n’est pas fait.</td>
</tr>
<tr>
<td>- Ce local sert actuellement de magasin pour le matériel technique(plomberie, matériel incendie, appareil pour la supervision technique et incendie,)</td>
</tr>
<tr>
<td>• Local technique (sous-station de chauffage du bâtiment calme):</td>
</tr>
<tr>
<td>- L’armoire de ventilation BC a été posée au fond du local</td>
</tr>
<tr>
<td>• Sas de la porte du côté de la chambre du Chef centrale :</td>
</tr>
<tr>
<td>- RAS</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Escalier entre le niveau 1 et le niveau 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>• RAS</td>
</tr>
</tbody>
</table>
Faux plafond entre le niveau 1 et le niveau 2
- RAS

Niveau 2
- **Salle de bain hommes:**
  - La salle de bain est aménagée et opérationnelle,
- **Salle de bain femmes:**
  - La salle de bain est aménagée et opérationnelle (elle a été couramment utilisée en hivernage).
  - Le WC ne sera mis en service qu'après la mise en place du système de traitement des eaux noires,
- **WC :**
  - RAS
- **Chambres :**
  - Pose de stores aux fenêtres
- **Lingerie :**
  - Ce local sert à entreposer les malles vides des hivernants, la lingerie (draps, couettes) et du matériel divers
  - Une serrure a été rajoutée sur la porte pour limiter le désordre en campagne d’été
- **Couloir:**
  - RAS

Escalier entre le niveau 2 et le niveau 3
- RAS

Faux plafond entre le niveau 2 et le niveau 3
- RAS

Niveau 3
- **Couloir :**
  - Le photocopieur de la station y est installé,
- **Toilette (cabine alla) :**
  - Le lavabo est opérationnel.
  - Le WC ne sera ouvert que lorsque le traitement des eaux noires sera en place,
- **Local urinoir :**
  - Le lave-main est installé et opérationnel.
  - L’urinoir sans eau a été posé
- **Laboratoire (pièce n°31) :**
  - Le local nous a servit pour les vidéoconférences,
- **Laboratoire (pièce n°32) :**
  - Ce local est dédié à la physique de l'atmosphère ainsi qu'au laboratoire de magnétisme et sismologie
  - Le circuit d’air comprimé 10 bar y a été tiré
- **Laboratoire (pièce n°33) :**
  - Ce local est celui dédié à l'astronomie
  - Le circuit d'air comprimé 10 bar y a été tiré
- **Laboratoire (pièce n°34) :**
  - Ce local est actuellement dédié à la glaciologie et aux analyses d’eau de GWTU
  - Le local a été réaménagé à la demande de OMAR CERRI pour plus de fonctionnalité
  - Le circuit d’air comprimé 10 bar y a été tiré
- **Laboratoire (pièce n°35) :**
  - Le sol n’est pas encore fait.
  - Le local a servit de lieu de stockage pour du matériel bureautique,
- **Salle radio :**
  - Installation des afficheurs de température sur l’armoire électrique pour les suivi des radômes des antennes extérieures FLEET et INMARSAT et câblage vers alarme CERBERUS

Escalier entre le niveau 3 et le toit
- Une trappe de sortie sur le toit définitive est à poser, actuellement il s’agit de planches en bois.

Faux plafond entre le niveau 3 et le toit
- Installation des sondes PT100( sur la gaine de soufflage d’air chaud des radômes) Contrôle de l’étanchéité des circuits d’air

Escalier de secours
- Les escaliers sont glissants lorsque l’on porte des chaussures mouillées: prévoir une peinture antidérapante à poser

Toit du bâtiment calme
- Pose d’une sirène incendie dirigée vers le camp d’été et test par très basse température
- La encore, l’éclairage extérieur a correctement fonctionné.

Portes de la station donnant sur l’extérieur
- Les portes donnant sur les escaliers de secours ainsi que la porte de la centrale sont toutes équipées d’éclairages.
- Le revêtement en fibre de verre des encadrements de portes se craquèle au froid,
• Remarque générale sur les portes qui restent à installer:
  - À l'ouverture de la porte, un système est nécessaire pour l'empêcher de taper contre la paroi du bâtiment ;
  - Porte ouverte, il faudrait un rappel pour pouvoir la refermer facilement ;
  - Une fois l'encadrement posé, le passage est trop étroit pour pouvoir rentrer les cages palettes ou prestobox ...(particulièrement pour le magasin sec) Avec le Merlot, nous avons utilisé la benne blanche pour monter le matériel aux étages en l’approchant le plus près possible de la paroi du bâtiment. De cette manière, les gens peuvent monter dedans pour décharger le matériel : système pas très sécuritaire, mais la seule façon de procéder à notre disposition
  - Un système de portique roulant serait éventuellement une solution

COMMENTAIRES :

• Evacuation des eaux
  - Le système EVAC d’évacuation des eaux noires n’a pas été utilisé en l’absence de l’unité de traitement des eaux noires,. Seule la cuve EVAC a été vidangée et nettoyée après la campagne d’été.
  - Le lavabo pour laver les instruments et la chaise du dentiste sont opérationnels. Les vidanges s’effectuent dans des bidons à vider régulièrement dans le carton de boues. Un système définitif d’évacuation pour ces eaux souillées doit être mis en place.

6.2 Etat des lieux à l’extérieur de la station fin octobre 2006

Un enneigement important est à noter au niveau de la cargo line (les cartons de boues sont sous la neige), sur la plate forme, entre les cuves conteneurs de fuel et d’eau ....

Tente Garage / Lâcher ballons

• La tente est chauffée au moyen de 3 radiateurs à eau chaude alimentés par le réseau de CONCORDIA et un poêle.
  - Un chauffage soufflant S+ a été rajouté durant l'hiver car il y faisait encore trop froid pour y travailler correctement
  - Renforcement du plancher sur toute la surface de la tente avec des madriers en bois
  - Sont stockés pendant l’hiver dans le garage :
    - La chargeuse 953 Caterpillar,
    - Le skidoo Polaris
    - 3 caisses
    - Des fûts de fluides divers (huiles, glycol …),
  - La tente sert également de local pour la préparation des ballons de sondage atmosphérique,
  - La tente garage s’avère petite pour les activités qui s’y déroulent. (réparations difficiles par manque de place : un véhicule doit en général être sorti, donc démarré …) et gonflage des ballons délicat). Un véritable garage en dur et convenablement chauffé, avec un portique intérieur de levage, serait vraiment un plus !

Fondoir

- Les portes du fondoir doivent être maintenues systématiquement fermées pour éviter toute pollution (fumées de la centrale notamment).
- Le fondoir a été nettoyé et vidangé et nettoyé 2 fois au cours de l’hivernage (mois de avril et octobre).
- Les portes du fondoir s’englantent rapidement côté intérieur des portes, ceci les alourdit énormément, rendant leur ouverture difficile. Un des panneaux a du être renforcé dans sa longueur a cause de ce phénomène. Le bois n’est pas le matériau le plus approprié car trop lourd et il se fissure.
- Mise en place d’un surbau sur le conteneur centrale pour limiter la chute de suies dans le fondoir

Cuves d’eau douce

Toutes les cuves disposent des mêmes équipements et pour les cuves en réchauffage, les armoires électriques dédiés sont équipées de régulateur de température et d’afficheur de niveau

• Les éclairages nocturnes sont très efficaces,
• Reprise d'isolation des caissons extérieurs avec de la laine de roche,
• Les 4 cuves d'eau ont toutes été raccordées au réseau de distribution pour tester la qualité de l'eau. Aucun problème de pollution de l'eau constaté(retour d'analyse)
• La résistance VULCANIC de la cuve WO2 a du être démonté pendant l'hiver (problème de disjonction par différentiel)

Cuves de gasoil

• Les éclairages nocturnes sont la encore très efficaces,
• Reprise d'isolation des caissons extérieurs avec de la laine de roche
• 16 cuves de fuel sont en place. Les câbles siliconés, sur les cuves se fissurant au froid, doivent être remplacés par du câble résistant

Autres cuves

• Cuve d’eau recyclée : Elle est remplie par la production de l’unité de traitement des eaux grises. Elle peut également être remplie par l’eau du fondoir,
• Cuve de boues : Durant l’hiver, elle était vidangée toute les 5 semaines environ dans les puits à boues en face de CONCORDIA,
<table>
<thead>
<tr>
<th>• Cuve de fuel F10 (AVCAT) : cuve dédiée au groupe de secours. Elle a été déplacée en octobre car gênante pour la porte OTIS du 3BB avec modification du tuyau d’alimentation vers la caisse journalière GES</th>
</tr>
</thead>
</table>

**Stockage du matériel technique**

- Tout les matériels restés à l’extérieur après la campagne d'été ont été, dans la mesure du possible, remis soit en conteneurs, soit dans des caisses en bois soit sur palettes et rangés à l'extérieur. Les conteneurs ont tous été fermés pour l’hiver.
- Les conteneurs en face de la centrale servent au stockage du matériel qui ne peut pas être rangés dans Concordia. Ils sont fréquentés tous les jours et sont utilisés comme magasins de pièces courantes.
- Le magasin sur terrain pour le stockage de toutes les pièces techniques est indispensable car il résoudra l'éparpillement des matériaux et rendra les inventaires moins laborieux !

**Eclairage entre le camp d’été et Concordia**

- En période de nuit, l’éclairage azimutal (60W) sur le toit de la centrale était allumée en permanence : elle est nettement visible depuis Concordia, et suffit à nous donner le chemin vers le camp d’été (même par mauvais temps).

**Eclairage extérieur sur la plate forme de Concordia**

- Les lumières extérieures ont donnés entière satisfaction pendant la période nocturne. Aucune maintenance particulière n’a été nécessaire, les lampes utilisées supportant bien le fonctionnement en milieu froid

**Pistes d’avion et taxi way**

- En prévision de l’arrivée du premier avion, les 2 pistes d’avion ont été préparées (Kass PB270 + herse) ainsi qu’une taxi way sur la cargo line, jusqu’aux pieds de la plate forme de Concordia.

### 6.3 Travaux concernant toute la station

#### 6.3.1 Nettoyage de la station

Notre DEEP-CLEANING a eu lieu tout le mois d’octobre :cloisons et sols des lieux communs et techniques, faux-plafonds et vides-sanitaire impliquant tout le personnel de la base( technique, scientifique et médical) : Après un an d’occupation, les locaux se salissent énormément.

#### 6.3.2 Réseaux d’alarmes techniques et incendie

Le réseau d’alarmes techniques et incendie Cerberus, opérationnel depuis mi avril 2005, a été testé et complété durant l’hiver. Les détecteurs incendie( fumée, thermique, flamme) ont tous été testés au mois de mai.

#### 6.3.3 Système de gestion de l’énergie : « énergie système »

Le système de gestion d’énergie est opérationnel depuis le mois de septembre 2005.

**Ce système permet de :**

- contrôler les températures de certains matériels et emplacements ;
- suivre les consommations d’eau et d’électricité ;
- mettre des plages horaires sur le fonctionnement de certains appareils de manière à répartir la charge électrique au cours de la journée ; délester certains équipements en cas de forte demande de puissance ; réguler le chauffage des bâtiments.

**Seront faits ultérieurement, après réception du matériel et/ou réalisation des travaux correspondants :**

- la régulation de la ventilation et de l’humidification dans chacun des bâtiments ;
- eventuellement une supervision des paramètres de fonctionnement de la centrale (température, pression, débit…)  

#### 6.3.4 Distribution d’eau et traitement des eaux grises

La distribution en eau (douce et recyclée) des bâtiments fonctionne efficacement. L’unité de traitement des eaux grises GWTU est opérationnelle. Un rendement moyen de 82% a été obtenu sur les 9 mois d’hiver 2006. Il reste à installer les fontaines d’eau douce dans les différents étages : 1BB, 2BB, 1BC et 3BC.

#### 6.3.5 Ventilation

Les réseaux de ventilation sont toujours en cours de pose.

Au cours de l’hiver, l’armoire électrique « ventilation BB » a été posée dans le local onduleur, raccordée aux différents appareils et testée. Actuellement le soufflage et la reprise d’air fonctionne dans ce bâtiment. Reste la régulation et l’humidification à mettre en place ( en attente des pièces ). Pour le BC, seule l’armoire électrique a été posée dans la sous-station de chauffage

#### 6.3.6 Identification des tuyauteries

La majeure partie des tuyauteries de la station sont identifiées au moyen d’étiquettes et/ou de peinture.

A été complété pendant l’hiver :

- La boucle primaire dans le BC et les faux plafonds avec de la peinture jaune
- Les gaines techniques et les nourrices pour le chauffage des bâtiments
- Les poutres maîtresses des 2 tours ont également été repérés avec leur position angulaire (étages, vides-sanitaires, faux-plafond, sous la station).
6.3.7 Réseau de chauffage à eau chaude

Ce réseau est opérationnel. Aucune modification n’a été apportée. Les résistances VULCANIC(24KW) de secours ont été testées en isolant les calories apportées par la boucle primaire. RQ : le chauffage de la tente garage est insuffisant en hiver, justifiant la mise en place d’un chauffage soufflant S+.

7 QUELQUES DIFFICULTÉS RENCONTREES

Au cours de l’hivernage, certaines difficultés ont été rencontrées : La liste ci-dessous peut servir comme un pense-bête pour l’hivernage prochain. Elle précise les difficultés rencontrées et ce qui a été fait pour y remédier dans l’immédiat et/ou à long terme.

- **Pompage du fuel : fuel figé dans les tuyaux en raison du froid**
  - Réchauffage du caisson sur la passerelle de fuel avec des leisters et des chauffages soufflants

- **Fonctionnement difficile des skidoos à partir de –45°C** (courroies de transmission rigides, huile se figeant)
  - Seul le POLARIS fonctionne suite à de nombreuses modifications
  - Hiverner les véhicules.

- **Fonctionnement difficile de la chargeuse à partir de –60°C**
  - Stocker la chargeuse dans le garage et l’utiliser uniquement pour les applications essentielles (fondoir et cartons de boues).

- **Gel de la canalisations d’eau à l’extérieur**
  - Ce problème ne devrait plus apparaître sachant que l’isolation des caissons a été reprise

- **Fondoir : alourdissement et blocage des portes**
  - Au cours de l’hiver, la partie intérieure des portes se couvre de glace, les alourdisant considérablement. D’autre part, elles sont souvent collées par la glace aux parois du fondoir.
  - Manipuler les portes avec précaution : ne pas les laisser tomber ...
  - Laisser la vanne 3 voies de chauffe du fondoir en marche forcée de manière à élever la température suffisamment haute pour fondre la glace.

- **Fondoir : pollution de l’eau douce**
  - Prendre toujours la neige dans la zone définie à cet effet et utiliser toujours le godet prévu.
  - Manipuler les portes avec précaution : ne pas les laisser tomber ...

- **Fuite d’eau dans le vide sanitaire et gel sur le sol du vide sanitaire**
  - Faire un tour d’inspection hebdomadaire et vérifier les cassettes EVAC.
  - Inspection de la vidange et de la cassette EVAC correspondante.

- **Fuite de liquides dans les faux plafonds**
  - Lors des transferts de vivres dans la station, mettre toutes les emballages cassés, percés ou douteux dans des bacs étanches en prévision de leur dégel.

- **Revêtement de sol MONDO**
  - En raison des difficultés d’entretien du revêtement de sol MONDO, port des chaussures et bottes interdit dans la station.

- **Câbles électriques : rigidité des câbles en silicone à partir de –50°C**
  - Les manipuler avec beaucoup de précaution, ils cassent facilement à partir de cette température.

- **Fenêtres**
  - Les fenêtres s’engagent au cours de l’hiver. Ne pas forcer sur les poignées au risque de tout casser.
  - Pour les déglacer, surtout ne pas utiliser d’objet tranchant … la meilleure solution est d’attendre le retour du soleil.

- **Difficultés d’utilisation du monte charge**
  - Fabrication d’une caisse en bois artisanale mais solide.
  - Faire attention lors de l’utilisation du monte-charge, ne pas trop charger la caisse en bois; être délicat lorsqu’on sort la caisse de la trémie.

- **Bouchon dans la cheminée d’extraction des fumées du GES**
  - Un système de récupération des purges de condensat a été confectionné. Penser à vérifier le niveau du joint hydraulique. Même système pour les fumées d’incinolet

- **Gel de l’ évacuation des eaux usées vers la cuve à boues**
  - penser a bien calorifuger tous le flexible et spécialement le raccord métallique CAMLOCK après chaque vidange
**8 CHIFFRES DE L’ANNEE 2006**


### CONSOMMATION DE FUEL

<table>
<thead>
<tr>
<th></th>
<th>Total Litres</th>
<th>Moyenne par semaine Litres/semaine</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>246 472</td>
<td>4 739</td>
</tr>
<tr>
<td>Centrale électrique</td>
<td>207 016</td>
<td>3 981</td>
</tr>
<tr>
<td>Chaudières</td>
<td>1 622</td>
<td>31</td>
</tr>
<tr>
<td>Chauffage des tentes</td>
<td>23 819</td>
<td>458</td>
</tr>
<tr>
<td>véhicules</td>
<td>14 015</td>
<td>269</td>
</tr>
</tbody>
</table>

### CENTRALE ELECTRIQUE DE CONCORDIA

- Heures de fonctionnement GE1: 2 085 heures
- Heures de fonctionnement GE2: 532 heures
- Heures de fonctionnement GE3: 6 177 heures
- Heures de fonctionnement GES: 51 heures
- Consommation de fuel (semaines 9 à 44): Par semaine Litres/sem: 3 766, Par jour Litres/jour: 538
- Energie par semaine en Kwh: 11 185
- Puissance instantanée en Kw: Moyenne kW: 75, Maximum kW: 130, Minimum kW: 52

### CHAUDIERES

**Forte dépendance vis à vis de la température extérieure et de la charge de la centrale électrique**

<table>
<thead>
<tr>
<th></th>
<th>Total Heures</th>
<th>Par semaine Heures</th>
<th>Par jour Heures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temps de fonctionnement en heures</td>
<td>1 622</td>
<td>3,67</td>
<td>0,5</td>
</tr>
<tr>
<td>Consommation de fuel en litres/jour</td>
<td>4,4</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### CONSOMMATION D’EAU POUR CONCORDIA

<table>
<thead>
<tr>
<th></th>
<th>Total Litres</th>
<th>Par semaine Litres/sem</th>
<th>Par jour Litres/jour</th>
<th>% du total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Consommation totale</td>
<td>656 424</td>
<td>12 623</td>
<td>1 803</td>
<td>109</td>
</tr>
<tr>
<td>Détail</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Eau douce</td>
<td>62 972</td>
<td>1 211</td>
<td>173</td>
<td>9,5%</td>
</tr>
<tr>
<td>Eau recyclée froide</td>
<td>315 848</td>
<td>6 074</td>
<td>867</td>
<td>48%</td>
</tr>
<tr>
<td>Eau recyclée chaude</td>
<td>277 604</td>
<td>5 337</td>
<td>762</td>
<td>42,5%</td>
</tr>
</tbody>
</table>

### UNITE DE TRAITEMENT DES EAUX GRISES

<p>| | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Volume total d’eau traité en litres</td>
<td>493 602</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Volume total d’eau recyclée produite en litres</td>
<td>378 342</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Volume total de boues produites en litres</td>
<td>115 260</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rendement moyen de l’unité en %</td>
<td>En moyenne 77%</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### CONSOMMATION DE FLUIDES DIVERS

<table>
<thead>
<tr>
<th>GAZ</th>
<th>HUILES</th>
<th>DIVERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oxygène</td>
<td>0</td>
<td>1 174</td>
</tr>
<tr>
<td>Helium(cadre)</td>
<td>3 cadres</td>
<td>5W30</td>
</tr>
<tr>
<td>Propane</td>
<td>2 bouteilles</td>
<td>Hydraulique ATF</td>
</tr>
<tr>
<td>Azote</td>
<td>1 bouteille</td>
<td>J26</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Glycol</td>
</tr>
</tbody>
</table>
Concordia Station - 2006 Winter Over Activity Report

Atmospheric Science and Earth Science - Ing. L. Agnoletto

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PROJECT: 2004/2.2 - Ozone Analyzer: Ozone surface concentration measurements
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PROJECT: 2004/2.6 - Meteo-Climatological Antarctic Observatory
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SECTOR: 6
PROJECT: 2005/6.1 - Physics and chemistry of the Atmosphere: STABLEDC
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I am in charge of the Atmospheric Science and Earth Science projects during the winter. I take care of the maintenance and operation of the following data acquisition instruments:

- **Concordia Weather Station**: Milos520 Vaisala AWS
- **Radiosounding System**: DigiCora III Vaisala Sounding System
- **Advanced Hygrometer**: VTP6 Thygan Meteolabor Hygrometer
- **Solar Tracker**: 2AP-GD Kipp&Zonen Tracker Gear Drive
- **CR10 datalogger and 2 Sun-Photometers**: CR10X Campbell Datalogger and Carter-Scott SP02 sun-photometers
- **CR23 datalogger, 3 Radiometers and 2 Pyrheliometers**: CR23X Campbell Datalogger, 2 Pyranometer CM 22, 1 Pyrgeometer CG 4, 1 Pyrheliometer CH 1 and 1 NIP Eppley pyrheliometer
- **Ozone Analyzer**: THERMO model 49C UV Photometric O₃ Analyzer.
- **2 Magnetometers, a three-axis Fluxgate Magnetometer and electronic data acquisition.**
- **2 Seismometers and data acquisition system**: Quanterra data logger, GPS timing and some workstations for auxiliary acquisition and data analysis.
- **12 m Tower** supporting weather sensors at different heights and CR23 datalogger

During the winter it has been necessary to improve the heating systems for the instrumentation installed inside and outside the scientific shelters to make possible the continuous data acquisition during the worst weather conditions. Heaters, thermostats and coats made up of heating insulator materials have been applied almost to all the instrumentation exposed to the severe environmental conditions.

As well a quite constant extraordinary maintenance has been performed on the electronics because of the instability of the power supply.

In collaboration with L. De Silvestri the software configuration of the Automatic Weather Station of Concordia has been adapted to allow data transmission through Argos Satellite and data logging of an added wind sonic sensor. Concordia AWS is actually transmitting data on the international circuit.

At the very beginning of the winter I installed a VTP6 Hygrometer and its control unit nearby Concordia Weather Station and I controlled the behavior of this new sensor to extreme conditions for all the period. A software (Hygrometer.vi) for the remote control and data acquisition has been realized.

Data analysis is necessary to understand the instrumentation behavior at the change of environmental conditions and to solve possible malfunctions.

Moreover I perform geomagnetic absolute measurements and I collaborate to study the correlation between weather conditions and precipitations through crystallographic analysis.

During the summer I collaborated to the installation of the Ozone Analyzer and BSRN station, making it easier to perform the extraordinary maintenance to the instrumentation.

At the beginning of the XXII Summer Campaign the sensors of the BSRN station have been replaced with new ones and improvement to the stability of the heating system and the leveling of the solar tracker have been brought on.

Detailed Laboratory Reports (password protected) are available on my personal Web Site (http://www.winteroverdomec2.it).

| Amount of acquired data: 22.4 Mb per day |
|----------------------------------------|-------------------------------|
| **Solar Radiation**                    | radiazio*.dat                  |
|                                       | fotom*.dat                    | 6000 kb |
|                                       |                               | 2500 kb |
| **Geomagnetism**                       | mmmddyy.dmc                   | 47 kb   |
|                                       | Smmmddyy.dat                  | 3122 kb |
| **Ozone**                              | ozo*_01m.him                  | 97 kb   |
|                                       | ozo*_30m.him                  | 4 kb    |
| **Meteorological**                     | dir: Concordia-yyyyymmd       | 1600 kb |
|                                       | Concordia-yyyyymmd_*.dc3db    | 6500 kb |
|                                       | yymmdd.log                    | 2 kb    |
|                                       | yymmdd.jpeg                   | 180 kb  |
|                                       | yymmdd.xls                    | 3 kb    |
|                                       | Dailyyyyyymmd.png             | 35 kb   |
|                                       | Archiveyyyyymmd.txt           | 1 kb    |
|                                       | CR23X*.dat                    | 6 kb    |
| **Seismology**                         | yymmdshell.doc                | 20 kb   |
|                                       | dir.CCO                      | 1700 kb |
| **Webcam**                             | dir: yymmd                   | 576 kb  |
Preliminary studies about statistical methods in the atmospheric sciences and C++ programming bases for my doctorate project at Siena University have been carried on during the year.

As well I worked to the realization of the poster “METdata: an integrated software for operational meteorological data”, in collaboration with L. De Silvestri and A. Pellegrini to present the development of the data acquisition interface, carried on during the IX
d and XXI expedition, as support to the Air Force service in the framework of the project for the renewal of the meteorological monitoring system across the runways of the Italian Antarctic Station MZS.

Timing

Every day:
- Routine activities for the maintenance of scientific instrumentation are performed.
  I go out during the morning and I reach CARO shelter where BSRN station and Ozone Analyzer are located. First it is necessary to perform a leveling of the radiometers and to remove crystal layers and snow lying upon the various sensors and from ozone analyzer inlet. I control acquired data and a daily report is edited about instrumentation time synchronization, evaluation of snow laying, accidental deficiencies and weather observations with particular attention to visibility. When diffuse light is present also during night hours these operations are repeated during the evening too.
  
- Data collection from the different acquisition computers in the data archive on Frostpoint PC.

Three times per week:
- If snow accumulation during the night has been copious it is necessary to go to Concordia Weather Station to clean its weather sensors too (two or three times per week).
- Sending of ozone and solar radiation data to the respective scientific groups.
- Checking of the acquisition system by remote control of the seismology observatory.

Weekly:
- Reading of seismometers offset and checking of the acquisition electronics at seismology shelter.
- Performance of geomagnetic absolute measurements at absolute measurement shelter.
- Downloading of the geomagnetic data and sending to the respective scientific groups.
- Backup of the whole data archive on an external hard disk.

Monthly:
- Downloading of the temperature data from the dataloggers located at geomagnetism automatic measurements shelter.
- Downloading of the acquired data from geomagnetic station located nearby aerosol shelter.
- Cleaning of the sensors upon 12 m tower and downloading of the data from its CR23 datalogger.
- Downloading of the data from Milos AWS flash memory card, conversion of the daily datasheets in a standard format and sending to CNR sever for the ozone group.
- Extraction, visualization and sending of the seismic major acquired events to check the proper working of the seismometers.
- Backup of the whole data archive on DVDs.

Each two months:
- Centering of the seismometers masses.
- Exchange of the magnetic tape where seismology acquisition system collects the data.
  
  About all the morning is spent outside for the ordinary and (very frequent) extraordinary maintenance and to collect daily technical information.
  
  During the afternoon acquired data are analyzed to check possible malfunctions in the instrumentation, data are sent to the respective scientific groups, I work on the possible problems that popped up during the checks of the morning and I carry on my PhD project.
  
  During the evening the radiosounding is performed (12:00 am UTC corresponding to 20:00 pm local DC time) and at about 21:45 pm I close the radiosounding procedure and I send data to meteorological air force service and meteo-climatological observatory servers.
  
  During the same satellite connection solar radiation data are sent to CNR server.

Displacement

The low temperature and the place that the “Clean Area” takes don’t allow the use of vehicles so the time spent to reach on foot the different scientific shelters has to be considered.

I cover an average distance of 2.5 km per day but I reached 9 km per day during the quite long periods in which there was a problem with data transmission from seismology shelter and to repeat several times the tests on the data line of the Hygrometer at MilosAWS.

Moreover after each black out (quite frequent on April and May) the tour to check the instrumentation without remote control (2.5 km long) and to download data (1.4 km) is not negligible.
Following detailed descriptions related to each project and some advices that I hope can help to work better.

Fig. 0 - Scientific shelters displacement; project at which I collaborate are underlined.
1. Concordia Automatic Weather Station
Location: 800 m from Concordia's towers, Southeast direction.

Summer quality surveys on data
During the summer a consistent request for Milos AWS meteorological data derived from scientific groups that were calibrating and installing their instrumentation.
Data have been daily qualified by the comparison with the other weather stations, Davis at the Summer Camp and American AWS 3 Km far from the towers.
Thanks for the support of Remote Sensing personnel (Corrado Fragiacomo) working at MZS for daily sending the American AWS data transmitted by Argos.

Data acquisition, conversion and dissemination
At the beginning of the winter I wrote the program MilosLogConv.vi in Labview 7.0 environment to convert to xls format the hourly data logged in daily files in Milos AWS Flash memory card.
I download monthly data from Flash memory card, the software performs the conversion of the txt datasheet to a usable format (xls) and produce print screen of the daily graphs (JPG) where Temperature, Relative Humidity, Pressure and Wind Direction and Speed are displayed.
This has been largely successful since during the stay at Concordia and thanks to these new files, I could carry on, in collaboration with Omar Cerri, a study about the correlation between precipitation and weather conditions at Concordia. The CNR Ozone research group could therefore receive quite real time data to study the correlation of ozone concentration with these parameters, and ask to me to perform strategic tests on the ozone analyzer.
After proper controls data are distributed to the scientists with the clause to wait for their publication on the official Meteo-Climatological Observatory Web Site before any public use.

Routine operation
Three times per week cleaning of the sensors is necessary. Snow accumulation is very consistent during the winter and it has to be removed from Temperature-Humidity sensor protection and especially from anemometers.
Temperature data could be over-estimated if snow deposition totally blocks the incoming air at the sensor. Wind speed acquired data sub-estimates wind speed even more than 1 m/s when the anemometers movement is slowed down by snow deposition (since January).
Under −50°C (since March) the ice generally stops completely the cold anemometer (not provided with heating).
During my stay at Concordia and analyzing wind data from the past year I noticed that above −50°C and since April, even when both wind sensor couples (heated and not heated) worked well, the heated anemometer sub-estimated wind speed compared to the cold one.
A hypothesis could be that snow infiltration in the inner parts of the heated sensor can produce a layer of water due to the sensor heating system. Due to the temperature raise, such layer stays close-fitting to the inner surfaces of the sensor. The successive slowing down of the temperature it freezes up, increasing its volume and producing a most important friction to the sensor movement from the inside.
This could be proved by observing the increase of the drift between the two signals from cold and heated anemometers with the decrease of the temperature during the daily oscillations (as shown in the following images from real time acquisition software) or even during a period of just two-three days (see examples in table 1).

The sub-estimation of the wind speed is greater for the heated anemometer than for the cold one when the temperature is low (-70°C). The difference decreases when the temperature rises up to –55°C.
Tab. 1 - Some remarkable events during winters 2005 and 2006 in which the wind speed sub-estimated is greater for the heated anemometer than for the cold one.

<table>
<thead>
<tr>
<th>T decrease</th>
<th>Rough T value</th>
<th>T increase</th>
<th>Rough T value</th>
</tr>
</thead>
<tbody>
<tr>
<td>25/03/05</td>
<td>-55 °C</td>
<td>26-27/03/05</td>
<td>-65 °C</td>
</tr>
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The **sonic wind sensor** installed during the summer does not work properly below –50°C, in these conditions its signal has completely no sense or there is no signal transmission.

Above –50°C, and during months characterized by marked snow accumulation (March and April), it is clearer than the cup anemometer and its measures could be more accurate than the other ones.

**Extraordinary maintenance**

Before the beginning of the real winter, some extraordinary maintenance was necessary to Milos AWS to avoid that ice and blowing snow could reach the inner electronic components.
I put insulation by thermo-constraining sheath in the open passage to the cables; I used butane to provide the heat for the insulating sheath.

It has been quite difficult and long to do the work taking care of the rigidity of the cables at low temperature.

**RH sensor behavior**

Since HMP45D (VAISALA) sensor has been replaced with a new one, the relative humidity measurement is quite better than the one of the preceding year. Observing the acquired data it is evident that during 2005 the working of the sensor was not good, signal remained quite fix at a value corresponding to 14-16% RH.

Since January 27th, 2006 (date of the replacement) the signal variations better reflect weather changes (their course follow the one of the temperature), and the previous bad behavior of the sensor is restricted to periods in which temperature is equal or below −70°C.

Anyway a sub-estimation of the real relative humidity is always present as shown in the following graph in which relative humidity recorded by the radiosounding probe at ground every evening at 12:00 am (UTC) is compared with measure coming from HMP45D.

---

![RH sensor behavior graph](image)

**Fig. 6** - Daily RH measurements at 12:00 am UTC since February to June are displayed for both radiosounding probe and HMP45D. In Delta_RH series are the differences between the values deriving from the two sensors. The equation in the graph could be used to slightly correct the inaccuracy of the RH value from HMP45D.

It is impossible to establish a correlation between the two measures since the probe stays on the ground during the ground check, while the HMP45D is installed at about 2 m from the soil.

Since the end of July a little structure to place the probe during the stabilization at a height of two meters has been placed by Eliseo D’Eramo near the place of the launch.

The results of one-month comparison show that it is possible to establish a correlation between the two sensors.
It is possible to correct relative humidity value from HMP45D by the well stabilized at ground RS92-K probe.

Comparison between weather conditions during the two winters at Concordia Station

In the graphics average monthly temperature, wind speed and wind chill regarding winter seasons in 2005 and 2006 are displayed.

- **Minimum temperature value** during the two years reached −80 °C and it is recorded on September 05th, 2006 at 2:37 am.
- Concordia is characterized by striking temperature variations. The **biggest temporal temperature variation** registered during 2006 reached 3.25°C/h, between June 25th - 26th (22:00 pm-2:00 am) temperature variation has been **+13°C along 4 h**!
- The **maximum thermic excursion** during the same day has been 23 °C on July 24th; the temperature passed from −71°C to −48°C.

In collaboration with L. De Silvestri the software configuration of the Automatic Weather Station of Concordia has been adapted to allow data transmission through Argos Satellite and data logging of an added wind sonic sensor. Concordia AWS is actually transmitting data on the international circuit.

Since the satellite transmitter doesn’t work below −40°C the AWS has been provided of a heating system made up of a small 70 W heater (plus thermostat 20±3°C) and an external insulating coat.
2. Soundings

Every day a radiosounding is performed at 20:00 pm local time (12:00 am UTC). When temperature is lower than –65°C it is necessary to wait 20 min for the RS-92 probe stabilization to external conditions after the blowing up of the balloon.

The rubber balloon (350 g) reaches the maximum height during the summer season. Following the radiosounding, in which the maximum height (26.004 m) has been reached, is displayed.
Fig. 8 - Some of the parameters recorded at different heights during a radiosounding: Temperature, Pressure and Relative humidity are displayed.

Fig. 9 - Wind Speed at different heights is displayed for the same radiosounding. In the graph is possible to notice the layer in which wind speed present an evident growth between 9,000 and 10,000 m, this is the reason because airplane fly above such altitude.
Since August 24th a new procedure for the launch of the balloons has been followed, it has been checked by Lorenzo De Silvestri, it consists in dipping the balloon in the kerosene before the blowing up so that paraffin creates a protective layer that make it firmer. Since that the maximum height increased more then 5000 m as evident from the graph.

A detailed procedure with advises to solve problems deriving from the use of Digicora III software to perform radiosoundings has been produced to allow to the future new personnel to continue the activity without drawback.

Fig. 10 - Height reached by the balloon during the year (red) is compared with ground conditions (T, RH) and pressure at the maximum height.

Fig. 11 - Balloon dips in the kerosene and launch of the probe

### RADIOSOUNDINGS REPORT update on 14/11/06

<table>
<thead>
<tr>
<th>N° days since the beginning of the activity 01-12-2005</th>
<th>N° executed radiosoundings</th>
<th>N° failed radiosoundings (no data)</th>
<th>N° uncompleted radiosoundings</th>
<th>N° impossible connections due to low signal quality, radiosounding sent with late.</th>
</tr>
</thead>
<tbody>
<tr>
<td>349</td>
<td>346</td>
<td>4</td>
<td>14</td>
<td>45</td>
</tr>
</tbody>
</table>

1. the balloon rips the plastic axis of the probe (wind too strong).
2. Digicora software error, it's compulsory to manually close the program losing data files.
3. problems with net board, files edt and std are missing.
4. no EDT no RH detection
5. pilot files missing
6. edt files are not saved, only edt and pilot files are present.
7. Digicora software error during archiving, there are not dc3db file and pilot files.
8. balloons explode at low height.
9. bad telemetry.
Tot radiosoundings with good result: Overhead 349 executed radiosoundings data of 287 of them have been correctly archived and sent in time to air force server, 45 have been sent the day after because of the low satellite signal quality, 14 have been sent in time but they are missing of part of the data files.

Tot faulty probe 8:
1 collects just the pressure, 2 doesn’t detect humidity and 2 don’t transmit data, 1 humidity measurement is unstable at ground, 1 humidity measurement stopped during the flight, 1 PTU sensor faulty, 1 connection problem to Digicora.

Tot exploded balloons before the launch 6:
In the local for the blowing up the temperature is too low and/or there is a factory bug.

Helium consumption (winter season):
14/04/06 Here in Concordia we received 7 racks of helium (with the new nipple), by the second and third raids. Until now I used two racks (one of which is an old rack) so we have 6 racks more. Here are stored three old empty racks.
During the summer I estimated the helium consumption that is 7 balloons/bottle, some balloons crash during the coldest days before the launch and it is necessary to use two of them.
For each of the bigger plastic balloons we estimated that the amount of helium is four times larger.
So using 20 plastic balloons you need 1 rack more.
06/06/06 Until now I used two racks (one of which is an old rack) and another is quite exhaust so we have 5 racks more.
21/06/06 Until now I used exactly three racks.
15/08/06 Until now I used exactly three racks but there was leak at the manometer for some days.
09/10/06 Until now I used exactly five racks.

3. VTP6 (Thygan) and Control Unit
The hygrometer sent from Meteolabor arrived at Concordia at the end of January. I installed it before the temperature became too low for the cables to work outside for a long time and to have the support of the logistic personnel to produce the appropriate pieces to mount it on the structure where is located the AWS Milos too (the hygrometer had no anchors to fix it).

Before the startup I put a multilayer insulation to cover the CU and a heating of 200 W inside the CU since the temperature was too low to put on the electronics.

Following more detailed technical information about the tests on data interface.
The Control Unit is installed very close to the VTP6.
The data interface is RS-485.
The data cable from the CU to the acquisition PC (in the lab) is a Belden cable with 4 couple of twisted wires, It is not shielded, and it is straight.
The distance from the CU and the PC is about 1 km.
The communication protocol is 2400,8,1,n as required.
For the moment I’m using an interface converter RS 485-232 (MODEL 2089 Ultra-miniature, DB-9 EIA/TIA to RS-485 Interface Converter from Patton) to interface the hygrometer with the pc. The sensor continued to work in the right way doing defrost cycles every 10 minutes until May (then ice blocked the ventilation system) but it’s impossible to communicate with it. The power supply is a little low (216-218 V AC) but is sufficient. The cable length is above the norm (500meters) but at this low baud rate it couldn’t be a problem. Shiel-de d cable is recommended but not compulsory.

I tested the integrity of the 1 km cable by some loop-back tests and other two Patton converter and all works well. I tested it also with a short data cable installing a heated tent near the CU to prevent damage to the portable pc (fig. at side), but the problem is not the length of the cable. I measured the resistance of the cable but it is not too high but voltages at the converter and at the CU don’t agree with Meteolabor indication.

I repeated all these measures with three different lengths of the cable (1 km, 200 m and 1 m long) and changing each time converter configuration and also wiring at the converter as following.

In collaboration with Meteolabor technical support we started to do further tests on RS-485 converter configuration.

The correct configuration for the converter is 4-wire/full duplex/Multi-point that means:

- **Receive Impedance:** High (16 kOhm typical) (S1-1 off) but because of the distance we tried also Low (120 Ohm) (S1-1 on) 4-wire mode (S1-2 and S1-3 off)
- **Echo Mode:** off (S1-4 off)
- **Carrier Control Method:** Constantly ON (S2-1 off)
- **RTS/CTS Delay:** No delay (S2-2 off)
- **“Xmt Off” Impedance:** High (S2-3 and S2-4 off)

I’m using the 4 wires and twisted pairs for Tx+/Rx- and Rv+/Rv- with the following connections:

- Transmit + of the CU to the Receive + of the converter and Transmit - to the Receive -
- Receive + of the CU to the Transmit + of the converter and Receive - to the Transmit -

I tried also vice-versa and exchanging – and + (on many converters the Tx and Rv data connectors are not marked correctly) connecting transmit of the CU to transmit of the converter and receive of the CU receive of the converter but the communication was impossible.

I tested all the possible combinations between the upper converter configurations and the wirings described, the voltages continued to be incorrect especially on computer side.

The hypotheses could be two:

- A converter RS 485-232 with its own power supply is necessary (we provide a Patton converter which requests power supply from pc serial plug RS-232) as technical support from Meteolabor advises. It seems that Patton converter does not have power supply, but uses power from the RS232 port. This usually is a little "dangerous" and sometime it works sometime not. The Converter they recommend is from W&T (Wiesemann und Theis, www.wut.de) this has been tested with their instrument, and works for sure. It has an external power supply (included). [http://www.wut.de/e-86201-ww-dade-000.php3?a=86201&b=0](http://www.wut.de/e-86201-ww-dade-000.php3?a=86201&b=0)
- The serial interface (RS-485) module onboard of Thygan’s Control Unit doesn’t work properly. In the while, as suggest from Andrea Pellegrini, I tried to interface the hygrometer with a weather station I have in the lab because there is an RS-485 interface upon it and it’s possible not to use the converter. I can’t receive answer from the hygrometer even in this way. The configuration I used is right I tested it with another device.

As asked the Patton converter has been tested with a new hygrometer at Meteolabor. The results: one of the configurations we already tried was right but it is not successful for the installation here in Concordia since the long cable and the fact that this converter has not a power supply circuit independent for the serial line.

Notes:
1) + and - are marked wrong
2) It does not work if the converter is set to 120-Ohm Impedance
   They do not really recommend using this device.
   It is preferable that converter is set on 120-Ohm impedance with a long line but Patton converter works in such a way only adding a small capacitor (0.01µF) to the bus (RCV+). The other problem might be the RS485 can only suffer about 7 Volt difference between computer ground and sensor ground. It is possible the converter is decoding something like 50Hz noise. The W&T interface (they recommend) has arrived with the
first flight to Concordia, it provides not only RS232/RS485 conversion but also galvanic isolation between the two devices, which eliminated the problem above.

The communication with the CU is now good but after some days the sensor stayed outside it started to have some problems in the measurement even at –35°C and under –50°C the ventilation cycle performed each ten minutes completely stops.

I realized the software for the control and remote data acquisition of the sensor in LabVIEW 7.0 environment. At the start up it performs a configuration of the sensor for the choose settings of measurement, it visualizes and stores the data and it performs a continuous check of the status of the system. Alarms for possible problems in the functioning are present.

The software is actually running but the functionality of the sensor is not really good.

In May I worked at the realization of a poster “METdata: an integrated software for operational meteorological data” in collaboration with L. De Silvestri and A. Pellegrini, to present the development of the data acquisition interface carried on during the XIX and XXI expeditions, as support for the Air Force service regarding the project for the renewal of the meteorological monitoring system across the runways of the Italian Antarctic Station MZS.

**Suggestion For Future Improvements**

- It is advisable to put in order the cables inside the weather station to make easier possible maintenance operations since the cables are completely stiff and moving them could cause breaks.
- In case of future installation of sensors with optics components, a heater to clean them from snow accumulation has to be planned and it will be necessary to increase power supply and dimensioning the cable to the weather station at least to 3.5 kW (1.5-2 kW to powering the heater).
- It is advisable to have a spare Flash Memory Card.

Connection box and RS485-232 converter for the data line of the hygrometer.
2004/2.4 BSRN implementation at Dome C
Collaboration started on Dec 6th, 2005.
Location: 700 m from Concordia towers, South-South West direction.

Installation of BSRN Station

During the summer 2005-2006 I collaborated with ISAC-CNR (Bologna, Italy) personnel to instal the station for the solar radiation monitoring.

The whole system consists of a solar tracker with shadow assembly upon which all the sensors have been mounted, 2 sun-photometers, 1 Pyrgeometer CG 4, 2 Pyranometer CM 22, 1 Pyrheliometer CH 1, 1 NIP Eppley pyrheliometer, 2 Campbell Dataloggers (CR23X and CR10X) and an acquisition pc.

At first logistic personnel realized a snow platform and the implanting of steel pipe to support the instrumentation, then we started with the displacement of the devices and the wirings between the platform and the shelter.

![Fig. 15 - Snow platform realization (2x2 m area, 2.8 m high)](image)

The CR23X data acquisition system for the radiometers and pyranometers has been placed inside the CARO scientific shelter close to the acquisition PC while CR10X datalogger (for the acquisition from photometers) and its power supply components have been placed inside a wooden insulated box on the platform at the base of the solar tracker.

After all the connections have been checked and the whole acquisition system tested, we proceeded with the horizontal leveling of the plane where radiometers are placed, of the radiometers themselves and the shadow structure, and the alignment with the sun of the pyranometers and the photometers.

Finally we realized an insulating multi-layer coat for the tracker and a further fitting-insulating box for the photometers.

The system has been checked up at each action.

Routine Operation

At least once per day it is necessary to clean the sensors from snow deposition and/or ice growth with an electric drier with a minimum power of 1,5 kW, to check the visibility of the sun at the upper pyranometer, and the leveling of the radiometers. If the bubble of the spirit level is out of precision (0.05° correspond to the bubble half outside the level circle) it is necessary to level the sensors.

A daily report about the maintenance is filled adding the temperatures of each component, the results of the system time synchronization, observations about sky status, visibility and weather conditions too.
4. 2AP-GD Kipp&Zonen Tracker

Maintenance at the tracker is limited to check that there are no obstacles to the movement of the cables, time synchronization and the control of the inside temperature. Temperature range is +20 °C (if temperature rises above this value a thermostat switches off the heating) till to –10 °C. Below this temperature an internal system control puts the tracker in home position limiting its movement. In April the temperature reached this limit and further precautions have been taken to solve the problem (see extraordinary maintenance).

Fig. 16 (left) - Vito Vitale works at the leveling of the system.

Fig. 17 (below) - Realization of the insulating coat, even at -25°C the heating is compulsory to melt the frozen glue of the aluminum band; an electric drier has been used.

Fig. 18 - During the summer months the snow deposition above radiometers is quite soft, after the cleaning the sun is enough to keep clean the sensors for several hours. During the winter the formation of a hard sub layer of ice is added to snow deposition and it is impossible to clean the radiometers and pyranometers without an electric drier. Beware to the use of the drier…the cold is very fast to act on the ventilation system and it is necessary to put on the machine outside the shelter until the engine is still warm. Even with this precaution it may finally crash.
The horizontal stability of the tracker along the day is not very constant so according with CNR scientists we decided to partially overcome the problem by leveling radiometers every day at the same time. Anyway the error in the horizontal plane is even less than 0.5° since when the CG 4 sensor (see after) is placed horizontally with the spirit level, the thermopile is horizontal within 0.5° and this is kept for each azimuth position in the 360° tour.

On May 10th the sun definitively goes down the horizon and the solar tracker led itself to home position (East) waiting for the next twilight (August 10th), but on August 2nd at 10:30 am the tracker began to move again for some hours following the sun from the position 17° Azimuth, 93° Zenith.

5. Radiometers, Pyraliometer and Sun-Photometers

Routine operation consists in the cleaning of all the sensors from snow deposition and ice formation, leveling of the radiometers and checking the alignment of the pyranometers with the sun to assure high quality measurements for global, direct and diffuse solar radiation, down-welling longwave radiation and AOT.

With the coming of the winter season the ice growth above the domes of the radiometers and the sensible windows of the pyrheliometer has become more and more important and the time for the cleaning has been fixed in the early (till reasonable) hours of the morning before the rising of the sun.

Since May 10th to August 1st the tracker stays in home position and the only sensor that continues to provide meaningful data is the CG 4 pyrgeometer. Anyway I continued to clean all the sensors to avoid dangerous piling up of ice and snow, I just stopped leveling CM22 radiometers since May 10th to August 3rd since also the diffuse radiation was completely absent.

Snow accumulation is more consistent for Eppley pyrheliometer than for the CH1 pyrheliometer since the last one has a circular protection to the sensible area that blocks quite well the blowing snow. For this reason CH1 signal has to be considered more accurate than the Eppley one.

In the same way ice formation above CG4 pyrgeometer (long wave radiation sensor) is less consistent than for CM22 radiometers.

Sun-Photometers keep themselves quite constantly clean, there isn’t ice formation above them, and just some snow accumulation sometimes can partially block the window of the lower one.

Ventilation and heating system runs continuously for all the radiometers, to stop it even for few minutes could be quite dangerous since ice could definitely block the ventilator.

On August 19th I performed some measurements to evaluate the light pollution arising from Concordia and the closest scientific shelters.

The background measurements started at about 18:15 pm in moon absence to have no traces of natural light.

I considered three elements of possible interferences: external light at CARO shelter, at Aerosol shelter and at Concordia towers.

Switching off these artificial lights data show that, even at very low luminosity level, they are not a disturbance for the sensors.
6. CR10X, CR23X Dataloggers and acquisition PC

Raw radiation data (from radiometers and pyrheliometers) are stored in the CR23x datalogger with a sampling frequency of 1 Hz while average data from sun-photometers are stored in the CR10x (located in the box at the base of the tracker) each 5 seconds.

Both of them are connected to the acquisition computer located inside CARO shelter where data are stored each hour. Time synchronization with the reference clock allows to obtain accuracy of about 3 sec.

For the first months time synchronization was set every 4 hours but it frequently failed since the inaccessibility of the server “domecpost” that works as reference clock. As consequence each time this happened the computer synchronized at a default time corrupting time reference of data files. Every time corrupted data files had to be reconstructed. For this reason time synchronization has been afterward set one per day and synchronization errors are almost disappeared.

Daily acquisition time drift is about 600 ms and it is a good accuracy since data are acquired with 1 sec frequency.

The wireless LAN provides the remote control from the station so to reduce loss of data. As well it is possible downloading data transfer from measurement site to Concordia Station to archive them.

After power cut event, wireless LAN is not quickly restored and an inspection at the shelter is necessary. Data are compressed and sent to Italy (about 10 Mb per week) to perform a near real-time processing of them by automatic procedures developed at ISAC-CNR.

Temperature System Control

The greatest problem at Dome C is the response of the instrumentation to the low temperatures and to their quick variations even in few hours.

After some improvements to heating and insulating (see extraordinary maintenance) tracker temperature is quite good, heating for sun-photometers has to be improved, a thermostat for the heating in the box where CR10x datalogger is located is necessary, PT100 probe for external temperature over-estimates real temperature of about 6°C, sometimes even more.

Inside the shelter the stratification of the air at different heights is really important even though the fan for the air circulation: temperature goes from –8°C at the ground to 23°C at 2 m height. A thermostat for the heating control of the shelter is necessary inside both the rooms.

In the following graphs the daily monitoring of the temperatures is displayed.
Extraordinary Maintenance

At the beginning of April, during some particularly cold days, the inner temperature of the tracker went down till –10°C blocking the movement. A further heating resistor and a thermostat for the temperature control has been installed (fig.18). Since it was impossible to reach the innermost part of the tracker but just to penetrate the exterior insulating coat, I realized also a second partial envelop on the back side.

The results are good; the tracker temperature never went down more than –5°C even at really extreme wintry weather conditions.

![Fig. 20 200 W heating plate and thermostat (+20°C) installed inside the tracker. In spite of the thinness of the plate and the small dimensions of the thermostat It has been really difficult to find the place to locate them.](image1)

At the beginning of May the wireless LAN was out of service as a consequence of a general black out at Concordia. More than one component crashed for the instability of the power supply, the network phone, the electric transformer of the Roam About access point and a port of the network hub have been substituted as soon as I found the spare components.

At the beginning of the XXII Expedition I received new material and the following improvement to the BSRN station have been implemented:

- Installation of two thermostats for temperature regulation inside the shelter (BSRN and Ozone rooms).
- Improved tracker leveling changing the old flange with a new firmer one.
- Moved the added heater and the thermostat that I installed during the winter, inside the body of the tracker. To do this it has been necessary to remove the external insulating coating. Actually the tracker contains a further 50 W heaters, a thermostat (20 ±3 °C) and a PT100 connected with a removable external display to control the inner temperature.
- Grease has bee added to the cogs of the engine.
- Pyranometers and Pyraliometers have been replaced with newer ones.
- At the end of the maintenance leveling of the whole system and pointing at the sun for the sensors have been set.
To perform these last operations the realization of a tent to work has been necessary.

At the end of the work good results for the improvement of the leveling and pointing at the sun have been reached.

**Suggestion For Future Improvements**

- It could be useful to acquire data also from the tracker to record the exact sun position (Azimuth and Zenith) during the day to have detailed information to compare with radiometers leveling status.
- It is advisable to have some spare ventilation systems for the radiometers since they are the components that hardest-worked during the whole winter and it is essential they continue to work during the next one.
2004/2.2 Ozone Analyzer: Ozone surface concentration measurements

7. Ozone Analyzer
Collaboration started on Dec 6th, 2005.
Location: 700 m from Concordia towers, South-South West direction.

Installation of ozone analyzer
During the summer 2005-2006 I collaborate with ISAC-CNR (Bologna, Italy) personnel to the installation of the ozone analyzer.

A turbine aspirates external air that from the inlet passes to the ozone analyzer through Teflon pipes and filters. All components have been treated with ozone high concentration air to reach saturation. The small pomp on the wall performs each day a zero and span level cycle for 30 min. The system is controlled by acquisition software through a serial interface that permits to control the pump too.

Routine Operation
Routine operation at ozone analyzer doesn't take so much time; it consists in the cleaning from snow deposition of the inlet at the top of the roof of the shelter, the checking of pipe connections and of the time synchronization.
Filters state is constantly good I only changed it one time in correspondence of a general cleaning of the shelter because graphite (due to problems to aerosol sampling pumps) was in circulation in the room. The filter was cleaned and the graphite didn’t influence the measurements.
Anyway the division door of the shelter have to be kept close to avoid possible interferences (for example in the temperature) due to the functioning of the pumps for aerosol sampling.
When required some functioning tests have been performed like cleaning of optical bench and intensity check to control the flow through the analyzer.
As for BSRN station, for the first months time synchronization was set every 4 hours but it frequently failed since the inaccessibility of the server “domecposta” that works as reference clock. As consequence each time this happened the computer synchronized at a default time corrupting time reference of data files. Every time corrupted data files had to be reconstructed. For this reason time synchronization has been afterward set once per day and synchronization errors are almost disappeared.
Daily acquisition time drift is about 6 sec and it is a good accuracy since data are acquired with 1 min frequency.
Data are daily analyzed to verify the correct functioning of the whole system and they are sent three times per week to ISAC-CNR personnel for the processing.
As well monthly Concordia AWS data are sent to study possible correlation between ozone concentration and atmospheric parameters.
Temperature System Control
Since unexpected variations in Ozone concentration have been recorded I installed a thermostat for
temperature regulation. Ozone decaying is very sensible to temperature level and in this way has been
removed the possible dependence from internal shelter temperature.

Suggestion For Future Improvements
- Just to provide a spare thermostat for temperature regulation inside the shelter (CO2O3 room).
It is advisable to ask for an assurance about spare components reserved to CARO shelter for WI_FI (n°1
3COM Ethernet hub, n°1 Enterasys Rom About, n°1 Selta NETphon).
2004/2.5 Geomagnetic and Seismology Permanent Observatories

7. Automatic Measurements Acquisition System
Collaboration started on Jan 20th, 2005.
Location: 400 m from Concordia towers, South direction.

Geomagnetic observatory consists of two shelters, one of them is reserved to magnetic field absolute measurements while the instrumentation for automatic acquisition is placed in the other.

Variations in the Earth's magnetic field are continuously monitored by a three-axis fluxgate magnetometer. The intensity of the field is measured by two independent magnetometers and the acquisition is triggered by a GPS. The sensors are located in a "subterranean" room while the acquisition electronics is above in the shelter.

I take care of the continuous running of the automatic instrumentation and data downloading, moreover temperature has to be constant inside the shelter for the correct functioning of the whole system.

Every week data are sent to the scientific group in Italy and France, and every month temperature datalogger located near the acquisition electronics and in the cellar are discharged at the laboratory, the acquisition is launched and dataloggers are placed again.

Network connections to the shelter have frequent problems so remote control for data downloading is impossible and reaching the shelter is necessary also to restart the acquisition when it stops.

On February, March, April and May we had many problems with power supply of the shelter and acquisition was stopped frequently (surely problems to the electric circuit from Concordia). In particular during the monthly tests above the emergency generator recovering of the power supply was impossible.

Finally in June technical staff decided not to involve scientific shelters in the tests on the electric plant since it would had not possible to solve the problem until the coming of the summer season.

8. Absolute Measurements
Every week I perform absolute measurements of magnetic field declination and inclination. They can take from one to one and a half hours long, but at the beginning, when I was not still used it took a much longer time. The low temperature at the interior of the shelter represented the major problem. Many times the temperature indication of the thermostat doesn’t agree with the real temperature (fig. 23) and the condition are harder since it is impossible to wear the boots and the snow suit to not disturb the measurement with metal zips. I don’t have a new thermostat at my disposal so I tried to dismount and mount again that one is installed, it worked well for a very short time.

Even setting the thermostat in a way that the heating is always on, it is impossible to increase the temperature inside the shelter in order to be at the limit of human resistance.

The Psion device for the magnetic field intensity monitoring didn’t work since the beginning. I examined all the available documentation I received and there is no handbook for it but just a sheet with proper serial settings for the communication.

Fig. 23 - On the right: temperature indication of the thermostat doesn’t agree with real conditions inside the absolute measurements shelter. Reference temperature is set to 20°C, measured temperature is 17.6°C but real temperature is −9.4°C. On the left: magnetic field declination and inclination absolute measurements
For the moment I synchronize the portable clock with GPS clock and then I take the exact F measurements from datasheets in which data are collected every second (ex: SJul1406.dat) by the automatic acquisition.

Extraordinary Maintenance

As the temperature started to go down a new problem arose during absolute measurements performance. It was impossible to take, through the window, the exact position of the azimuth mark placed on the other shelter since when I enter the shelter the humidity due to breath quickly freezes upon the cold window and an ice layer grows above it. I manually removed it (with difficulty) for three times because it was impossible to focalize the azimuth mark.

So Eliseo D'Eramo built a Plexiglas window and its plastic axis for the assembly and we installed it inside the shelter above the old one using just glue to avoid inserting metal component.

When I have to focalize the azimuth mark I open the inner window that prevent the humidity dull the glass just below. Anyway I have to be quick taking the measurements because the ice layer appears very fast.

Suggestion For Future Improvements

- Changing the thermostat (or the probe location) at absolute measurement shelter since remarked temperature is not the real one and increase the heating (no amagnetic panel at disposal).
- To provide programs for remote control running in windows 95 ambient similar to VNC and WS_FTP95
- See also Part III - General Considerations for information about power cuts.
9. Seismological Station

The seismological station is composed of two advanced seismometers, data loggers, GPS timing, and a sun workstation for auxiliary acquisition and data analysis. The instrumentation and the sensors to check the environmental conditions are spread over a three level structure. At the lowest level, at a depth of 15 meters, a vault in the ice houses the seismometers. The compact ice at this level makes possible the good coupling with the sensors and the temperature is very stable. (fig. 24).

The second level is tunnel in the ice about 40 m long that allow reaching the vertical stairs to go down. (At side)

A sun workstation placed at the laboratory (at Concordia station) performs an auxiliary remote acquisition and a second computer allows the remote control of the acquisition system.

Acquisition electronics is lodged in the shelter at the first level (at the surface).

The station performs a continuous storing of seismometric data.

Routine Operation

I regularly carry on the check of the functioning of the instrumentation (once a week and after any kind of problems at the shelter, and three times per week by the remote control), maintenance operations, data retrieval and backup.

It is necessary a constant temperature control, even if I checked the temperatures at the shelter more times per day, it is possible that something happens during the night (see extraordinary maintenance).

Seismometer Masses Centering

Each two months centering of the seismometers masses and the exchange of the magnetic tape where seismology acquisition system collects the data have to be performed.

The centering of the masses is quite hard to achieve. It is a delicate operation since the good placing of seismometers masses influences the quality of data recording, if masses are not in a good equilibrium position it can happen that an earthquake couldn’t be recorded with all its intensity.

What happens at very low temperatures is that it is impossible to center the masses without heating the seismometer, so it necessary to go down to the cave to put the heating box above the sensor, remove it after some hours and then to continue to center the masses until the seismometer is cold again since the masses move from the equilibrium position consequently to temperature changes. (fig. 25-26)

This takes about one day but sometimes the procedure fails and it is necessary to do it again from the beginning.

The long stay at the shelter is not comfortable since temperature stratification. Nevertheless the adequate heating system the ground temperature is always below zero degrees.

Fig. 24 - Seismometers are placed in a cave about 15 m below snow surface to make possible a good coupling with the soil and stable temperature conditions.

Fig. 25 - Heating box for seismometers

Fig. 26 - Masses centering operations
It could be really useful to fit up the shelter with a little bench just to sit and lift up the feet during the long stay. (fig. 26)

**Data Analyses**

Data are analyzed just to verify the correct functioning of the seismometers. Following some example of data processing.

Data belong to one of the three axis of oscillation of the seismometer masses, it is possible to visualize the acquired data taking in consideration three different time intervals.

**TONGA – May 03rd, 2006 Magnitude 7.9**

Displayed about 10.5 days from May 03rd to May 14th. The first vibrations in the graph belong to the seismics of interest and on May 13th other evident earthquakes at Java are recorded.

1. Displayed about one day data (May 3rd, starting time 00:00). The Earthquake at Tonga is isolated and its duration is longer then 2 hours.

2. Displayed about 3 hours from 3:00 pm to 5:45 pm. The earthquake dynamism is well visualized.

**Extraordinary Maintenance**

During the winter we had about frequent problems due to power supply instability. The hypothesis is that voltage gets down causing a growth of current intensity since the cable is too small for the increased power request at the shelter. (See also Part III - General Considerations).

Moreover I checked the voltage of the main power supply at the shelter and it is constantly too low.

Fuses that are inside the instrumentation as protection to electronics circuits from current peaks crashed at each of such events.

I had to replace a modem for the data line since the fuse was not reachable and change its alimentation to connect it to 12 V batteries.

Pressure monitor problem was limited to the change of the fuse connected to power supply circuit.

I had to create a suitable fuse for temperature monitor since I hadn’t similar ones at my disposal.

The most dangerous event for the instrumentation has been a night (on August 29th) during which the heating system switched off for a peak of current that broke the protection fuse, and the temperature decreased in very few hours.
Consequently a further thermostat for temperature regulation has been installed at the shelter and I connected the heater directly to main power supply (avoiding protection fuses).

Actually the system consists in two thermostats which control the two lamps (to provide the heat) inside the niches where the electronics lodge. The two doors of the niches have to be kept close.

Since the electronics provides a constant considerable heating, the temperature of the shelter has to be kept relatively low to avoid that the temperatures inside the niches rise too much. So the third thermostat for the control of the temperature of the shelter is set at the minimum allowed temperature of 0°C. I set the three thermostats in the way to have constant temperatures: 0°C in the shelter, +22°C in the first niche where the PC stays and 26°C in the second niche where Quanterra acquisition lodges. In this way inside temperatures are always stable even in extremely variable external weather conditions. During the summer the niches could be kept open increasing to 10°C the temperature set on the main thermostat of the shelter.

**Suggestion For Future Improvements**

- To require the replacement of the cable that provides power supply to the shelter for the next season.
- To provide a spare thermostat for temperature regulation inside the shelter.
- A stock of any size of fuses for electronic circuit protection in particular for cc powering.
- It could be really useful to fit up the shelter with a little bench just to sit and lift up the feet during the long stay as during masses centering operations.
A study about correlations between weather conditions and snow crystals precipitations at Dome C is carried on in collaboration with Omar Cerri.

Daily data consist of observations of the possible precipitations, weather observations according to a pre-established model (Modello 1), extraordinary phenomenon which we observe about the sky status, images about precipitation, an auxiliary crystallographic analysis observing the images and hourly graphics displaying temperature, relative humidity, pressure and wind speed daily course.

In particular for what regards humidity we took in consideration just relative variations and correlations with temperature and never the absolute value.

In what follows some considerations about meteo-crystallographic observations since January to April are presented.

The laying essentially consists of precipitation crystals, growth above the observation table (air-hoar) and blowing snow deposition.

Snow crystals have been classified according to Magono and Lee classification system (Magono & Lee, 1966).

Typical for Dome C are the following species: N1a, N1b, N1c, N1d, N1e, C1d, C1f, C2a, R1a, I3a, rounded particles (blowing snow). The species that show up with the highest frequency are C2a, C1f, N1e and wad of thin needles (air-hoar).

Remarkable phenomenon:

- Dome C is characterized by weak wind and crystal structures are intact in 98 % of the cases.
- Daily precipitations are exiguous and the thickness is less than 1 mm. The average thickness is hard to estimate when air-hoar growth is present.
- Precipitation crystals are always present in conditions of cloudiness even if very exiguous.
- On January even if light refraction phenomenon from floating crystals were present no correlated precipitations have been observed on the table.
- Diamond dusts have been rarely observed.
- Air-hoar are always present in correlation with the following weather conditions: -65°C<T<-60°C, 30%<RH<35% and very weak wind; air-hoar presence is very rare below this temperature and relative humidity values.
- Usually precipitations are characterized by the following categories: C2a, C1f, C1d and isolated N1e, while the growth is characterized by: N1b, N1b, N1c, N1d, N1e complex structures (wad of needle), R1a, I3a.
Fig. 30 - Precipitation crystals 26/01/06

Fig. 31 - Air hoar 03/03/06, 04/07/06, 04/15/06
11. CR23 Tower
Collaboration started on Jan 20th, 2006. Location: 1 km from Concordia towers, South direction.

Routine Operation
Routine operation consists in monthly data download and cleaning of the sensors installed up the 12m tower. Data from sensors are stored in a CR23 datalogger located inside a box at the base of the tower. Data are analyzed just for what regard battery voltage and internal temperature of the CR23 box. One of the cups of the top anemometer crashed in my hand during one of the maintenance operations and evident signs are present above other plastic components.

Extraordinary Maintenance
To avoid that the datalogger reaches a temperature too low for the correct working as during the preceding year, I installed a further heating resistor and a thermostat for the temperature control (fig.33) and an insulating envelop limits heat leakage. Anyway the insulating coat is realized to allow opening of the box for internal inspection to the datalogger and connections.

The results are good; the temperature never went down more than \(-10\) °C even at really extreme wintry weather conditions.

Since this year Concordia powers this instrumentation and the stand-alone system provided by photovoltaic panel, wind generator and battery ensure a stable power supply during power cut.

A small heater allows the use of a laptop to download data but it is advisable to check voltage and tent temperature before powering the computer since voltages are very low and the heating doesn’t work well.

For the same reason during the depth winter is impossible to clean the tower from snow deposition till the top, it is quite far from the closer heated place and lack of an adequate heating system, so it is necessary to wait one of the rare good days during which temperature rises to about \(-60\) °C and the wind is weak.

For this reason a revision of the electric circuit to the tower has been requested for the next season. (See also Part III - General Considerations)

Fig. 33 - 100 W heating plate with thermostat (+ 15°C) and insulating coat installed at the CR23 datalogger lodgment.

Suggestion For Future Improvements
- New sensors to replace the old ones on the tower including protective hat for temperature probes.

See also Part III - General Considerations for information about power cuts.
Part II – Support

In such isolated conditions it is impossible not to support other colleagues.

First of all I want to thank Eliseo D’eramo for his constant availability and skill also in fields that not directly corresponded to his duty. He helped me providing materials I needed and realizing artisanal components when in lack of them as a Plexiglas window to make possible I perform absolute geomagnetic measurements also during the winter, a nipple for the manometer connected to helium rack for radiosounding, two little structures one to place the RS92-K probe during the stabilization at a height of two meters near the place of the launch and another one to sustain the balloon during the blowing up.

On my part I gave constant support to Omar Cerri for his data acquisition systems, snow accumulation measurements and in the first period of night samplings, and to Michel Impara to set up the very first videoconference sessions, to solve the problem with the not working AW11 and Davis weather stations, I helped him in computer assistance, with extraordinary maintenance to wireless LAN and some telecommunication devices as the Telex and the Iridium Satellite Phones. I assisted Minh-Ly Pham-Minh in her telemedicine system interfacing the voice-audio devices.

A not negligible time (2 day per week until April and then reduced to 1 day per week) has been spent in stocking of the food at the beginning of the winter, weekly cleaning of the station, regular service at the kitchen and for bathroom cleaning and meetings (including monthly fire alarm and dispositions for the anesthetist role) and the final cleaning of all the walls of the base.

I really want to thank scientific and logistic personnel (from PNRA, ENEA, CNR, INGV), with whom I have been lucky to work, for its constant presence during the whole year.

In the same way, I would like to thank all the researchers and technicians from French institutions for their availability.

Special thanks to Giampiero Venturi and Eliseo D’Eramo for the logistic support given for the summer maintenance to the BSRN station.

I think that during this summer the time reserved for the transmission of the working experience to the next winter over persons has been enough.

Since Nov 10th, 2006 I collaborated for this with Maurizio Busetto for what concern the Physic of the Atmosphere projects and with Pietro Di Felice for what regards the Earth Science projects.
Part III – General Considerations

It's lively advised to each member of the winter-over crew to bring all his own software including operative system, service packs and drivers (audio, video and so on...), everything useful for a possible new installation beginning from a hard disk format, a personal mobile hard disk with minimum capacity of 250 GB, spare hard disks for each new device and I think what remains for powering and net connection will be enough for the next winter too.

I want to thank Vito Vitale to have provided a portable personal computer, essential for the job and to live better during the whole year.

The greatest problem I encountered here in Concordia is power supply instability. Sometimes even UPSs are not enough to protect the electronics since voltage arriving to the shelters could be out of the input range.

It caused quite constant breaks of the most different instrumentation components that it has been hard to replace since the lack of new ones.

Sometimes I used pieces I found at the summer camp used in similar dismissed devices (but I always took note of this), some times I had to make do adapting what I found when not suitable.

I had frequent dialogs about this with evolved technical staff and I thank José Dos Santos to have found solutions for what was possible to do, first of all the exclusion (on June) of the scientific shelters from the monthly tests with the emergency generator that caused two additional black outs (at minimum) during this day.

An explanation about the frequent problems to the powering of seismology shelter and geomagnetism shelters could be the too small dimension of the cables.

The last problem with power supply is the line to the green tent near the 12 m tower. I measured the voltages in the small tent and in astrophysics tent from where powering derives and I found really low value (170 V and 190 V respectively). During the winter the tent is powered from Concordia station through geomagnetism line but tension fall is too big and surely it necessary a new dimensioning of the entire line for the next winter.

A problem with ground voltage is evident at Concordia station. I measured voltages between the phases and neutral: there is not a good balance in the sharing of the loads on the lines. This problem has been underlined to the summer logistic personnel.

The second problem is due to the really quick and marked temperature variations that could reach 15 °C in 4 hours and 23°C in just 12 hours.

Even if in the first very cold months I repeatedly set out for the heating regulation at the shelters in case of need, my mediation was not quick enough and all the shelters (with the exception of geomagnetism shelters) were devoid of temperature regulation.

It has been very hard the research of thermostats when I finished those ones at my disposal but finally I installed a quite good temperature control at about all the scientific shelters and in the most inner part of the instrumentations.

Obviously I am available to make a contribution to any kind of work or publications, which can rise from the data collected during this year.

Finally as conclusion of a new really interesting and challenging work experience I’d like to propose a theme for a hypothetical technical publication that can be useful for future scientific instrumentation installations. I would be honored to be contacted by research groups with which I have collaborated to give in-depth ideas.
Concordia Station - 2006 Winter Over Activity Report

Glaciology - Dr O. Cerri

Scientific activity: 2006-07 season

The scientific activity was carried out in the framework of the Project 2004/05.01: Paleoclimate and paleoenvironment from the chemical, isotopic and physical stratigraphies of ice cores.

Project leader: Roberto Udisti

The 2006-07 activity at Station Concordia was mainly coordinated with the following research programs or sectors:

- Concordia Station program
- TAVERN project
- Physics of Atmosphere
- Chemistry in Polar Environment

The glaciological side of this activity was focused on:

Assessment of the physical features and chemical composition of all-year-round size-segregated aerosol samples and study of the atmosphere/snow interaction

Glaciology scientists at Dome C

Omar Cerri: winter-over 2006
Andrea Morganti: summer 2006/07
Alessandro Iacomino: winter-over 2007

We thank Lucia Agnoletto, Eliseo D’Eramo and all the 2006 winter-over and 2006-07 summer field people for their support and help in our activities.

Research program outlook

The research program aims to study today sources, transport pathways and depositional processes of atmospheric aerosol collected at Dome C, in order to better understand past changes in sources intensity and transport efficiency of physical, chemical and isotopic markers measured along ice cores and to correlate these changes to climatic and environmental variations. Besides, studying the processes occurring at the atmosphere/snow interface improves our knowledge of today air-to-snow transfer functions and post-depositional processes in the surface snow layers and increases the reliability of the reconstruction of paleo-atmosphere composition from ice core stratigraphies.

2005-06 activity

At Dome Concordia, during the winter-over 2006 and summer 2006-07, the scientific team carried out several activities:

1. improvement of the glacio-chemical lab in the Concordia Station;
2. setup of a new aerosol-sampling shelter near the “clean area” zone at Dome C;
3. collection of size-segregated aerosol samples with several devices at resolution ranging from one day to one month;
4. daily collection of superficial snow, hoar (when occurring) and fresh precipitation (when occurring);
5. on-site measurements of ionic composition of superficial snow and hoar by ion chromatography;
6. physical characterization of snow and ice crystals by visual observations;
7. activities carried out in collaboration with other research groups.

1. Improvement of the glacio-chemical lab at Concordia Station

Glacio-chemical lab facilities in the Concordia Station (CS) were improved with ion chromatography materials, new aerosol-sampling pumps and some minor instrumentation. A new lab arrangement for the 2007 winter-over was carried out in collaboration with Shaun Deshommes and Claire Le Calvez.

2. Setup of a new aerosol-sampling shelter

All the aerosol-sampling devices, distributed in three different shelters (named “Salvietti”, “Vitale” and “Udisti former” shelter) during the 2006 winter-over, were transferred in a new shelter (hereinafter named “Udisti” shelter) close the “clean area”, about 750 m south-south/west of Concordia Station (upper-wind the dominant wind direction, in order to minimise contamination from anthropic activity).
The “Udisti” shelter was installed in December 2006 and the majority of the activity in this month was devoted to transfer sampling devices from the old sites to the new one. The “Udisti” shelter was ready in January 2007, when aerosol measurements and samplings re-started. This activity is going on in the present 2007 winter-over campaign.

In the “Udisti” shelter the following instrumentation is now working:

- 2-heads low-volume aerosol sampler (FAI-Hydra) for PM10 (Particulate Matter lower than 10 um) and PM2.5 sampling;
- low-volume PM10 sampler (Tecora EchoPM) for daily PM10 sampling
- medium-volume aerosol sampler (Tecora Echo-PUF) for one-month integrated PM10 samples.
- low-volume aerosol sampler (Tecora EchoPM) for 7- or 15-day sampling of PM10 on quartz filters for elemental carbon (EC) and organic carbon (OC) tentative measurements;
- 8-stage (ranging from 0.7 to 10 um) impactor (Andersen) (up to January 2007)
- 4-stage (10 um, 2.5-10 um, 1-2.5 um, < 1 um) impactor (Dekati);
- Optical Particle Counter (OPC) operating in the range 0.3 – 16 um;

3. Collection of size-segregated aerosol samples

Since January 2006 to today (different sampling periods are specifically indicated) the following samplings and measurements were carried out in a continuous way (with some relevant stops for device failures during the winter severe weather conditions):

- 3-day samplings of PM2.5 and PM1.0 aerosol size-classes (chemical composition of soluble fraction of aerosol). In the period January 2006 – November 2007, 60 PM2.5 samples were collected. From January 2006 to April 2006 (due to failure of a vacuum pump), 22 PM1.0 samplings were carried out. The sampling is now working since January 2007 (resolution: 4 days; PM10 and PM2.5).
- daily samplings (from 03 January 2006 to 27 June 2006 and from January 2007 to today) of PM10 aerosol fraction (identification of long-range abrupt transport to Central-Antarctica of marine and continental air masses). During 2006, about 120 samples were collected.
- one-month integrated samplings of PM10 aerosol particles for chemical and mineralogical characterization (major elements, Rare Earth Elements, ions) of dust reaching Dome C;
- one-week aerosol samplings with 8-stage impactor for chemical characterization of size-segregated aerosol particles (up to January 2007, with a total of 38 8-filter samplings);
- 4-day aerosol samplings with 4-stage impactor for chemical characterization of size-segregated aerosol particles. Sampling stopped from 12 May 06 to December 06, due to failure of the device. In this period, 25 4-filter samples were collected; the sampling is now working;
- one-week or 15-day (in alternate way) low-volume sampling of PM10 on quartz filters for tentative EC and OC measurements (from January 2007);
- continuous measurements of size-distribution of PM10 aerosol particles by OPC (time resolution= 5 minutes). During 2006, measurements were carried out for 300 days. Activity is now carrying on.
- two-week sampling of 12-stage size-segregated aerosol fractions (in collaboration with M. Legrand activity);
- one-week samplings of high volume aerosol samples (in collaboration with M. Legrand activity).

Aerosol sampling and measurements were carried out in order to:

- obtain a chemical and physical characterization of bulk aerosol (size segregated) and single particles;
- identify and, possibly, quantify the main sources of aerosol particles reaching inner areas of Antarctica (Dome C);
- study the size distribution of aerosol particles as a function of sources, transport processes and chemical behaviour;
- gain information of transport pathways of air masses reaching Dome C;
- identify possible fractionating processes occurring during the transport.

4. Surface snow, fresh snow and hoar samplings

The sampling of surface snow, fresh snow and hoar, started in the previous DC campaigns, was continued in the “clean area” for the entire 2006-07 summer field and is going on in the present winter-over period. Since January 2006, superficial snow was collected twice a day (from 01 January 06 to 03 May 06 and from 12 August 07 to today), in relation with maximum and minimum solar irradiance, and one a day during the dark period (from 04 May 06 to 11 August 06). All samples were collected in duplicate: the first sub-sample was on-site analysed and the second was stored at -20 °C and sent to the Florence laboratory.

When hoar formation occurred over the top of snow surface, hoar samples were collected and analysed with the same protocol of the superficial snow collection.
Every fresh deposition (snow, ice crystals) were collected, if deposition quantity on collection-plate was sufficient.
A total of about 550 samples (superficial snow, fresh deposition, hoar) were collected in the period January 2006 – December 2006. Sampling is now working.
Daily samples of superficial snow were collected all-year-round for stable-isotopic measurements in collaboration with Barbara Stenni (University of Trieste), in the framework of the Glaciology project.
Since February 2006 to November 2006, monthly samples of superficial snow were collected in the clean area for research groups of the Chemistry in Polar Environment (F. Soggia, University of Genova) and Atmospheric Physics (G. Scarponi, University of Ancona) programs.
Snow and hoar were sampled in order to:
- compare chemical composition of aerosol, hoar, surface and fresh snow;
- evaluate air-to-snow and snow-to-air transfer functions;
- evaluate the effects of changes in solar irradiation in fixing or removing chemical compounds in surface snow;
- estimate the relevance of sublimation/condensation processes in modifying the superficial snow chemical composition;
- study the uptake of gas-phase acidic compounds by hoar fragile structure;
- study post-depositional processes affecting some non-conservative chemical species.

5. On-site measurements of ionic composition of superficial snow and hoar by ion chromatography
Lab activity was focused on the analysis by ion chromatography of selected snow and hoar samples. Since January 2006 to November 2006, all the snow and hoar collected at Dome C were analysed for inorganic anion (fluoride, chloride, nitrate and sulphate) and some organic anions (MSA, acetate, and formate). On-site measurements, carried out just after the sampling, will be compared with the measurements of the same samples in Florence, in order to enlighten differences due to post-depositional processes (volatilization, chemical reactions). A total of 530 snow and hoar samples have been analysed in the period 05 January 2006 – 14 November 2006.
Besides, in the lab it was carried out all procedures for sampling activity (e.g., aerosol filter cleaning) and sample care and storage.

6. Physical characterization of snow and ice crystals by visual observations and measurements
Daily observations of snow and ice crystals were carried out on-site in order to characterise snow and diamond-dust deposition and to correlate chemical composition to snow morphology. Snow and ice crystals were classified and photographed. This activity was performed in collaboration with the A. Cagnati (ARPA – Veneto) research group. A total of 280 daily observations were carried out in the period 19 January 2006 – 22 November 2006. Activity is now carrying on.
Density of daily deposition of snow and ice was also performed when deposition quantity was sufficient.
Density, temperature and dielectric constant of snow and firn were measured twice a month (one a month in winter) in the first 70 cm snow layer. Measurements resolution was 10 cm. Density was measured both by weighing a know snow volume (10 cm resolution) and by using a specific probe, named “snow fork” (continuous measurements). This activity was carried out in collaboration with G. Macelloni (IFAC.CNR Florence) and A. Cagnati (ARPA – Veneto) research groups.

7. Activities carried out in collaboration with other research groups
Monthly measurements (only in summer period) of accumulation rate were carried out at the 50-stake farm located about 3 km south of Concordia Station (M. Frezzotti project). Weekly measurements of accumulation rate were performed at the 13-stake farm located near the “Salvietti” shelter.
Snow temperature measurements by probes located at different depths in the first 10-m snow layers (Macelloni)
Data acquisition of geomagnetic measurements (A. Piancatelli, University of L’Aquila). Collaboration with Chemistry in Polar Environment and Atmospheric Physics was carried out at the highest level.
Collaboration with M. Le grand in collecting all-year-round aerosol samples by high-volume sampler (weekly) and 12-stage Dekati impactor (15-day resolution) at the “Legrand” shelter.
Collaboration with D.D. Rousseau (CNRS – IPEV) for palynology studies. Pollen samples were collected one a week or every 15 days on cellulose filters.
1. Scientific tasks
The potential of the antarctic plateau for astronomy is in increased recognition. Low wind speed, poor humidity, good meteo conditions, all these features are progressively seducing the astronomical community. Seeing measurements made by Vernin at the South Pole in 1995 pointed out the probable good turbulence conditions on the antarctic plateau. That led to the development of a site-testing programme at Dome C, taking advantage of Concordia facilities. This site testing programme is a part of ConcordiAstro and aims at measuring all turbulence parameters of the site (Fried parameter, scintillation, atmospheric conditions...) during the polar night. Conclusions of this programme will be determinant for the future of astronomy at Dome C.

The first winterover conducted by Karim Agabi gave first answers to these questions. The temperature is very low in winter, the wind speed dramatically increase in the first meters above the ground. This contributes to form a turbulent surface layer with very poor ground seeing. The height of this surface layer is about 35 meters. Above this, the turbulence conditions are exceptional, with median seeing values around 0.3 arcsec. In summer this turbulent layer vanishes and the seeing is good downto the ground.

Another important result of Karim’s winterover is the amount of clear sky time during the winter; although no dedicated statistics were taken, a raw estimation is that the weather is good about 90% of the time. That’s very good news for astronomers.

A second winterover, mainly dedicated to the continuation of the site testing programme, was achieved by Eric Aristidi. Parts of the previous programmes (DIMM, GSM, Microthermals) were runned for another winter, in addition with new experiments (Scidar, Corona).

2. Programme of the present mission
The scientific programmes which were at the menu of the winterover 2006 are the following

- **DIMM**: Measurements of the seeing on the top of the 5 m high astronomical platform (continuation of a previous programme).
- **SSS**: Monitoring of the vertical profile of the turbulence by means of a Scidar (the Scidar is a new programme which replaces the balloon radiosoundings of last year).
- **GSM**: Estimation and monitoring of the Outer Scale of turbulence with the GSM experiment (continuation of a previous programme that failed to work last year).
- Microthermal sensors: monitoring the surface layer turbulence (continuation of a previous programme that failed to work last year).
- Sonic anemometers: monitoring the temperature, wind speed vector and turbulence in the first 30 m above the ground (new programme).
- **CORONA**: testing the performances of a stellar coronograph, prototype for future experiments (new programme).

In addition to these programmes, I watched at the automated instrument GATTINI developped by the observatory of Arcetri (Florence, Italy) in collaboration with the University of New South Wales (Sydney). I also performed some lunar observations (Earth Shine) in collaboration with a group of the Observatoire de Paris.

3. Experiments and results
3.0 Weather
For the first time, estimations of the clear sky fraction were made this year. It was estimated visually several times a day, using a scale from 0 (no visibility) to 1 (cloud-free sky). Considering the period covered by the winterover (Jan 1st – Oct 31st), the clear sky fraction was greater than 0.978% of the time. Other numbers are presented in fig. 1. This excellent clear sky fraction is of course of great importance for astronomical observations, in particular for asteroseismology, where extremely long integration times (several weeks) are needed. A simulation by B. Mosser (Observatoire de Paris) showed that Dome C
asteroseismic observations should provide performance better or similar to a 6-site network at mi-latitude (a paper is was recently submitted to the Publ. of Ast. Soc. of Pacific).

<table>
<thead>
<tr>
<th>Time % for clear sky &gt; 0.9</th>
<th>78%</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt; 0.85</td>
<td>80%</td>
</tr>
<tr>
<td>&gt; 0.5</td>
<td>91%</td>
</tr>
</tbody>
</table>

# of consecutive clear days (fraction >0.9)

<table>
<thead>
<tr>
<th>Average</th>
<th>5.3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max.</td>
<td>14.9</td>
</tr>
</tbody>
</table>

# of consecutive bad days (fraction <0.25)

<table>
<thead>
<tr>
<th>Average</th>
<th>0.5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max.</td>
<td>1.6</td>
</tr>
</tbody>
</table>

Fig. 1 - Left: statistics of the clear sky fraction during the period Jan 1st – Oct 31st. Right: time percentage for two given clear sky fractions as a function of the month.

3.1 DIMM

The DIMM, or “Differential Image Motion Monitor” is a telescope equipped with a mask with sub-apertures of diameter 6 cm distant 20 cm. This mask is placed at the top entrance of the telescope. One of the holes is equipped with a small angle prism (deviation 30 arcsec), the other one with a glass parallel plate.

We use a Schmidt-Cassegrain Celestron C11 telescope (diameter 280 mm) with a 2xBarlow lens (equivalent focal length 5600 mm). It is placed on an equatorial mount (Astro-Physics 900). The mounts is fixed to a massive wooden foot. The DIMM is operated from the top of a 5 m high platform to avoid the contribution of the ground layer turbulence.

A digital CCD camera is placed in a thermostated box (temperature around –20°C), the box and the camera being located at the focus of the telescope.

All this equipment has been customized to work in Antarctic cold conditions.

Left, the DIMM system. Note the 2 hole mask at the telescope top. The box at telescope back contains the camera. Right: typical short-exposure frame of the star Canopus at the focus. The two images move with turbulence, analysis of their differential motion provides the seeing.

Seeing statistics for the winter 2006 (Feb 1st – Oct 31st)

The seeing conditions we found are similar to those of the previous winter. Statistics of the last two winterovers are presented in the table hereafter. The behaviour of the seeing with the time (see fig. 2) is also similar to what was observed last year: very good values in summer turn into poor seeing at spring and remain around 1.5 -- 2 arcsec until November.
### Campaign Summary

<table>
<thead>
<tr>
<th></th>
<th>WO 2005</th>
<th>WO 2006</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of data</td>
<td>55385</td>
<td>67305</td>
</tr>
<tr>
<td>Median seeing (&quot;)</td>
<td>1.22</td>
<td>1.34</td>
</tr>
<tr>
<td>Mean seeing (&quot;)</td>
<td>1.30</td>
<td>1.51</td>
</tr>
<tr>
<td>Std deviation (&quot;)</td>
<td>0.77</td>
<td>1.02</td>
</tr>
<tr>
<td>Max (&quot;)</td>
<td>6.49</td>
<td>9.61</td>
</tr>
<tr>
<td>Min (&quot;)</td>
<td>0.08</td>
<td>0.09</td>
</tr>
</tbody>
</table>

Fig. 2 - Left: seeing statistics for the last two winterovers. Right: monthly-averaged seeing versus month for the two winterovers.

Day-by-day values are shown in figure 3. As it can be seen, the DIMM ran almost every day with short down time due to mechanical problems, bad weather (including wind speed > 8 m/s) or loss of the star. The histogram of the seeing values is plotted in figure 3, and shows the classical 2-bumps structure with a clear maximum near 2 arcsec that vanishes in summer where the shape of the histogram becomes nearly a gaussian centered on 0.6 arcsec.

### 3.2. GSM

The GSM (for “Generalised Seeing Monitor”) is based on two identical DIMMs observing simultaneously the same star. It is on site since last year, but did not work properly because of critical vibrations problem. GSM aims at measuring the outer scale, one of the few parameters that characterises the turbulence. It is useful for designing adaptive optics systems for extremely large telescopes. The distance between the telescope is 1 m in the NS direction. For certain positions of the star, it happens that the two telescopes bump into each other. This problem is to be corrected for next year, but it caused a lot of down time in GSM observations. We took advantage of this down time to perform isoplanatic angle estimations, which require one telescope only.

#### 3.2.1. Outer scale measurements

At the focus of each GSM telescope are two images of the same star. The two images are moving according to the turbulence and the motion of their barycenter is recorded in the X and Y directions. We obtain 8 curves (4 per telescope) of these barycenter motions. Every minute a set of 6 cross-correlations of
the X-direction motions (less sensitive to vibrations since it corresponds to the declination axis) is computed, giving access to the outer scale through model fitting.

The vibrations problem were solved during the summer campaign by protecting the instrument with wind screens and adding counterweights on the telescope mounts. Vibrations were reduced to a tolerable value as long as the wind speed is lower than 3 to 4 m/s. Different trials were made in February to find the best configuration for the orientation of the 2-holes mask of each telescope. A Matlab software was written by A. Ziad (LUAN) and me to process the data. Then, the first outer scales could be obtained at the beginning of March. GSM worked fine for about 3 months, until the end of May, where telescope motors became out of order.

Statistics of the outer scales during these 3 months is presented in figs. 4 and 5. Low values of $L_0$ were found, which is quite a good news for possible future large telescopes to be operated here.

<table>
<thead>
<tr>
<th>Nb of data points</th>
<th>5640</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean $L_0$ (m)</td>
<td>11.3</td>
</tr>
<tr>
<td>Median $L_0$ (m)</td>
<td>7.3</td>
</tr>
<tr>
<td>Std dev (m)</td>
<td>13.4</td>
</tr>
<tr>
<td>Max $L_0$ (m)</td>
<td>0.7</td>
</tr>
<tr>
<td>Min $L_0$ (m)</td>
<td>144.8</td>
</tr>
</tbody>
</table>

Fig. 4 - Left: outer scale statistics obtained during the period March-May 2006. Right: corresponding histogram.

Fig. 5 - Day-by-day outer scale values during the period March-May 2006.

3.2.2. Isoplanatic angle measurements

An estimation of the isoplanatic angle can be made through sintillation measurement of a single star. Best results are obtained when the input pupil of the telescope is 10 cm diameter with a central obstruction of diameter 4 cm. A dedicated mask was built 2 years ago for that purpose, to be used in front of one of the C11 telescopes. We used one of the GSMs for monitoring the isoplanatic angle during the time when the outer scale measurements could not be done. That led to 4 months of monitoring, until the motorization of the telescope get down at the end of May.

The results are presented hereafter. They are comparable to what was found last year with the same equipment (3.6 arcsec) and with the radiosoundings (3.2 arcsec).
Table 1:

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nb of data points</td>
<td>27956</td>
</tr>
<tr>
<td>Mean $\theta_0$ (arcsec)</td>
<td>4.4</td>
</tr>
<tr>
<td>Median $\theta_0$ (arcsec)</td>
<td>4.1</td>
</tr>
<tr>
<td>Std dev $\theta_0$ (arcsec)</td>
<td>2.3</td>
</tr>
<tr>
<td>Max $\theta_0$ (arcsec)</td>
<td>0.6</td>
</tr>
<tr>
<td>Min $\theta_0$ (arcsec)</td>
<td>23.4</td>
</tr>
</tbody>
</table>

Fig. 6 - Left: isoplanatic angle statistics obtained during the period February-May 2006. Right: corresponding histogram.

Fig. 7 - Day-by-day isoplanatic angle values during the period Feb-May 2006.

3.3. SSS

SSS stands for “Single Star Scidar” (Scidar being an acronym for “scintillation detection and ranging”). The scientific goal of the SSS is to measure the vertical profile of the optical turbulence $C_n^2(h)$ and the wind speed $V(h)$ from the scintillation of a single star. The SSS technique derives from the so-called Scidar technique, which analyses the scintillation on the entrance pupil of a telescope, of a double star. The SSS technique, using a single star, cannot retrieve the altitude from the triangulation, but analyses the shape of the spatial correlation of the scintillation.

SSS replaces the in-situ radiosoundings performed last year by Karim Agabi by means of balloons launches. The vertical resolution is not as good as for the balloon measurements, but the main advantage is that we will be able to obtain a turbulence profile in a few minutes of integration. The SSS, observing several hours a day will provide thousands of profiles, instead of the few tens obtained last year.

The turbulence profiles give the location of the atmospheric layers that produces the optical turbulence. The profiles obtained last year showed that 85% of the turbulence is located in the first 35 m above the ground. After the publication of the results, astronomers started to imagine structures to put telescopes above this elevation.

Turbulence profiles give also access to all the parameters characterizing the turbulence: seeing, coherence time, isoplanatic angle.

The SSS is composed of a 40 cm Meade 16 Schmidt-Cassegrain telescope driven by an equatorial Astrophysics 1200 mount. A short focal lens is used to collimate the optical beam, and a CCD acquires the defocused image of the telescope pupil. Several thousands of images are analyzed in real time to deliver spatio-temporal cross correlations (fig. 9). Each few tens of seconds, such a correlation is stored in order be processed off line by the “simulated annealing” method.
After its installation on the dedicated wooden platform during the summer campaign, the SSS was put in hibernation until the beginning of March when the sky was dark enough to allow optical alignment. It then ran as often as possible from March 15th to September 24th. We faced two problems that led to a lot of down time. First the SSS is sensitive to vibrations and could not run when the wind speed was above 3 to 4 m/s. For this reason it it foreseen to move it to the ground (the platforms contribute to the major part of the vibrations), maybe at the current location of Corona. The second cause of down time is the ice deposit on the Schmidt plate of the telescope (see section 6).

Anyway the SSS operation is a success and we obtained more than 580 hours of data representing 25 gigabytes. Part of these data was emailed to the LUAN for processing, the computers here being not powerfull enough to run the simulated annealing program. We estimated that the whole data processing will require about 214 days of CPU time on our calculus server at Nice.

Preliminary results from the data sample processed at Nice showed $C_n^2$ profiles similar to those obtained with the balloons: a huge turbulent layer near the ground, and very little turbulence above (see fig. 10).

### 3.4. Microthermals sensors

As was said before, the turbulence in winter at Dome C is dominated by a ground layer several tens of meters high. Accurate monitoring of this turbulent layer is critical for the design of future observatories, in particular the statistics of the thickness of this layer.

The surface layer is not sampled correctly by the SSS. We then installed a dedicated experiment based on micro-thermal sensors placed at four levels (elevations 2.6 m, 8.1 m, 15.4 m and 28.4 m) on the 30 m high tower located 800 m away from the base. These sensors were already installed last year by Karim Agabi and Tatiana Sadibekova, but the accumulation of ice during the winter did not allow any measurements in the first winterover. So during the summer season, new pairs of sensors were placed on the mast, and protected with hoods (fig. 11) to avoid ice deposit while waiting for the night (microthermals don’t work in daytime).

Principle of the measurement is the following. Four sensors are are fixed to an horizontal bar of the tower at each level. They form two redundant pairs, named A and B. The sensors are tungsten filaments whose electric resistance depends on the temperature. We measure the resistance difference between the two sensors in a pair, and convert it to temperature difference with an accuracy of a few millidegrees. Turbulence makes this temperature difference fluctuate. Every 2 minutes, the variance of these fluctuations is computed and gives access to the coefficients $C_T^2$ and $C_n^2$ (structure functions of the temperature and refractive index, see for example Borgnino et al., 1979, A&A 79, 184). This parameter characterizes the local turbulence. The other sensor pair estimates the same thing and allows to have another independent estimation (and also in case of mistrunctioning of the first pair).
The microthermal experiment was started at the beginning of March. Despite the protections, we found out that the majority of the sensors were already broken and had to be changed. The tiny tungsten filaments at the end of the sensors are very fragile. First data were obtained on March 12th. Figure 12 shows a 24-hour monitoring of the $C_T^2$ taken on April, 6th.

For two months (until the end of May) I tried to make this experiment run correctly and to obtain reliable data. We exchanged a lot of emails with Max Azouit (LUAN), the designer of the system I faced a lot of problems, mainly caused by the frost. We had to climb the tower once a week (twice a week would indeed have been better) and remove all the accumulated snow and ice using a heat gun. To use this heat gun, an electric cable with plugs at each sensor level was set up by the Shaun Deshommes (the technical manager) on March, 29th.

Between two weekly visits at the tower, it happened almost every time that about one half of the sensors get broken (probably the filaments got heavier with the ice and broke at the wind). They had to be replaced, and sometimes during this switch it happened that some sensors broke down again. Once in place, the sensors would give good data for a few hours to a few tens of hours, depending on humidity. It happened once that the filaments were frozen only 30 mn after being placed... difficult to perform a monitoring for months in these conditions ! We had a heating system but it was not powerful enough to defrost the sensors.

I faced also problems with the electronics. Each sensors is put into a Wheatstone bridge that is balanced before climbing the tower. And once in its place at the tower, it appeared often that the Wheatstone bridge was unbalanced (in that case the sensors are saturated and the data unexploitable). We don’t know the origin of the problem. Also the electronics of the 4th level broke down on April 14th ; the signal from level 4 was then driven to the level 1 modulus, and the level 1 (elevation 2.60 m) was abandonned.

Finally, and despite our efforts and tenacity, we could not obtain exploitable data from the microthermals. My feeling is that it is not adapted to Antarctic conditions. It will indeed be unmouted and shipped back to Nice at the beginning of next summer campaign. But we still want to monitor the surface layer turbulence,
and our hopes are now in the next generation sonic anemometers (see sect. 3.6) to be set up for the next winterover by Tony travouillon.

3.5. Corona

Corona does not belong to the site testing topic. It is a demonstrator of a stellar coronograph aiming at detecting faint objects (such as exoplanets) around stars. Corona is an optical bench fixed to a 355 mm diameter telescope (Celestron 14). When a star is pointed by the telescope and placed on the optical axis, the incoming light is extincted by optical interference. A nearby companion is not affected by the system: if one observes a double star (or a star with a faint close companion), the main star light is strongly attenuated and the faint companion becomes visible. The coronograph needs perfect optics and excellent seeing to attain its optimal performances (in laboratory the extinction has reached a factor 600).

Corona is a prototype for future instruments to be developed at Dome C. One of the top astrophysical topics to be developed here is indeed the search for exo-earths (planets like the Earth around stars). The aim of the Corona experience is to evaluate the performances of such a system in the atmosphere and the winter conditions at Dome C.

![Corona optical bench](image13.jpg)

Fig. 13 - The Corona optical bench (the black box) fixed on a Celestron 14 telescope.

Optical alignment of Corona was performed during the summer campaign, so where the first daytime tests on the sky. These were realised on bright single and double stars (Canopus, Alpha Cen, Alpha Crux). They showed an extinction around 10 in the summer good seeing conditions.

Corona was then left in hibernation while waiting for the night. I restarted it on March 30th, with an external temperature around –65°C. I noticed that the images were distorted by strong aberrations and that the telescope collimation was no longer possible. Fig. 14 show two long exposure images of the star Canopus at the coronographic focal plane. The size of the stellar image is multiplied by 5 because of the aberrations caused by the cold. These aberrations were also visible when looking through with the eyepiece of the telescope.

Attempts of coronography were made on these images, but the extinction was very low, less that a factor 2. So Corona could not be exploited during this winterover and will be shipped back to Nice on next November.

![Images of Canopus with Corona](image14.jpg)

Fig. 14 - Images of the single star Canopus with Corona. Left: image taken on Dec. 11th (T=–28°C) Right: image taken on March 31th (T=–63°C) The star was away from the optical axis so that it is not extincted. The field of view is 16 arcsec.
3.6. Sonics

This experiment was developed by Tony Travouillon (Caltech, USA) in collaboration with our group. These anemometers estimate the temperature and the three components of the wind speed vector from ultrasound emission, and derive the refractive index structure function (such as the microthermal sensors) through a model. They are placed on the American tower at elevations 7 m, 17 m, 22 m and 30 m, and aim at giving a monitoring of the wind/temperature/turbulence conditions in the first 30 m above the ground.

![Image of a sonic anemometer on the tower.](image1)

The experiment was installed in summer and worked fine until mid-February where the temperatures get too low. These models of sonic anemometers were indeed not foreseen to work under $-38^\circ$C. So no results came from this experiment in winter. A new set of anemometers, more resistant to the cold (they were successfully tested in laboratory at $-80^\circ$C) will be set up by Tony for the next winter.

3.7 Other

3.7.1 Earth Sine

This experiment was made in collaboration with the team of Danielle Briot (Observatoire de Paris). The aim is to check the detectability of the signature of the chlorophyll (Vegetation Red Edge) in the red part ($700 - 800$ nm) of the spectrum of the Earthshine. Earthshine can be seen on the dark part of the Moon during the first or the last days of the lunar cycle. This corresponds to a Earth light on the Moon. The light of the Sun arrives on Earth, is reflected by the Earth, arrives on the Moon, is reflected by the Moon and comes back on Earth. The light coming from the different parts on Earth is blended, as in the case of an extra-solar planet seen as a whole. Arcichovsky suggested as soon as 1912 to look for chlorophyll absorption in the Earthshine spectrum, with the aim to calibrate chlorophyll in the spectrum of other planets. This is a first step towards the search of extraterrestrial life on planets outside the solar system.

Observations of Earthshine can be done during the first days or during the last days of the lunar cycle. From intermediate Earth's latitudes, observations of the waxing Moon are possible in the evening and observations of the waning Moon in the morning. In both cases, observations are twilight observations which cannot be carried on during a long time. The part of Earth facing the Moon depends on the localisation of the telescope and of the lighted part of the Earth, that is to say to the West of the telescope in the evening and to the East in the morning. Only in high latitudes it is possible to observe the Moon in the first or the last days of the cycle during several hours, and even sometimes during all the day long. This opportunity happens at Dome C approximatively six times in a year. So, during one observing time, continents and oceans successively face the Moon and the variations of the Vegetation Red Edge according the successive "landscapes" of the planet Earth could be detected. A rather small telescope and low resolution spectra can be used to detect VRE in Earthshine spectra.

After some unsuccessful attempts due to bad weather conditions during the 2005 Winter Campaign, preliminary observations could be carried out between March and August 2006.

The first observing run was performed on March 26th. It just consisted in a series of photos of the Moon, with a small telescope, every hour to estimate the ratio earthshine/sky background (see fig. 16). The results were encouraging since this ratio was over 10. Pictures were taken using a Nikon D70s camera, which allow photometry in three colours. Complete image processing will be made by D. Briot when I'll be back at Nice (the amount of data was too large to be sent by email).
The first trials of spectroscopy were made for the earthshine of May. I had a little plastic grating with me (I took it before leaving Nice, just in case) and some photographic lenses. That allowed me to build a simple spectrograph with low spectral resolution (R~100), using one of the video cameras of a finder as the detector (fig. 17). This video camera has a better sensitivity in the red/near IR than the Nikon D70s.

Spectra obtained in May with this experimental setup were not satisfying. The video signal from the camera was not stable, and the automatic gain and exposure time did not allow a reliable calibration procedure. Moreover the meteor conditions were bad the day of the observation (May, 21th) with a lot of cirrus and a layer of flying snow blown by the wind. The detector was changed after this run. I took one camera of GSM (since GSM was out of order at this time).

Spectra of the earthshine could finally be obtained during the runs of July (July 30th) and August (August 27th and 28th). The exposure time was adjusted to a value of 30 mn by successive trials to achieve the required SNR (the VRE is only a few percents). Example of spectra obtained on July 30th are shown in fig. 18.
Complete data processing will be made when I’ll be back in France with the data. Yet it can be said that these preliminary tests are a success. The experiment should continue next winter with a better spectrograph (SNR can be greatly improved by using a blazed reflection grating). Discussions are currently in progress between D. Briot, the future winterers and the LUAN.

3.7.2 Gattini

The Gattini are 3 small site testing instruments currently operating at the Dome Concordia station. The Gattini team is formed from astronomers from Italy, France, America and Australia and the instruments are part of the IRAIT site testing program. Two of the instruments are small transit cameras that will measure optical sky brightness, large area cloud cover and detect bright aurora throughout the winter season. These values are very important for future optical astronomy at the Dome C site, that currently there is much excitement about. The third instrument is called a lunar SHABAR, short for Shadow Band Ranger, that aims to profile the ground layer by using scintillation of the moonlight. All these systems can be remotely accessed (for control and transfert of a small part of the data) through an Iridium phone connected to the main Gattini computer. The instruments were installed at the base by Eric Aristidi and Tony Travouillon in January 2006, and have been cared for by Eric throughout the winter season. The PIs are Anna Moore, originally from INAF:Arcetri and now at CalTech and Jon Lawrence from UNSW. Data will be published by the end of the year in time to help groups currently designing optical telescopes for future astronomy at the site.

![Fig. 19 - Left: the boxes hosting the infrared camera and the all sky visible camera. Right: the Shabar array of photodiodes.](image)

The instruments have worked quite fine all the winter long. We just faced some problems with the frost on the glass window in front of the IR camera. I used to remove it manually at the beginning, but since the instruments are near the 30 m tower, 800 m away from the base, maintenance was beginning difficult as the temperatures get around –70°C. So we asked the mechanic of the base to built a thermostated box to put onto the existing system. It did the job in removing the ice when it was turned on at maximum power. However, this produced too much heat for the cameras to cool low enough. When the heat was lowered enough to cool the cameras, there was not enough heat to stop ice forming. A new solution will be installed for the next winter.

4. Technical problems

- Motors of the telescope: all the motors of the Astro-Physics AP 900/1200 mounts were modified for Antartic conditions. A heating resistance and a thermal sond were put inside the carter of the mortors. However a lot of position encoders (they are inside the motor carter) broke down, especially after days of strong wind or very low temperatures. I could repair until I finished my stock of spare encoders. Then I had to make a choice between the experiments (the motors can be exchanged between the telescopes). Corona was the first one to be stopped, then GSM. Hopefully I could finish the winter with the DIMM and the SSS running.

- Carters of the RA/Dec gears: It’s a problem I noticed with the AP 1200 mount of the SSS. When the temperature was below –70°C, it was impossible to rotate the telescope around the RA axis. Even when the motor was removed (in this case the RA gear is free and the axis should rotate without problem). I think it is caused by a mixture of grease and snow which becomes like glue and block the gear. Probably during the frequent interventions on the RA motor some snow entered the axis. This problem was not observed on the DIMM. We tried to build a heating tape with resistances and put it around the axis. Things were better with this tape. For the next winter I would suggest to put some heating resistances inside the RA/Dec axes of the all the telescopes.

- Optics: below –60°C optical aberrations were observed. On the DIMM/GSM experiments we do not use the full telescope pupil, but only two 6 cm diameter circular holes. The shape of the sub-images is not
affected by the temperature, but the distance between the two images increase by a factor 30 to 40 % when the temperature varies from –50°C to –75°C. The line joining the two images gets a tilt of about 10°. The full pupil image is strongly aberrated and triangle-shaped. This problem was critical for Corona (see section 3.5). At the end of the winter I realised some intra/extrafocal images in order to reconstruct the wavefront and understand the origin of these aberrations (a technique imagined by Roddier and designed as the Roddier’s test). I did this on the SSS telescope (it is a Meade 16”), which was the less affected of all the telescopes. I could not do the same for the Corona (a Celestron 14”) and the DIMM (Celestron 11”) telescopes: it was too late, temperatures did no longer get low enough. I suggest to the future winterers to make this test on all the telescopes at the beginning of the next winterover.

- Video connetors: all the telescopes are equipped with a finder. They are composed of a lens (300 mm focal length) and an video CCD camera. I had some problems with the video connectors of these finders, and changed them several times during the winter. Still there are a lot of loose connections. This will be investigated during the next summer season.

5. Conclusion

The first winterover conducted by Karim Agabi gave a lot of informations about the turbulence conditions above Dome C. One of the key points was the discovery of the 35 m high surface layer, that is likely to influence the design of future visible and IR telescopes.

Observations carried out during the second winterover confirmed Karim’s measurements. The ground seeing estimated by the DIMM shows the same dramatic increase at the end of the summer and remains around 1.5 – 2 arcsec until the middle of the spring. A summer-like behaviour (values around 0.6 arcsec and a sharp minimum in mid-afternoon) was first observed in the first half of October where temperature rocketed for hours above -50°C.

The vertical profile of the turbulence was intensively monitored, several tens of thousands of profiles will be derived from the SSS data, still waiting for their processing on the hard disk. That’s a huge progress compared to the 40 profiles obtained last year by means of radiosoundings. The bad point is the failure of the two sets of instruments dedicated to surface layer monitoring (sonics and microthermals).

GSM problems have been overcome and first outer scale measurements were carried out this year. The SSS giving also integrated numbers such as the isoplanatic angle and the coherence time, we now have a monitoring of the complete set of parameters that characterize the optical turbulence.

Corona, the prototype of stellar coronograph, is a deception. It was the first instrument that needs accurate imaging in the focal plane at Shannon sampling of the Airy disc. Strong optical aberrations at low temperatures did not allow its exploitation. But there is a lot to learn about the origin of these aberrations and the cure for future telescopes. It seems that the Meade 16” is less sensitive than the Celestron used for Corona. Optical tests were performed at the end of September, but it was too late. Too late in the season and too late to take advantages of these tests to modify the new telescopes. However it will be mandatory to make other tests at the beginning of the next winter, soon enough to modify the instruments foreseen for the winter 2008.

Last, the cloud coverage has been monitored for the first time by two independent instruments: a visual estimation 4 to 5 times a day, and the visible all-sky camera of Gattini whose data are still to be processed. Yet the news are good, the clear sky fraction is over 0.978 % of the time.

Acknowledgements.

I wished to thank the persons who helped me during this winterover. All the people I sent on the 30 m tower for de-icing the sonics and changing the microthermals: Shaun Deshommes, Loïc Le Bechec, Miguel Ravoux, Minh-Ly Phan-Minh. Thanks to Eliseo d’Eramo, the mechanic, for the thermostated box on the Gattini infrared camera and for the insulation of the shelter below. Thanks to Shaun and Eliseo for various interventions on the telescope mounts. To Miguel for the help in setting up the spectrograph on the mount for earthshine observations. Thanks also to José Dos Santos who realised the heating coil for de-icing the optics of the SSS telescope. To Michele Impara who translated weekly the updates for my website in italian. And thanks to the people who provided help on various technical/scientific points by email throughout the winter, in particular M. Azouit, JB. Daban, D. Briot, J. Lawrence, F. Valbousquet, F. Vakili, J. Vernin, A. Ziad.