Concordiasi Meeting Minutes

10 December 2008

Participants:
CNES: Didier Renaut, Philippe Cocquerez
ECMWF: Anthony McNally
IPEV: Yves Frenot
LGGE: Christophe Genthon, Ghislain Picard, Hélène Castebrunet, Michael Town
LMD: Albert Hertzog
Météo-France: Eric Brun, Jean Pailleux, Florence Rabier, Alexis Doerenbecher, Fatima Karbou, Aurélie Bouchard, Vincent Guidard, Stéphanie Guedj, Laaziz El Amraoui, Vincent-Henri Peuch
NCAR: Hal Cole, Jack Fox, Terry Hock (Joe Van Andel and Keith Romberg by teleconference)
WMO: David Parsons (by teleconference)

Florence Rabier: **Concordiasi status**
She reminds the main goals of the Concordiasi project and gives an overview of the activities that took place in 2008 (science, testing and developing of instruments and balloons, field campaign especially the radiosonde launches from Concordia and Dumont d'Urville, communication). The Concordiasi website devoted to datasets collected during the field campaigns is presented. The plans for 2009 are: the main driftsonde field campaign, together with radiosonde launches from Dome C and DDU, but also from UK and Australian stations possibly, and the submission of the BAMS paper.

David Parsons: **WWRP, IPY and Concordiasi** (by teleconference)
He introduces the WMO Research Programme Components (including WWRP, to which THORPEX belongs)and described the objectives of the IPY-THORPEX cluster (out of 10 projects, Concordiasi is the only one in the Southern Hemisphere). More coordination and collaboration between the various projects would be beneficial. WWRP encourages publications on these projects and raises the issue of how to treat the research legacy of IPY. His particular interest would be to see the impact of observations on high impact weather (precipitation, high winds).

Christophe Genthon: **Model and Data analysis at Concordia**
Christophe introduces Mike Town (Concordiasi post-doctorate in LGGE). LGGE contributes to instrument deployment and maintenance at Concordia station (and also at two other coastal stations). LGGE mainly focuses on boundary layer processes: monitoring and documentation. Comparison of measurements with model outputs (ECMWF and Météo-France/ARPEGE global models) led to improvements in the ECMWF system. Diurnal cycle is strong for the temperature at ~4m, but not present after ~45m. Some disagreements between measurements on instrumented tower and radiosonde data look suspicious and might be explained by launching procedures (to be investigated). Global meteorological models seem to miss some processes close to the surface during nighttime. LGGE is also particularly interested in documenting precipitation events and how snow accumulates (deployment of present weather sensors, extraction from microwave passive satellite sensors). To do in 2009: study lower boundary layer (ARPEGE/AROME), process data measured during the past seasons (data not transmitted through Iridium, but stored locally; including SODAR measurements at Concordia by an Italian team), proposal for a highly intensive radiosounding period (up to 6 radiosondes a day, in clear sky conditions). This SOP will be organized by LGGE (Christophe and Mike) using Concordiasi radiosonde data. Data from tower measurements in Concordia will be available for the Concordiasi project, in particular during the intensive special observing period.
Anthony McNally suggests checking the altitude used in global models to explain the differences between measurements and model data. Hopefully, this is not a problem as the orography is quite smooth on the Plateau. Yves Frenot says that SODAR data from the astronomy community (from previous years, no data will be collected during Concordiasi) should also be made available if needed, according to the Antarctic Treaty. Eric Brun suggests investigating the possibility of deploying tethered balloons. There

are no plans, but Christophe will check with Andrea Pellegrini about the possibility of having such platforms.

Michael Town: **The atmospheric infrared spectra in polar regions**
He describes the issues for in particular surface temperature retrievals from IASI data. Challenges: atmospheric emission, surface emissivity, spatial & temporal variability surface temperature, clouds. Surface emissivity over Antarctica is mainly affected by snow emissivity, which is highly variable (wavelength and snow grain size). Temporal variability is partly due to annual temperature cycle. Characterization of clouds differs depending on from where the measurement is done (ground based estimation or cloud cover derived from satellite observations). A compromise between accuracy of surface temperature retrieval and work done on factors affecting the retrieval has to be found.
A discussion raises several questions. The spatial heterogeneity of snow type on the Plateau would have to be taken into account, as IASI measurements are an integration of signal over a significantly large area (compared to local measurements). Furthermore, the link between grain size and emissivity is quite difficult to apply to retrievals because the satellite measurements are affected by effective emissivity only. It then seems that a dynamic retrieval of emissivity should be preferred to atlases. It does not seem realistic to use information on microwave emissivity to help for the infrared, as there are very different grain sizes at the surface (affecting the infrared) and below (affecting the microwave).

Anthony McNally: **Status of AIRS/IASI assimilation at ECMWF, monitoring of Concordia and Dumont d'Urville soundings**
Over land, IASI data are actually not assimilated in the ECMWF system, neither tropospheric AIRS data. In particular, problems of cloud detection and surface emission modeling have to be solved, especially for infrared measurement. On the contrary, satellite data usage in the stratosphere is satisfying. Background error statistics are very important in the assimilation process. Nevertheless, they are so poorly accounted for that they appear detrimental to the data assimilation efficiency over the polar regions. Field campaigns should help describing these errors in a better way and improve the usage of satellite data over polar regions. Bias correction and model error (and their interaction) can dramatically damage the usage of satellite data, in particular over polar regions. Jean Pailleux points out that the currently used variational bias correction (VarBC) should handle the observation bias. Anthony McNally stresses that VarBC needs anchor data to properly separate bias correction from model error. Ch Genthon mentions the possibility of launching balloons able to go higher than latex balloons at Concordia, which could be used for special observations to document model biases at high altitudes.

Vincent Guidard: **Status of AIRS/IASI assimilation at Meteo-France**
In operations, AIRS and IASI data are assimilated in a similar way (~50 channels, only over open sea), with a good impact, especially over Southern Polar regions. In pre-operational mode, IASI usage is extended over land and sea-ice; though they are affected by clouds, additional AIRS data are assimilated.

Aurélie Bouchard: **Developments for data assimilation over Antarctica and monitoring of Concordia and Dumont d'Urville soundings**
Microwave emissivity has been modified for snow, in the context of the Concordiasi project, which leads to more realistic simulated observations from model data. Aurélie summarizes satellite data usage for both operational and Concordiasi specifically tuned models. The latter shows good impact on forecasts, with respect to both observations and independent analyses (ECMWF analyses). Boundary-layer wind speed is also improved. A focus on cloud detection for AIRS: comparison with data from the A-train (CALIOP and CloudSat) shows that cloud-top pressures retrieved from our cloud-detection method, lidar and radar instruments are not consistent, because they do not measure the same effect from the clouds. Aurélie confirms that human ground-based estimation for clouds is available at Concordia and Dumont d'Urville, and will be used for a finer investigation.

Laaziz El Amraoui: **IASI assimilation for chemistry applications**
Laaziz briefly described the MOCAGE chemistry model. Assimilation scheme is a 3D-FGAT minimizing the objective function in the observation space (PSAS). 2°x2° super-observations are built up from clear

ozone total column (OTC). Cloud flags for observations are provided by EumetSat in the L2 product. A posteriori diagnostics on assimilation exhibit a chi² value of 0.8, which is not far from the ideal value of 1, meaning that the assimilation is not far from optimal. Good agreement between OTC in the case of IASI or MLS assimilation in structure but not in amount. To do in 2009: validation against ozone sondes, quantification of biases.

Yves Frenot: **Initial Environmental Evaluation**
Resources of the Antarctic (seals, gas…) and various territorial claims. In 1957-1958, International Geophysics year led to the Antarctic Treaty. Consequences, in the area south of 60° South :

-no new claim for territory or extension of claim
-no weapon, no radioactive tests nor waste storage
-continent devoted to peace and science

A protocol signed in Madrid in 1991 reinforced these statements (several annexes, including the need of preparing an Initial Environmental Evaluation prior each activity in Antarctica and the obligation to evacuate all wastes from the Antarctic treaty area). For the Concordiasi project, the document for Initial Environmental Evaluation has been written (quick detailed review of the content is given). Conclusion: scientific interest is irrefutable, there is no alternative, likely impacts are less than minor or transitory. Learnt from Vorcore: 60% of flights end outside the Antarctic Treaty area. This document will be put on the website. Final authorization has been delivered by the French competent authority and information has been forwarded to NSF/OPP.

Philippe Cocquerez: **Balloon development and initial results from T-PARC**
Philippe gives an overview of the T-PARC campaign. Zero-pressure balloons were used (flight level varies from daytime to nighttime), contrary to super-pressure balloons that will be used during Concordiasi. Problems of balloon leaks occurred during T-PARC, implying shorter flights (duration as expected but flight course slower than expected resulting in shorter distance). Mission specifications for Concordiasi have been edited, with still an open issue on ozone photometer from U. Colorado (approval by NSF still pending). Flight control centre will be at CNES Toulouse and Scientific Mission centre will be at Météo-France Toulouse. 12 MSD + 6 PSC (temperature- and pressure-meters, plus 3 combinations of instruments [ozone particle meter or GPS radio-occultation]) flights are planned. Heavy or hazardous hardware have already been shipped to McMurdo (balloons, ground means, pyrotechnical devices), but flight trains are still under development. Ground test will be performed until late January 2009. The validation flights in Seychelles have been postponed to April 2009. The objectives include up to 2 MSD flights and 1 PSC flight, the validation of driftsonde gondola, the management of scientific instruments onboard payload module, etc. A decision point (GO or NO GO) will be made at the end of the Seychelles campaign. Albert Hertzog describes the status of the LMD instruments: Meteorological sensors (improved compared to Vorcore ones) + Ozone UV photometer still in ground test and validation phase; candidate instrument to participate to the Seychelles campaign). U. Wyoming instrument is ready, some work on software is remaining. GPS radio-occultation is OK, interface development is on-going.

Terry Hock: **driftsonde development and initial results from T-PARC**
Driftsonde system= balloon based dropsondes.
MIST sonde: GPS wind and altitude, Vaisala RS92 PTU sensors, fall time 20 minutes from 40 hPa, fall velocity from 50 m/s at 40 hPa to 10 m/s at the surface. A driftsonde gondola has a capacity of 54 sondes. Control of dropsondes release is done through a webpage (dedicated website of EOL). In addition to the control panel, data and information on gondolas and dropsondes are available. Figures from T-PARC: 13 good flights (over 16 balloons launched; 2 balloon failures and 1 gondola electronic hardware failure), 394 sondes dropped (over 494 possible, 253 good drops, 117 failed to release, 26 questionable data). Whole sounding database is available on-line.
Florence Rabier wonders whether it would be possible for NCAR to put data on the GTS right after they receive it. Terry prefers Météo-France team to download data from the website and put them on the GTS, as NCAR would also have to download them from the website.

Alexis Doerenbecher: **targeting strategy for Concordiasi: satellite overpasses and meteorology**
Objectives: dropsondes collocated with overpasses of AIRS and/or IASI; in the vicinity of radiosounding stations, deployment with respect to predictability purposes. Crossover between IASI swath and AIRS track occur every 3.5 days, and IASI scans a part of Antarctica every 100 minutes. Schedule of the release 1 day in advance, prediction of tracks and swath (from Météo-France CMS) and of balloons position (from LMD) is needed. Adaptive observation consists in locally deploying additional observations in meteorologically sensitive areas. Examples of sensitive areas for Antarctica are shown (they are over coastal regions and off the coasts; very few of them over the continent). Impact on lower latitudes, in particular for Tasmania and Australia, is less likely to have sensitive areas close to Antarctica. Hypotheses and possible strategies are described in a very detailed way (see presentation for an in-depth explanation).
Question from NCAR: How accurate the time of dropping should be for IASI overpass purposes (numerous steps are needed from the gondola being asleep to a complete transmission through Iridium)?
Answer from Anthony McNally: It depends on the dynamics of the atmosphere in that region. References to Jaivex campaign show that half an hour delay may be too long in some meteorological situations. However, it is expected than up to an hour difference could still be OK over high latitudes. Documentation of the time variability could be obtained by performing multiple launches occasionally.
Question from Anthony McNally: Would it be possible to give counter-order for dropping if up-to-date information from visible imager on-board MetOp or Aqua indicates that high opaque clouds are present (to save sondes)?
Answer from Florence Rabier: She thinks that even cloudy scenes are opportunities to solve some challenges (like assimilation of IASI in cloudy conditions). LMD trajectory forecasts will be made available on the web. Philippe Cocquerez adds that CNES will rely on similar trajectories, but based on a daily update of the ECMWF forecast.

Discussion (planning for the Seychelles campaign, communication plan...)

What if the decision after the Seychelles campaign is NO GO ? This would have to be discussed between all partners. Ph. Cocquerez guesses that CNES would try to delay the campaign once again, if NSF is ready to share this effort.
Some participants of the communication team are still not designed, in particular at CNES. Didier Renaut will urge CNES to proceed.
Yves Frenot informs that a special event on IPY will be held at Collège de France (14-15 May 2009). He thinks a presentation of the Concordiasi project would be useful.
Preparation of the paper in BAMS should go on nominally. Florence Rabier reminds that some contributions are missing.
Yves Frenot reminds CNES that, as soon as the GO sign is given, all technical, medical, etc. processes have to be planned quickly. Ph. Cocquerez informs that all procedures are planned to begin before the Seychelles campaign.

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With the participation of: Florence Rabier, Alexis Doerenbecher, Aurélie Bouchard, Vincent Guidard, Dominique Puech, Philippe Cocquerez, Albert Hertzog, Terry Hock, Jack Fox, Hal Cole, Christophe Genthon and Michael Town.

All information on the launch of balloon (successful, etc.) will be available on the website.
2 persons from NCAR will be in McMurdo to prepare gondolas and interact with CNES team. They will post information on the preparation on the website. In Boulder, a team is dedicated to monitoring of the gondolas (more from an engineering perspective). 1 person from NCAR will help training during a 3-week period. NCAR is willing to provide as user-friendly as possible and which will be tuned for Concordiasi purpose. Florence suggests trying the system during the Seychelles campaign. NCAR will

evaluate this possibility, including either 1-week of someone from NCAR in Météo-France Toulouse or the reverse.13 gondolas will be built up. It is then up the to PI to decide the number of spare gondolas among that pool (1 spare gondola). 6 gondolas will be dedicated to PSC flights.
CNES commitment for dropsondes is 600 sondes (a total of 700 sondes would be available). PSC flights: first ozone dedicated flights (4), then 1 dedicated to GPS radio-occultation; 1 MSD flight in between; then the last PSC flight dedicated to GPS radio-occultation, before all the other MSD flights. CNES has to end launches before the end of October (beginning on September 1st). Philippe stresses that any clear launch window will be used, which means that, during favorable periods, a launch every day might take place (even 2 launches in a day). Weather conditions are less convenient in McMurdo than for AMMA or T-PARC. All participants agree that a launch for MSD flight every 2 days would be ideal. Alexis reinforces that this strategy for launch is perfect to rapidly have a sufficient constellation of balloons (in particular to have enough choice between various locations). He re-explains the two strategies that have been prepared. Preference goes to the second option. Times of dropping (00 UTC, etc.) correspond to central time of 6-hour assimilation windows. Energy for LMD T and Pressure sensors is supplied by CNES (on-board balloons). They are expected to have duration of months. In specifications, up to 4 sondes per gondola per day is planned (consistency between control of the gas amount in the balloon and the weight of the gondola). Gas amount monitoring will be done in CNES Toulouse. NCAR has to check whether signal from dropsondes may interfere with signal from radiosondes (radius of interference may range up to 200 km). Frequency used by the driftsonde system is already decided in advance. Arrangements have to be found with stations launching radiosondes. Florence wonders whether uploading launch schedule 1 day in advance is possible. NCAR has not developed the interface so far, but it seems possible. Changing the uploaded schedule may be trickier. Up to now, launch order was given in real time with no delay. Testing all these options during the Seychelles campaign would really be appreciated. Additional funding from NSF for NCAR participating to the Seychelles campaign is still pending. Steve Cohn will keep Concordiasi team informed. Trajectory forecasts will be made available by LMD (every one interested will have to pick up the data, both on ASCII format and KML format). Interface with Google Earth has already been developed, and trajectories (real position of balloons and location of dropsounding). Florence raises the question of the number of quasi-simultaneous drops that can be done. NCAR has still to work on that point, to optimize the usage of bandwidth and telephone lines. Battery and energy supply is a crucial point (having also impact on weight of the gondola). What if dropping is unsuccessful? Procedures have been improved, e.g. to inform on the status of dropping. Engineer at NCAR will be reachable 24/7. NCAR proposes to automatically re-drop (only once) if the status of the first drop is unsuccessful. Different levels of access to data (visualize and update) on NCAR website will be designed to meet responsibility of each person involved. Software to convert data into GTS format is freely downloadable from the web. This software is also an opportunity to check the consistency of the soundings. Florence (as PI of the project) will have to contact WMO. Temporal sampling of in-flight data from T-Z sensors on-board balloons has to be decided by Météo-France team. NCAR asks for any schedule / planning of the Seychelles campaign. Philippe informs that the campaign will start on April 1st, then 1 week for preparation, then 1st launch on second week of April (MSD flight), then launch of a PSC flight during the same week, and eventually the last launch (PSC flight) after checking first data; possibly another MSD flight is forecast. Flight duration can range from 2 weeks to 2 months (depending on the trajectories and which countries are over-flown; clearance is OK for 20S-10N). 25 to 50 sondes should be available in each MSD flight. Terry mentions that NCAR reprocesses the data and that a “clean” dataset will be made available within 3 to 6 months after the field campaign.