

Protocol of the Inca-Meeting, March 7/8, 2001, Oberpfaffenhofen

Participants:

Frank Arnold, Frederique Auriol, Janine Baehr, Reinhold Busen, David Duda, Markus Fiebig, Jean-Francois Gayet, Franz Immler, Bernhard Mayer, Andreas Minikin, Joelle Ovarlez, Andreas Petzold, Hans Schlager, Otto Schrems, Ulrich Schumann, Marco Seifert, Frode Stordal, Johan Ström, Peter van Velthoven, Peter Wendling, Peters colleague, and Helmut Ziereis

The meeting was opened by Johan Ström and Ulrich Schumann. Johan Ström distributed the draft version of the interim report to CEC asking for comments and corrections. The financial report including the costs for the campaigns is shifted to the final report due to the unclear situation regarding the reimbursement of costs. Ulrich Schumann stated, that the agreement on further work on the data up to agreements on common publications should be a major goal of the meeting.

The meeting continued with data presentations of the different groups:

MPIK Heidelberg: Frank Arnold reported on measurements with the electro static probe (ESP). From earlier experiments, where the ESP was operated in combination with other instruments (LIOMAS, SIOMAS) it is known, that both large and small ions are enhanced in clouds. During INCA the ESP signal again showed enhanced ion concentrations inside clouds. The nature and the origin of these "cloud ions" is still unclear.

Air Chemistry, DLR: Janine Baehr reported on measurements of NO_y and NO, as well as O₃ and CO, especially on vertical profiles of these species. In the Prestwick profiles on most of the days the profiles are as expected with decreasing concentrations of the gases with height, except for ozone. On October 12, however, the nitrogen components were extremely high at altitude. Crossing a plume of polluted European air mass could be the reason for these enhanced concentrations.

Comparing the northern and southern hemisphere higher values for all gaseous components are found in the North, the concentrations being in accordance with the earlier POLINAT measurements. The ratio of particulate NO_y to gaseous NO_y is distinctly higher in the Southern hemisphere, mostly caused by the overall lower concentration of gaseous NO_y on this hemisphere.

Helmut Ziereis pointed out, that the total particle surface area, given in $\mu\text{m}^2/\text{cm}^3$ is important for the particulate NO_y concentration. The surface area calculated from different instruments like FSSP, Polar Nephelometer or 2D-C varies more or less, as these instruments do cover different size ranges of particles. To really understand the process of gaseous NO_y condensing on particles the dependence on surface area, temperature and HNO₃ concentration needs to be taken into account.

Andreas Minikin adds some results from comparing the FSSP 300, the Polar Nephelometer and the 2D-C probe. The differences are quite distinct, but the agreement improves considerably when applying a 21 second running mean on the data. The ratio FSSP/Polar Nephelometer depends on the cloud element number concentration.

Joelle Ovarlez remarks, that probably time shifts between the time series of different instruments could cause systematic differences, too.

Particle measurements, ITM: Johan Ström presented data from the transfer flights to Punta Arenas. Remarkable differences were found when using either the forward or backward looking air intake. Outside clouds nearly the same size distribution was measured, but distinct differences occur at high humidity or in clouds, respectively. For explanation Johan Ström states the hypothesis, that smaller particles might be chemically different from larger ones. This could cause preference of growth and enrichment at the forward looking inlet.

INCA data base and CNs: Andreas Minikin gave an overview on the data base installed at DLR for storing and exchanging the INCA campaign data and a short introduction in accessing the data. The data of both campaigns and the ferry flights are available with some exceptions. The data base also includes some statistics on flight time in the UT, LS, in clouds etc.

Andreas Minikin also presents some profiles from Punta Arenas and Prestwick for $CN > 14\text{nm}$ and accumulation mode particles, as well as for volatile and non-volatile particles.

Filter samples of particles: Andreas Petzold presented a first overview on the inspection of filter samples. In total there are only few particles on the filters, which are grouped in three size ranges: $0.2 - 0.5 \mu\text{m}$, $0.5 - 1.5 \mu\text{m}$, and particles $> 1.5 \mu\text{m}$. The particles are mostly non-volatile, with a 70 % mineral and metallic fraction. About 5 % is NaCl, and 20 % cannot be identified, but this fraction is presumably of organic origin.

Water vapor, LMD: Joelle Ovarlez presented some statistical considerations on the RH data collected during both INCA campaigns. Outside clouds no supersaturation with respect to water was found, the RH level and the ice supersaturation was in general higher in Punta Arenas. Inside clouds some peaks exceeding liquid water saturation were recorded, which need a further check. Johan Ström remarked, that the volume number concentration of residual particles was higher in the Northern hemisphere, which may explain the lower supersaturation in this case.

Satellite Data, NASA: Dave Duda presented examples of satellite pictures received and processed during the campaigns. The products are available in the Internet under: <http://angler.larc.nasa.gov/inca/> Further tasks of NASA are the comparison of both hemispheres, the deduction of aerosol parameters from the satellite products, and the evaluation using in situ aircraft data..

Bernhard Maier briefly explained the possibilities and chances of his software tool MYSTIC, which contains radiative transfer modules, and outlined his plans for working with the INCA dataset.

Aerosol LIDAR, AWI: Franz Immler shortly reviewed the measuring principle of the MARL system and showed examples of INCA measurements. A first classification of the measurements leads to the conclusion, that

- at Punta Arenas classical cyclones with extended cirrus in the warm sector were prevailing, strong cirrus layers were found connected to the tropopause, and
- at Prestwick the situation was much more complex, in addition aerosol layers were observed here.

Both data sets are similar in the distribution of optical depths. An important and necessary next step is a compilation of coincidences of LIDAR measurements and satellite overpasses.

Cloud Physics, LaMP: Jean-Francois Gayet presented an overview on the model capabilities of the Clermont-Ferrand group including A. Flossmann, W. Wobrock and M. Menier. An inversion method was developed for evaluating the crystal size spectrum and the ice water content from measurements of the scattering phase function.

From comparing the extinction coefficients and effective particle diameters deduced from the different probes J.-F. Gayet suspects the effective diameter from the FSSP 300 not being correct. Different reasons are discussed, obviously not the finally corrected data have been used for this comparison.

From statistical considerations regarding the cloud physical data Frederique Auriol concludes, that in Prestwick more but smaller ice particles are found compared to Punta Arenas.

Chemical predictions, NILU: Frode Stordal reviewed the work performed for supplying chemical forecasts during the field campaigns, which were a really great help in mission planning. The work package is finished, a detailed description is found in the CEC interim report.

NILU will further be engaged in verifying the specific sea salt prediction with data from the Göteborg group, another verification is needed for the dust particles prediction.

Out of the INCA scope Frode Stordal presented some work on radiative forcing due to aerosols.

Meteorological analyses, KNMI: Peter van Velthoven briefly reviewed the forecast products available at KNMI. He has calculated the meteorological fields for the flight missions, the parameters along the actual Falcon flight track are interpolated from the model and are available for the Punta Arenas campaign. The data for the Prestwick campaign will follow shortly.

A suggestion to calculate the humidity fields in Punta Arenas and Prestwick from the last ten years for the relevant campaign periods will be checked. This could help to climatologically classify the measuring periods in 2000.

Residuals / Interstitial aerosol, SU: Marco Seifert gave a status report about the work with the residual size distributions measured by the CVI-payload. Also in the residual particle properties there is a systematic difference between the two campaigns. Clearly the residual particles are larger in the SH compared to the NH. The reason for this is not clear yet, but it has important implications for the scavenging of aerosol volume in the tropopause region. By number the cirrus clouds scavenge about 1 % of the available aerosol.

Johan Ström reported on an encounter of a cirrus cloud on the out-bound ferry flight, which was clearly located above the tropopause: The cloud was extensive and

covered many hundred kilometres, but at times the cloud was thin and contained very few ice crystals. The ozone concentration was around 400 ppb when the cloud first was observed. Although, the aircraft flew on a constant pressure level the ozone decreased, which indicates that the cloud became relatively closer and closer to the troposphere. Trajectories point towards the air spending at least 10 days in the stratosphere and the origin of the air mass appear to be the Arctic. More analysis of the cause for the apparently high humidity in the stratosphere remains. The response from the participants on this topic was overwhelming.

Ulrich Schumann briefly reviewed the ATC data, which are available for the Prestwick campaign. This data material needs a closer look and evaluation.

He suggested to publish the results later in the year, but to provide a draft of the papers before the summer break.

The following topics were identified in the discussion (lead author in brackets), the final titles have to be specified:

- Water vapor (Ovarlez)
- Trace gases (Schlager et al.)
- Meteorological differences between the measurements in Punta Arenas and Prestwick (Schumann et al.)
- Asymmetry parameter (Gayet)
- Absorbing material in cirrus crystals an hemispheric comparison (Ström)
- Evaluation of CNC data (Minikin)
- Satellite data (NASA)
- MARL: N-S differences (Immler)
- Sensitivity study: What differences in cirrus properties are needed to cause differences in radiative forcing? (Maier)
- N-S differences in the NILU model output (Stordal)

Draft in a shape ready to print should be prepared until the middle of September, with the intention to publish in GRL.

In the final discussion the following points were addressed:

- The final project meeting for INCA is planned for December in Stockholm.
- Everybody is asked to provide results in graphical form for being included in the INCA webpage.
- In the data archive information on time lags for time series of different instruments is needed to avoid misinterpretations of data.

The meeting was closed by Johan Ström.