▶ Chlorine Monoxide Radiometer Intercomparison in Ny-Ålesund, 1997

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▸ Introduction and Overall Concept

From January to April 1997 an intercomparison of four chlorine monoxide (ClO) millimeter wave radiometers was performed. The observation site was the Arctic NDSC station Ny-Ålesund at 78.9° N and 11.9° E. All instruments received the thermal emission of stratospheric ClO at either 204 GHz or 278 GHz. Unfavourable weather conditions and different times of presence in Ny-Ålesund limited the number of days when simultaneous measurements were possible. Three of the four participating groups have delivered data up to now, and the only day when these groups simultaneously took good data was March 17. The intercomparison has been devided into two steps, firstly the test of the calibration procedure and secondly the comparison of the retrieved profiles. This procedure was chosen because the different retrieval algorithms may lead to different altitude resolutions in the profiles and to different widths of the ClO layer. For the first step a simple scaling factor method was used to fit a calculated spectrum of a given altitude distribution to the measured spectra. Different scaling factors indicate differences in either the calibration procedure, the correction due to tropospheric absorption or in the scaling process in which the data are converted to the same observation angle. This step has been completed for those groups who delivered data. The second step, the profile intercomparison is in progress.

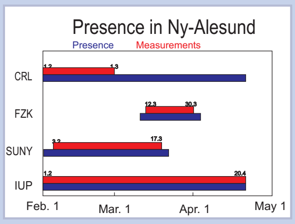

Figure 1.
IUP University of Bremen
FZK Research Center Karlsruhe
SUNY State University of New York
CRL Communicat. Research Laboratory

▸ Examples and Method

To reduce baseline effects and to eliminate contributions of other emitting species we have subtracted night time data from day time data. This procedure is feasible because of all emitting species in the observed frequency range ClO only has a significant diurnal cycle. At night ClO is almost completely converted to its dimer. ClO not converted to the dimer at night effects all spectra equally. Because of the variing observation angles of the different instruments, the difference spectra have been converted to zenith direction. A model profile with a peak mixing ratio of 1.6 ppbv at 23 km altitude was used for the calculation of the model spectrum scaled to the data (see Raffalski et al., poster #106). The spectra presented here were taken under comparatively unfavourable weather conditions causing a rather poor signal to noise ratio. For more information on data see posters of McDonald et al. (#104), Hochschild et al. (#100) and Raffalski et al. (#106).

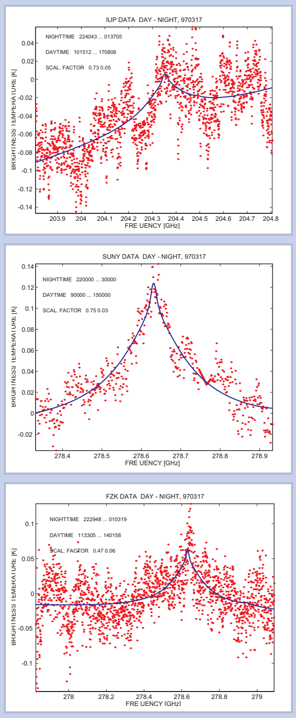

Figure 2. Day minus nighttime data (dots) of March 17 and scaled radiative transfer calculation of a given ClO distribution (solid line).

▸ Results and Discussion

For three of the four participating groups six days of simultaneous measurements were found. Due to different observation schemes as noted in the table, observation times and integration times for the different instruments deviate from each other. All data are contaminated by standing waves that were caused by reflections in the optical paths of the instruments. The scaling factor method has proven to be rather insensitve to standing waves as present in Figure 2. The 0.6 GHz bandwidth of the SUNY instrument causes a slightly different scaling factor compared to the 1 GHz bandwidth of the IUP and FZK instruments. To take this into account we have also plotted the scaling factor for the IUP instrument with a reduced bandwidth in Figure 3. The agreement between the IUP data with a reduced bandwidth and the SUNY data is evident. The differences between the IUP data with a full bandwidth of 1 GHz and the IUP data with 0.6 GHz bandwidth must be attributed to the profile used for the calculation of the model spectrum fitted to the data. The FZK scaling factors deviate from the other two data sets by about 30%. At this time we think this deviation is due to differences in the tropospheric correction algorithms.

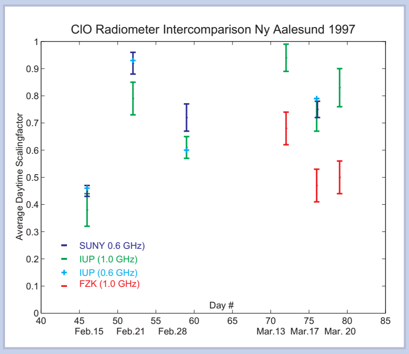

Figure 3. Daily averaged scaling factors of simultaneous ClO measurements. Note the different bandwidths for the IUP

▸ Instrument Parameters

	SUNY	FZK	IUP	CRL
mixer diode	SIS	Schottky	Schottky	SIS/SIS
system noise [K]	340	1100	1200	600/800
bandwidth [GHz]	0.6	1.0	1.0	1.0/0.5
frq. resolution [MHz]	1.17	1.2	1.3	1.2/0.4
balance system	ref. beam	adj. load	ref. beam	adj. load
single sideband filter	yes	yes	yes	yes
center frequency [GHz]	278.6	278.5	204.3	204.3/278.6

▸ Future Work

In the second step of the intercomparison the retrieved profiles will be compared. SUNY and IUP retrieve profiles from day minus night spectra while FZK simultaneously retrieves ozone and ClO profiles from each individual spectrum.

▸ Acknowledgements

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