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HAMP - the microwave package on the upcoming High Altitude and LOng range aircraft HALO

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New cloud observation techniques are needed to improve our understanding of the impact of clouds on the earth's water cycle and radiation budget, which represents still one of the largest uncertainties in global and regional climate modeling. An airborne platform for such observation techniques will be provided by the new German research aircraft HALO (High Altitude Long Range) that will be commissioned in 2009. HALO will open a new dimension for climate and atmospheric research. By HALO it will be possible to survey the atmosphere on continental scales but with much finer resolution and with more powerful instrumentation than feasible on space borne platforms.

An advanced set of microwave remote cloud sensing instruments (HAMP - HALO Microwave Package) will be operated on board of HALO. It consists of a cloud radar and a suite of passive radiometers in different frequency bands. The radar MIRA-36 operates at 36.5 GHz. Although this is an unusual low frequency, it benefits from the wider range of applications due to less signal attenuation in deep clouds and rain, compared to the 94 GHz radar operated on CloudSat. The frequencies for the passive microwave radiometers were selected in allusion to the AMSU-A and -B sounder. Thereby the 150 GHz channel of AMSU-B has been replaced by frequencies in the 118 GHz oxygen band. In combination with the 60 GHz oxygen complex channels, this frequencies can be used for precipitation retrieval after Bauer and Mugnai (2003). Furthermore by including channels in the water vapor lines at 22.235 GHz and 183.31 GHz and higher microwave channels sensitive to scattering in the ice phase, various precipitation retrieval algorithms can be compared by measurements with HAMP.

This presentation introduces the microwave package on HALO. It further shows the potential of the observations by presenting results of a simulation study for the selected microwave frequencies and the cloud radar. The potential of the selected frequencies for hydrometeor observations and their retrieval has been investigated by developing simple algorithms based on a data set of simulated brightness temperatures and concurrent hydrometeor contents and profiles. These were achieved by cloud resolving model simulations and forward radiative transfer calculations for a set of midlatitude precipitation events. The different sensitivities of the various passive microwave frequencies to varying hydrometeor contents and surface properties can be clearly seen. Even for very simple retrieval algorithms, good retrieval capabilities for frozen hydrometeors over both surfaces (land/ocean) and for rain over ocean surfaces are found.

References:

Bauer, P., and A. Mugnai (2003), Precipitation profile retrievals using temperaturesounding microwave observations, J. Geophys. Res., p. 4730.