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Cirrus properties from IR Sounders and analyses in synergy with other instruments

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Satellite observations provide a continuous survey of the state of the atmosphere over the whole globe. IR sounders have continuously observed our planet since 1979, with improvements in spectral resolution: the TIROS-N Operational Vertical Sounders (TOVS) onboard the NOAA polar satellites, the Atmospheric InfraRed Sounder (AIRS) onboard Aqua (since 2002) and the InfraRed Atmospheric Sounding Interferometer (IASI) on board METOP (since 2006). The spectral resolution of IR sounders along the CO_2 absorption band makes them the passive instruments most sensitive to cirrus, day and night. High-level clouds constitute about 40% of all clouds.

The LMD IR sounder cloud property retrievals for TOVS, AIRS and IASI are based on a weighted [U+F063]2 method using channels sounding along the 15 micron CO_2 absorption band. Once the cloud physical properties (cloud pressure and IR emissivity) are retrieved, cirrus bulk microphysical properties (De and IWP) are determined by investigating their spectral emissivity difference between 8 and 12 [U+F06D]m. The latter are obtained by using the retrieved cloud pressure and are then compared to those simulated by the radiative transfer model 4A - DISORT, using single scattering properties of column-like or aggregate-like ice crystals provided by MetOffice (Baran et al. 2001). The TOVS Path-B and AIRS-LMD cloud climatologies (1987-1994 and 2003-2009) participated in the GEWEX cloud assessment (http://climserv.ipsl.polytechnique.fr/gewexca).

AIRS presents the significant advantage to be part of the A-Train, including two active instruments since 2006: the lidar CALIOP of the Cloud-Aerosol Lidar and Infrared Pathfinder Satellite Observations (CALIPSO) mission and the Cloud Profiling Radar (CPR) of the CloudSat mission. The synergy with these active instruments, which provide accurate information on geometrical cloud height and thickness as well as on the number of vertical cloud layers, allowed the evaluation of cloud properties retrieved from the AIRS observations and to adapt this method then also to IASI measurements. First results will be presented. In addition we present detailed studies on the vertical and horizontal extent of different types of cirrus, also in combination with upper tropospheric humidity. Ice super saturation in the upper troposphere has been determined from AIRS humidity and temperature (NASA L2) within the AIRS pressure layers, after calibration with Measurements of OZone and water vapour by AIrbus in-service airCraft (MOZAIC).

References:

Baran, A.J. and Francis, P.N. and Havemann, S. and Yang, P: A study of the absorption and extinction properties of hexagonal ice columns and plates in random and preferred orientation, using exact T-matrix theory and aircraft observations of cirrus, J. Quant. Spectrosc. Ra., 70, 505–518, 2001