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Global Cloud Climatologies from satellite-based InfraRed Sounders (TOVS, AIRS and IASI)

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Satellite observations provide a continuous survey of the state of the atmosphere over the whole globe, and their record length exceeds now more than 25 years. The International Satellite Cloud Climatology Project (ISCCP), using data from a combination of geostationary and polar orbiting imagers, contributed to the understanding of numerous cloud physical processes. Due to their relatively high spectral resolution, IR vertical sounders provide reliable properties of cirrus clouds (day and night). Especially in the tropics, where the cirrus amount is abundant, ISCCP misidentifies about one third of these clouds as midlevel clouds. Therefore, IR sounders provide complementary information to ISCCP.

We present climatological averages of cloud properties as well as their regional and seasonal variation, from the TIROS-N Operational Vertical Sounder (TOVS) Path-B cloud climatology (8 years, 1987-1995) and from the AIRS-LMD cloud climatology (6 years, 2003-2008). The Atmospheric Infrared Sounder (AIRS) onboard the NASA Aqua satellite provides measurements at a much higher spectral resolution than TOVS. The LMD IR sounder cloud property retrievals are based on a weighted χ^2 method using different channels around the 15 micron CO_2 absorption band. The TOVS Path-B and AIRS-LMD climatologies participate 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, has allowed to evaluate the AIRS cloud height and to develop a method to determine the cloud amount. Thus the A-Train provides a unique tool to develop a reliable cloud property retrieval and error estimation as well as more detailed studies on the vertical depth of different cloud types. Results will be presented in this session.

After the evaluation of the retrieval method, it was applied to four months (January, April, July and October 2008) of global observations from the Infrared Atmospheric Sounding Interferometer (IASI) aboard the European platform Metop. The spectral resolution is about twice as high as the one of AIRS (between 8 and 15 micron), leading to the possibility of refined cloud property retrieval. Moreover, further versions of this sensor are scheduled to be launched in the future, ensuring measurements with similar characteristics up to about 2020.