Upper tropospheric cloud systems from Satellite Observations : what can be achieved? A GEWEX perspective

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Clouds in the upper troposphere, representing about 40% of the Earth's total cloud cover, play a crucial role in the climate system by modulating the Earth's energy budget and heat transport. These clouds often form mesoscale systems extending over several hundred kilometres. Cirrus emerge as the outflow of convective and frontal systems or form in cold air supersaturated with water. Both their evolution with climate change and their feedback can only be reliably estimated if these cloud systems are adequately represented in climate models.

Only satellite observations provide a continuous survey of the state of the atmosphere over the entire globe and across the wide range of spatial and temporal scales. The Global Energy and Water cycle Experiment (GEWEX) Cloud Assessment provided the first coordinated intercomparison of publically available, standard global cloud products retrieved from measurements of multi-spectral imagers, IR sounders and lidar. While imagers on geostationary satellites have a better temporal resolution, the good spectral resolution of IR sounders makes them particularly sensitive to thin cirrus, also during night and when overlying low-level clouds.

Recently GEWEX has initiated working groups on Process Evaluation Studies (PROES) to provide observational based metrics for a better understanding of physical processes. One goal of the GEWEX PROES working group on 'Upper Tropospheric Clouds and Convection' is to gain a better understanding of the role of convection on cloud feedbacks. Several studies have suggested that upper tropospheric clouds (and cirrus in particular) assert a control on convection itself and thus on precipitation and the hydrological cycle. Within this framework we are building a synergetic data base of upper tropospheric cloud systems derived from the Atmospheric InfraRed Sounder (AIRS), the Infrared Atmospheric Sounding Interferometers (IASI), coupled with information on the vertical structure from active instruments of the CALIPSO and CloudSat missions, rain rates from microwave sounder AMSR-E and from the Tropical Rainfall Measuring Mission (TRMM), on the life cycle from imagers on geostationary satellites and on thermodynamics from meteorological reanalyses.