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Satellite precipitation estimation over the Tibetan Plateau

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Precipitation characteristics over the Tibetan Plateau are very little known, given the scarcity of reliable and widely distributed ground observation, thus the satellite approach is a valuable choice for large scale precipitation analysis and hydrological cycle studies. However,the satellite perspective undergoes various shortcomings at the different wavelengths used in atmospheric remote sensing. In the microwave spectrum often the high soil emissivity masks or hides the atmospheric signal upwelling from light-moderate precipitation layers, while low and relatively thin precipitating clouds are not well detected in the visible-infrared, because of their low contrast with cold and bright (if snow covered) background.

In this work an IR-based, statistical rainfall estimation technique is trained and applied over the Tibetan Plateau hydrological basin to retrive precipitation intensity at different spatial and temporal scales. The technique is based on a simple artificial neural network scheme trained with two supervised training sets assembled for monsoon season and for the rest of the year. For the monsoon season (estimated from June to September), the ground radar precipitation data for few case studies are used to build the training set: four days in summer 2009 are considered. For the rest of the year, CloudSat-CPR derived snowfall rate has been used as reference precipitation data, following the Kulie and Bennartz (2009) algorithm. METEOSAT-7 infrared channels radiance (at 6.7 and 11 micometers) and derived local variability features (such as local standard deviation and local average) are used as input and the actual rainrate is obtained as output for each satellite slot, every 30 minutes on the satellite grid.

The satellite rainrate maps for three years (2008-2010) are computed and compared with available global precipitation products (such as C-MORPH and TMPA products) and with other techniques applied to the Plateau area: similarities and differences are discussed. Relevant characteristics of precipitation fields are derived and analyzed, such as diurnal cycle, precipitation frequency, maximum rainrate distribution and dry areas detection. Interannual variability of precipitation pattern and intensity is also discussed.