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A feasibility study on precipitation regime classification by meteorological states

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Appropriate microphysical models of rainfall systems are essential for accurate precipitation retrievals from satellite measurements. For a better estimate of rainfall from the microwave imager satellites in Global Satellite Mapping of Precipitation (GSMaP), Takayabu (2008, GEWEX Newsletter; hereinafter T08) produced 3-monthly maps of dominant rainfall systems, utilizing TRMM Precipitation Radar (PR) and Lightning Imaging Sensor (LIS) data.

It is worthwhile if we can classify different type of rainfall systems not from satellite rainfall data themselves but from the environmental meteorological states. In this feasibility study, precipitation regime classification over the oceans is performed by constructing a look-up-table (LUT) for estimating precipitation types in terms of local state of the atmosphere and ocean. This time, we chose four variables to construct the LUTs; sea surface temperature (SST), pressure vertical velocity at 500hPa (ω_{500}), lower-tropospheric baroclinicity at 900hPa (dT_{900}/dy), and lower-tropospheric stability (LTS), obtained from ERA-interim and OISST. The LUTs are trained with the precipitation types defined by T08. The four-dimensional probability density functions for each precipitation types were utilized to reconstruct precipitation types at each point.

The constructed four-dimensional LUT is shown to have a reasonably good skill in estimation over the oceans. The possibility of detection (POD) is above 60% up to 90% for all seasons. The estimation skill is less dependent on months despite that the LUT was trained with only one month climatology, indicating the choice of these state variables is reasonable. The LUT can also describe interannual variations of precipitation regimes, e.g., those differences in El Niño and La Niña periods.

The way of separation by selected environmental states is mostly meteorologically reasonable, although some representative variables have some room for improvements especially in the midlatitudes. We are also challenging on the precipitation classification by environmental states over land.