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Impact of various observational datasets on the assimilation and forecast of tropical cyclones.

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Tropical cyclones are tremendous natural hazards that threaten coastal populations worldwide. The purpose of this study is to perform data impact studies with the Aladin Réunion Limited Area Model, which is the largest and only tropical implementation of all of the versions of the Aladin consortium. It allows special focus on the Indian Ocean area and a "tropicalized" 3DVar data assimilation. Studies are performed for several storms of the 2006/2007 cyclonic season of the South West Indian Ocean basin. This last season proved to be very active with 10 named storms, 4 of which attained the "major hurricane" wind threshold of 50m/s.

Satellite data has proven most invaluable when trying to initialize Numerical Weather Prediction (NWP) models since the oceanic zones over which the cyclones develop are, by nature, data sparse. Yet, the occurrence of clouds or rain proves to be a challenge when trying to assimilate satellite data: non linear processes predominate and the use of refined, costly numerical methods might be required. These computational costs are usually found to be prohibitive and cloudy/rainy data assimilation usually is a missing component in most operational centers. This proves to be of critical importance when dealing with tropical cyclones because their dynamics take place in the core, consistently missed by observations. Of the few centers that do not suffer from this crucial observational lack, the European Center for Medium Range Weather Forecasting (ECMWF) has implemented a 1DVar inversion for cloudy/rainy areas which uses complex moist physical schemes to retrieve a Total Column Water Vapour (TCWV) equivalent from the rainy radiances, which is then used as pseudo-observation in the 4DVar assimilation.

In order to alleviate the constraints posed by such a costly 1DVar inversion, we investigated a statistical multi-linear regression that fits TCWV with the brightness temperatures of the SSM/I instrument, relying on the ECMWF analyses. The algorithm is then applied to combine clear-sky radiances with cloudy/rainy TCWV in the 3DVar data assimilation scheme of Aladin Réunion. Impacts of further observations and pseudo-observations such as a 3D wind bogus and microwave SST are also conducted.