Wind Convergence Observed by QuikSCAT

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QuikSCAT is providing daily coverage of surface wind speed and direction over 93% of the global ocean, under clear and cloudy conditions, day and night. The high accuracy and resolution made it possible to compute derivative quantities, such as atmospheric wind convergence, which reveal details of the atmospheric phenomena.

The Intertropical Convergence Zones (ITCZ) north of the equator in the eastern Pacific and the Atlantic Oceans and their seasonal meridional migrations were well observed from space, mostly through cloudiness and rainfall in the past. Despite many studies, the existences and seasonality of the ITCZ south of the equator is still controversial. By definition, ITCZ should be examined through surface wind convergence, but surface wind convergence are largely not available in the past because of the poor resolution of wind maps computed from routine ship reports. Using QuikSCAT winds, the weaker convergence zones south of the equator were revealed in the eastern Pacific and across the entire Atlantic in most of the time during the annual cycle. Two different mechanisms which distinguish the formation of stronger from the weaker ITCZ were identified.

The influence of surface wind convergence is not confined to the surface but is felt throughout the atmospheric column through mass conservation. Surface wind convergence strongly influences the precipitation and cloud through vertical advection. The rainbands in hurricanes identified by the radar on the Tropical Rain Measuring Mission were shown to align with surface wind convergence, using high resolution QuikSCAT winds. QuikSCAT data show that Atlantic hurricanes are rooted in surface wind vortices spinned out the shear zone in the Monsoon troughs off Africa. In these early stages, the surface wind divergence in these vortices is only clear link of the scattered cloud patterns to available vorticity in the studies of cyclogenesis. The surface wind convergence and associated vorticity are also used to study the positive ocean-atmosphere feedback which is believed to be the sustaining factor of a 3000-km break in the Pacific Trade Winds and North Equatorial Currents stretching from the Hawaiian Islands to the western Pacific.

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