Detecting Tropical Cyclone Water Vapor Transportation with the TRMM and Advanced Microwave Sounding Unit (AMSU)

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Abstract

Water Vapor is the principal contributer to the precipitation, and large-scale environmental vapor flux plays a significant role in the genesis, development and dissipation of tropical cyclones (TC) through its transportation and convergence. Allow the updraft movement, abundant water vapor around TC could coagulate and release latent heat, and these latent heat provide the energy to TC intensity maintenance and evolution.

TRMM microwave imager rain estimates are used to quantify the spatial distribution of rainfall in TC over the global oceans, and we could calculate the Total Precipitation Water (TPW) from its latent heat data. Moreover we will use the data from Advanced Microwave Sounding Unit (AMSU), on board the new generation of environmental satellites –NOAA-K/L/M. The three channels 18, 19, and 20 of AMSU-B which are centered around the 183.3 GHz water vapor line can give humidity information on the upper, middle, and lower troposphere.

Firstly, our studies are focus on the physically retrieval of the water vapor flux from the brightness temperatures at AMSU-B. With the regression method, we can find that the corresponding channel 183.3±7GHz, 183.3±3GHz and 183.3±1GHz brightness temperatures decrease exponentially with water vapor flux on the upper, middle and lower troposphere, respectively. By this exponentially algorithm, there are great water vapor transportations as indicated by the water vapor channel brightness temperatures.

Furtherly, combination the TRMM latent heating data in the heavy precipitation area around TC, we find heat release is one of the most important factors to impact TC intensity, especially to the long-life and land load TC, illustrating by the Typhoon Bilis (0604) formed from the northwest pacific. And there is the logarithm relation between latent heat release and precipitation.

The results present the change of brightness temperatures is well fitted to the water vapor transportation, even, the good correspondence of the retrieved results of large-scale environmental water vapor flux convergence around TC with the precipitation in the TC eye wall .