Recent Changes in the Tropical General Circulation Revealed by Satellite Measurements (MODIS)

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Since the mid-nineteenth century the Earth's surface has warmed, and models indicate that human activities have cause a part of the warming by altering the radiative balance of the atmosphere. Especially, atmospheric variability in the tropics plays a significant role in regulating weather and climate on global and regional scales. Vertical circulation like Walker and Hadley circulation is represented as a key component of the tropical atmospheric system.

Our aim is monitoring long-term changes revealed in satellite measurement (MODIS), which is closely linked to other climate variations and trends, is needed to both predict and detect change of a general circulation in tropics.

Using MODIS/Terra Level 3 data over the period of 2000 to 2009, we analyze the recent change of tropical general circulation. We obtain the linear trend by employing a regression method and construct JFDs (Joint frequency distributions) among satellites products. Through analyzing eigen-vector and PC time-series of JFD EOF, we also want to demonstrate the recent change of tropical general circulation. CTT anomaly has a significantly increasing trend in Indo-western Pacific and central Pacific, while CF anomaly tends to increase in most ITCZ and SPCZ. Moreover, PWV anomaly represents a dominant negative-trend. Mostly, these changes indicate the reduced convective overturning or the split Walker cell. Additionally, we confirm the distinct trend in 1st mode PC time-series of JFDs consistent with the tropical mean change of satellite products. Also, a projection pattern along 1st mode PC time-series of JFD is similar to its trend map.

These changes provide support for the view that the vertical overturning is changed and moisture in equatorial convective region becomes drier the period, that is, the recent change in tropics represents a reduced convection over Indo-western and central Pacific, which reveals weakening or splitting the Walker circulation.

Keywords: Tropical general circulation; Walker circulation, Hadley circulation, Joint frequency distribution, Satellite, Trend.

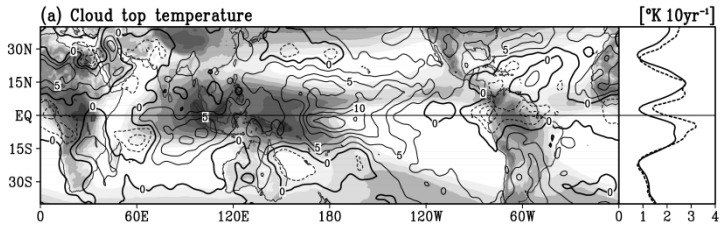

Figure 1. Linear regression coefficient (contour) in (a) cloud top temperature [°K/decade] observed MODIS/Terra over March 2000 to February 2009, where dashed contour and shading area indicates negative value and climatological mean, respectively. Zonal average is plotted as solid (global-average) and dashed (ocean-average) lines at a right panel.

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