



An Objective Climatology of Tropical Plumes

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Tropical Plumes (TPs) are continuous bands of high and mid-level clouds stretching over several thousand of kilometres from the Tropics pole- and eastward into the subtropics or even mid-latitudes. TP-related poleward moisture transports can lead to extreme precipitation events in the outer Tropics or subtropics, and the cloudiness associated with TPs affects the Earth's radiation budget. Previous TP studies were based on a subjective visual inspection of infrared satellite images and were therefore quite time consuming with respect to climatological investigations. Here we present a newly developed objective identification algorithm that allows a flexible and quick processing of large datasets. The new algorithm is applied to 10.8 μ m brightness temperatures (BTs) from the Cloud Archive User Service (CLAUS), which provides global data on a uniform latitude-longitude grid at a spatial resolution of 0.5 by 0.5 degrees and a temporal resolution of three hours for the time period July 1983 to June 2006.

Following the classic definition by McGuirk et al. (1987, Mon. Wea. Rev.) TPs are defined as extended bands (length > 2000 km) with BT anomalies below -30 K that cross 15° North or South. Additionally a criterion for the elongatedness of TP is developed, which is based on the length-width ratio of the smallest rectangle that contains the TP. The detected systems are tracked in time based on spatial overlap and attributes such as lifetime are determined. For boreal winter (Oct.–March), the resulting climatology reveals that TP occurrence is largely confined to oceanic regions with the main maximum located over the Central South Pacific close to the South Pacific convergence zone. Other TP frequency maxima are found over the eastern parts of the North Pacific and North Atlantic Oceans and over the western part of the South Atlantic near the South Atlantic convergence zone. In boreal summer (April–Sep.) the geographical distribution of TP occurrence has a similar structure, but the frequency is generally reduced except for the Bay of Bengal and the Northwest Pacific.

Based on composite analysis typical conditions for TP geneses in the different regions are examined. TP development over the North Atlantic and North Pacific Oceans is clearly linked to the propagation of extratropical upper-level troughs into low latitudes as documented in earlier studies. Over the North Indian and Northwest Pacific Oceans convective processes within the Tropics appear to play a more important role. The TP statistics derived from the CLAUS data set will be compared to a statistic obtained from the recently released, more homogenous, but lower resolution PATMOS-x dataset, from which trends in the occurrence of TPs can be assessed.