Improvements of TRMM V7 rainfall estimates from perspective of precipitation features

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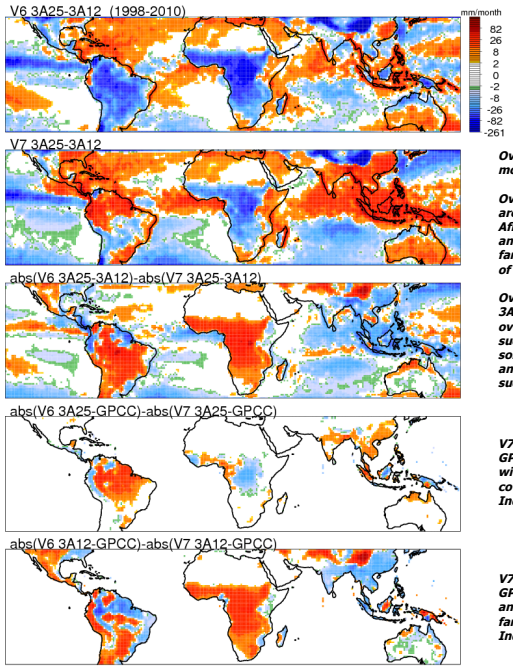
Differences between 3A25 and 3A12 and comparisons to GPCC



Overall, 3A25 and 3A12 are more consistent in V7.

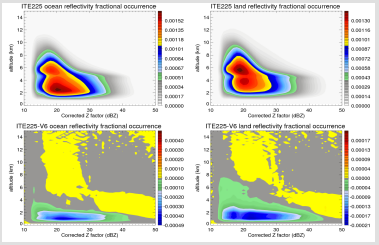
Over land, V7 3A25 and 3A12 are closer together over Africa, South America, SW US and North India than V6, but farther apart over China, Bay of Bengal, and SE US.

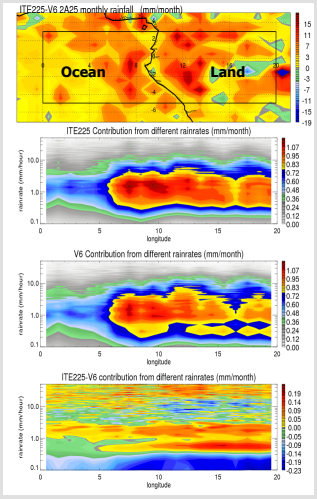
Over ocean, V7 3A25 and 3A12 are closer together over many rainy regions, such as SPCZ. There are also some regions that V7 3A25 and 3A12 are farther apart, such as the Gulf of Guinea.

V7 3A25 is closer to the GPCC over the regions with good rain gauge coverage, except over Indonesia.

V7 3A12 is closer to the GPCC over Africa, SW US, and South America, but farther apart over China, India and Amazon.

Changes in V7 (ITE-225) 2A25



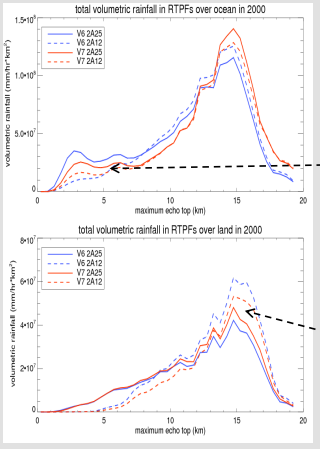


Major changes in V7 2A25 algorithm include the non-uniform beam filling correction; increase of the range bin number for the near surface rain; addition of 0.5 dBZ PIA to account for wet land surface; new DSD model; improved classification of rain types.

Two things can be noticed here:

1. ***PDFs of attenuation-corrected reflectivity are shifted toward higher values in the lowest altitudes.***
2. ***Near surface rainfall rate < 0.5 mm/hr are less frequent, but moderate rain rates (0.5 - 3 mm/hr), are more frequent, more over land than over ocean.***

Rainfall contribution in all raining (PR+TMI) regions

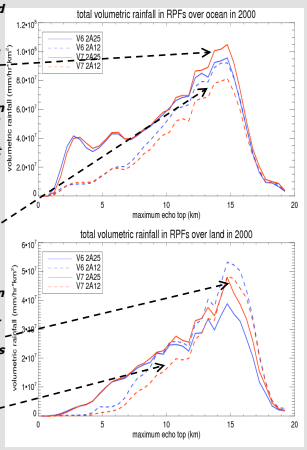


More rainfall is contributed from tall systems over both land and ocean in V7 2A25 than V6. (red solid is higher than blue solid).

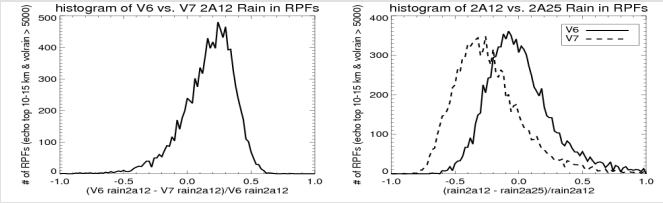
Over ocean, V7 2A25 and 2A12 are closer together in all raining regions than V6 (two red curves are closer than two blue curves). But within the PR raining regions, 2A12 becomes lower than 2A25 in tall systems in V7 (Two red curves are more separated).

Over land, V7 2A12 and 2A25 are closer together in the tall systems than V6 (Two red curves are closer than blue curves). But lower rainfall contributions are from "shallower" systems (echo top < 12 km) in V7 2A12 (red dashed is lower than blue dashed).

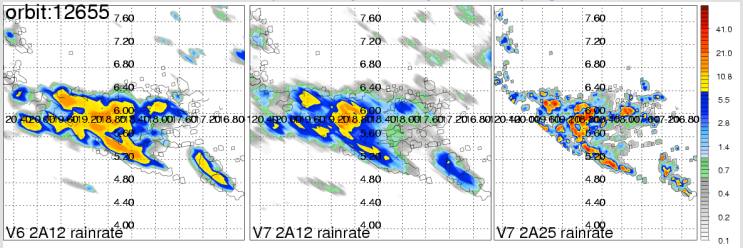
Rainfall contribution in PR raining regions



Larger differences between V7 2A25 and 2A12 in the PR raining regions in tall systems over ocean



A case with V7 2A12 < V6 2A12 within RPFs, more at: *http://trmm.chpc.utah.edu/tmp/v6greaterthanv7/*



Summary:

• The V7 2A25 rainfall retrieval algorithm increases the frequency of high and moderate rain rates. There is a larger contribution of rainfall from tall systems over both land and ocean than V6. The total rainfall climatology is more consistent with the GPCC over the regions with good rain gauge coverage. The biggest improvement is over the Amazon.

• The V7 2A12 rainfall retrieval algorithm over land is tuned with the V7 2A25 product, so the rainfall contributions from tall systems are more consistent with V7 2A25. However, the total rainfall is underestimated in systems with echo top lower than 12 km, partly due to the warm rainfall that cannot be detected with the ice-scattering based algorithm.

• The V7 2A12 rainfall retrieval algorithm over ocean has introduced the concept of the probability of rain. This concept includes a much larger area possibly with rain than the rain certain area in V6. The gridded total V7 2A12 rainfall and total rainfall in all raining regions are more consistent with 2A25 than V6. However, it appears that the V7 2A12 "smears" the rainfall to a larger area so that within the PR detected raining region, the rain rate from V7 2A12 is relatively lower than V7 2A25. This probably is more physically consistent with the large footprints of TMI.

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