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GPM requirements for flood forecast at different basin scales

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Hydrological responses to precipitation events largely depend on the scales at which the flow accumulation processes take place. While extreme precipitation could cause devastating floods in a matter of hours in small catchments, the buildup of flood waves can take days or weeks in large river basins. Proper preparations in anticipation of flood events, particularly in large basins, can save lives and human assets if reliable predictions are available in time.

The prediction of flood event at different basin scales poses different requirements on precipitation monitoring missions. However, basin responses are affected by numerous conditions (land cover, topography, geology, etc.) the most important element is how river networks connect the landscapes at different scales. Recent analysis by Fekete et al. (2001) demonstrated the effects of network scales on representing river catchments by analyzing simulated gridded networks at different resolutions. The study showed that a minimum of 200 gridcells is necessary to properly reconstruct the geomorphology of the real river network. By ensuring that the residency times within 200 gridcell subbasins are negligible compared to the temporal resolution, the lack of representing the geomorphological properties at 200 gridcell basin scale becomes irrelevant. By applying the 200 gridcell rule across networks with differing resolutions and with assumed residency time (or flow velocity) distribution within grid cells, one can establish the relationship between adequate temporal resolution and corresponding spacial scales. The above network analysis provides a crude estimates of the spatial and temporal requirements for the GPM data retrieval. As a consequence of the 200 gridcell rule, one can also conclude that actual accuracy at the gridcell level is less important than providing information on the precipitation heterogenity over smaller domains while maintaining higher accuracy at some aggregated level. The accuracy

requirement of the precipitation monitoring can also be assessed through other simple considerations. Assuming that the runoff ratio ($r = R/P$) is constant within the error range of the precipitation, the runoff estimation error (ε_r) due to uncertainties in precipitation (ε_p) can be estimated as $\varepsilon_r = \varepsilon_p/r$. Since, the runoff ratio is always less than 1.0, precipitation error normally translates to even greater uncertainties in estimated runoff (Fekete, 2002).

The presentation will demonstrate the use of these simple assumptions to establish the science requirement for GPM and other future precipitation monitoring missions from the aspects of predicting extreme flow conditions. The analysis of existing precipitation products from GPCP and TRMM will be used as a demonstration of the current capabilities and an assessment of the expected improvement from GPM will be presented.

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