IMPROVING PRECIPITATION FORECASTS USING TRMM, SSM/I BASED RAINFALL ESTIMATES

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This study has several components: A collection of TRMM and SSM/I based rainfall estimates, using the microwave radio metric data set, is made on a real time. This data set from four polar orbiting satellites is binned on 6-hour intervals over a transform grid of a high-resolution global model. This data set covers the latitude belt 60S to 60N. Rain rates are estimated using a number of microwave based rainfall algorithms in an ongoing manner. The FSU global spectral model is used to carry out rain rate initialization (i.e. physical initialization) for these different rain rate estimates. These constitute the multianalysis component of our study. A vast number of 6-day forecasts are next carried out using these initial states using the FSU Global Spectral Model. We also include precipitation forecasts made by several major operative global modeling groups in this roster of models. These forecasts constitute a part of our FSU superensemble real time system. This system provides daily precipitation forecasts up to 6 days globally. All forecasts are verified against one of the best TRMM products called TMI-2A12 and the SSM/I based rainfall estimates derived from an algorithm called GPROF. The best rainfall measures are used for the estimates of model biases and forecast verification. Some of the major results of this study are: The rms error of precipitation from day 1 to day 6 of forecasts show that the multimodel/multianalysis based superensemble forecasts are lowest compared to the member models. The same is true for the superensemble compared to the ensemble mean (of bias removed, or not removed, individual) models. The above results hold for several regions such as globe, Europe, North America, a monsoon domain, Africa and South America. These results hold for individual days of forecast as well as for the real time forecasts since March 1999. The same results on the superior performance of the superensemble as compared to member models are seen if the correlation of forecast rains with respect to the observed estimates. This precipitation forecast data set (at day 3 of forecasts) was found to provide useful guidance for some of the major recent floods over the tropics. In that sense the best member model was found to have large phase errors in time and space as compared to the superensemble forecasts. When the equitable threat scores are examined as a measure of precipitation skill scores we note that below the threshold of 50 mm per day of rain or higher the scores of the superensemble are again higher than those of all member models, the ensemble mean and the higher resolution ETA model. For rainfall rates higher than 50 mm per day the ETA model appears to have a higher skill. The resolution of the superensemble is around 80 km whereas the current resolution of the ETA model is around 22 km. This suggests the need for a mesoscale superensemble. In the construction of the superensemble during the training period (as well as the forecast verification) there is a strong need for reliable observed fields. We have found that the use of TRMM and SSM/I based rain rates do lead to the best forecasts. If instead we were to train with poor rainfall estimates (such as the GDAS rain of an operational model) then we find that the resulting superensemble (thus constructed) has a very low skill.