Local Area Quantitative Precipitation Forecasts For Atmospheric River Events in North-central California Using the MtnRT® System

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The MtnRT® local area forecast system was developed during 2006-2013 by Fox Weather (Fox, 2014) to assist in our operational forecasting as well as development tasks. The development was funded in part by two USDA grants with the National Institute of Food and Agriculture through Oregon State University. These required us to predict weather inputs over complex terrain near 2km grid-spacing to provide inputs for a crop disease warning system. The precipitation code in MtnRT was modified in 2010-2014 to include characteristics of rains unique to Atmospheric River (AR) systems (Neiman, 2009). Further modifications were done to better define rainfall maxima associated with low level jet features over ocean as well as land.

A brief description of MtnRT pertinent to analysis of AR systems will be summarized, including:

- Vertical depth of the precipitation zone below melting level.
- Existence of a low level jet and IWV flux for the layer comprising the jet.
- Effects of height, slope, and aspect with respect to wind vectors within the liquid precipitation layer.
- MtnRT additions to the variability already given by the parent input model.

For Fox Weather, MtnRT is a useful tool for diagnostics, analysis, and illustration for sub-tropical precipitation systems as well as for forecasting. It enables operational hydrologists to quickly distinguish rains from atmospheric rivers versus other types of warm frontal systems. It is a useful tool for classifying landfalling fronts with respect to the scale and pattern of terrain-induced variation of a current or historical front. Cases will be shown of AR events and simple warmfrontal events in order to show differences between a non-warmfrontal rain, warmfrontal rain with differing tropical moisture amount, and a more typical AR type system. The illustrations will include:

- Characteristics of an AR event at our forecast scale (2 km for precipitation of this type).
- Fox Weather's use of MtnRT as a diagnostic tool for approaching storms on our forecast scale.
- Delineation of forecasted local rainfall maxima in the Northern Sierra foothills region
- Forecasted versus observed 1 hour rainfall (Santa Cruz Mountains).

While large scale patterns are classifiable into basic conceptual illustrations, small or local scale variability is more complex. Every storm is different, and one cannot assume a basic climate footprint overlying all or even most rain events. Regional targeted climatologies do not exist at the 1-2 km scale in most areas, although the PRISM spatial climate system is an example of a fine scale precipitation climate model used for mapping of extreme precipitation.

References

Fox, A. (2014). *MtnRT® White Paper: Summary of the MtnRT® system – providing weather inputs for plant disease models.* Published by Fox Weather, LLC, Fortuna, CA, USA at www.foxweather2.com/MtnRT_WhitePaper140502.pdf, 54 pp.

Neiman, P. J., A. B. White, F. M. Ralph, D. J. Gottas, and S. I. Gutman (2009). A Water Vapor Flux Tool for Precipitation Forecasting. *U.K. Journal of Water Management* , 83-94 .