Exploring satellite-based thermal sounding capabilities during extreme events: lessons learned during CalWater and El Nino Rapid Response campaigns.

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The objective of this work is to demonstrate the capability of satellite-based thermal soundings in capturing high impact mesoscale events associated with the development and trends of atmospheric rivers, over otherwise poorly sampled regions of the Pacific Ocean. The high vertical resolution and spatial coverage of hyper-spectral sounders is a key element to fill this critical observational gap.

We use the NOAA Unique Combined Atmospheric Processing System (NUCAPS) to retrieve vertical profiles of temperature and relative humidity from the Suomi-NPP CrIS/ATMS data, distributed in near real time (less than 0.5 hours) by the Community Satellite Processing Package (CSPP) Direct Broadcast. These profiles are collocated to a large number of correlative soundings from the GFS and ECMWF model analyses and in situ radiosonde measurements collected over the Pacific Ocean during the CalWater 2015 and the 2016 El Nino Rapid Response campaigns. One of the key focus areas for these intensive field campaigns was a close study of atmospheric river phenomena and their impact on extreme precipitation events over the West coast of the United States. The near real time availability of NUCAPS soundings from CSPP Direct Broadcast played a critical role in enabling early close up investigations and facilitating flight-planning activities.

This paper attempts to perform two main investigations. A first comparative analysis is aimed at validating the robustness of the NUCAPS retrievals under rapidly evolving, high relative humidity and cloudy conditions. Scope of this work is to demonstrate the added value provided by NUCAPS soundings in complementing radiosondes and model analyses, when it comes to provide real time measurements of lapse rate and moisture structure associated with the development and landfall of atmospheric river phenomena. Secondly, we are exploring the possibility to use NUCAPS measurements to feed a back trajectory model analysis to improve our understanding of tropical-

extratropical interactions that lead to the development of atmospheric rivers. NUCAPS global and uniform spatial coverage is key to capture smaller scale flow features that can help solving the open debate on the "river" versus "moisture conveyor" definition of an atmospheric river.