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Exploring high-vertical resolution data sources for use in NearCasting

Ralph Petersen (1), Lee Cronce (1), Robert Aune (2), and William Line ()

(1) Cooperative Institute for Meteorological Satellite Studies (CIMSS), University of Wisconsin – Madison, Madison, Wisconsin, USA, (2) NOAA/NESDIS/STAR, Advanced Satellite Products Branch, Madison, Wisconsin, USA, (3) Cooperative Institute for Mesoscale Meteorological Studies (CIMMS), University of Oklahoma, Norman, Oklahoma, USA

The CIMSS NearCasting system is a Lagrangian system that is intended to provide full-resolution projections of Geostationary Earth Orbiting (GEO) GOES (Geostationary Operational Environmental Satellite) and SEVIRI (Spinning Enhanced Visible and Infrared Imager) moisture and temperature products. The system has been demonstrated at several US National Weather Service (NWS) Centers and the European Severe Storms Laboratory (ESSL). While these tests focused both on where/when all types of deep convection will/will not occur and which convection will likely become severe, new applications and data sources are explored in this presentation that further expand the utility of the 1-9 hour forecast products.

Responses from tests at ESSL and the NWS's Storm Prediction Center (SPC) and Aviation Weather Center (AWC) have identified the need for more detailed information about changes in vertical moisture and stability structures, such as will be available from the hyper-spectral Infra-Red Sounder (IRS) to be included in Meteosat Third Generation (MTG). Separately, US forecasters in the high-latitude regions, where GEO data are not suitable, have requested that the NearCasting techniques be applied to hyper-spectral sounder products generated from the multiple Low Earth Orbiting (LEO) satellites that make frequent overpasses there. A wide range of forecasters have also noted the additional need for short-range guidance using full resolution satellite observations in cloudy conditions (not included in IR-only satellite products) for application to a variety of problems, especially those related to heavy precipitation events.

In this presentation, techniques developed for hyperspectral soundings over Alaska are demonstrated and applied over Europe using retrievals from orbital sequences of LEO satellites, specifically the Cross-track Infrared Sounder (CrIS) and Infrared Atmospheric Sounding Interferometer (IASI). Although these hyperspectral IR observations lack the spatial coverage and temporal detail of GEO data, the enhanced accuracy and vertical resolution provide a preview of improvements that can be expected from MTG-IRS. The increased vertical sounding resolution can be especially useful in areas where radar coverage or other asynoptic observations are limited and in instances when conventional NWP guidance is questioned. The higher vertical resolution will also support provision of more reasonable and realistic analysis and forecast products, such as near-surface moisture features, more physically based stability indices (e.g., Convective Available Potential Energy (CAPE)) and better estimation of tropopause locations and expected maximum storm heights.

Finally, the inclusion of microwave observations provided through the new EUMETSAT retrieval algorithm will also be investigated. Although at lower vertical resolution, NearCasts using these data offer the opportunity to add short-range forecast information in cloudy areas where IR instruments are unable to fully penetrate. Short-range projections of these less-frequent LEO observations at full resolution have the potential of long-term importance as a continuing compliment to MTG-IRS well into the future, since temporally continuous microwave observations will not be available from geostationary platforms in the foreseeable future.