GOES-R Volcanic Ash Risk Reduction (R3): New operational GOES-R decision support within NOAA's High Resolution Rapid Refresh

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Abstract

The successful launch of Geostationary Operational Environmental Satellite-R Series (GOES-R) satellite on November 19, 2016 accounts for a new era of satellite remote sensing and situational domain and hazard awareness. A Volcanic Ash – Detection and Height baseline product will be available in real-time using new Advanced Baseline Imager (ABI) instrument observations. We aim to evaluate the baseline product with real GOES-R ABI data, and to provide pathways to use GOES-R ash retrievals within the numerical prediction systems used by National Oceanic and Atmospheric Administration (NOAA) National Weather Service (NWS).

As a first goal we test the ability to use GOES-R ABI-VAA data to define volcanic Eruptions Source Parameters (ESP) for volcanic activity within the GOES-R footprint. The ESP data are necessary to initialize volcanic cloud prediction models. We propose to build upon previous research by implementing near-real time ESP data to initialize the Weather Research Forecast model coupled to Chemistry (WRF-Chem). The availability of ESP from near-real time ABI-VAA products will result in new unprecedented capabilities for volcanic ash cloud prediction. We use the GOES-R ESP data to initialize the volcanic emission parameterization routine within our fully automatic University of Alaska Fairbanks (UAF) WRF-Chem environment and the modern data assimilation within NOAA's ESRL High Resolution Rapid Refresh (HRRR) modeling system. This proposal directly addresses the highest GOES-R topic areas to improve operational environmental prediction and addresses NOAA's research and development objectives of a Weather Ready Nation and Integrated Environmental Monitoring. We will use aerosol aware physics packages within WRF-Chem to simulate volcanic aerosol-radiation-cloud feedback, and perform case studies running the model with and without aerosol feedback processes. The potential of aerosols from volcanic eruptions to alter the physical structure of the atmosphere will be evaluated for all GOES-R ABI-VAA ash detections. GOES-R volcanic ash model initialization routines will be implemented into NOAA's HRRR system. The proposed project aims to improve Numerical Weather Prediction (NWP), and to build an improved volcanic ash decision support system that NOAA and NWS can use within their Meteorological Watch Offices (MWO) and the Volcanic Ash Advisory Center (VAAC) system.