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Synthetic GOES-R and NPOESS Imagery of Mesoscale Weather Events

Overview

This poster contains work from two NESDIS proposals: GOES-R, and IPO. Synthetic observations are being generated from a numerical cloud model in combination with radiative transfer algorithms. The emphasis of the projects is to produce synthetic imagery that can be used as proxy data and algorithm development.

The RAMS Model

- CSU non-hydrostatic cloud model
- Sophisticated two-moment cloud microphysics with aggregates, graupel, hail, pristine ice, rain, and snow
- Two-way interactive moving nested grids
- Initial condition from NCEP eta model analysis
- Transition from RAMS to WRF model in later years

Radiative Transfer Model

- OPTRAN code for clear-sky transmittances
- Cloud optical properties (single scatter albedo, extinction coefficient, and asymmetry factor) from modified anomalous diffraction theory (MADT) for each of the seven hydrometeor types.
- Bulk optical properties are calculated by weighting with hydrometeor number concentration from RAMS simulations
- IR radiances from Delta-Eddington formulation
- Vis and near IR from Spherical Harmonics Discrete Ordinate Method (SHDOM)
- SHDOM was used to compute 3.9 µm clear and cloudy radiances.

Initial Case Studies

- Oklahoma Severe Weather Outbreak, May 8-9, 2003
- Hurricane Lili Landfall, Sep 30-Oct 3, 2002
- Lake-Effect Snow, Upstate NY, Feb 12-13, 2003
- California/Utah/Colorado Fog Event, Jan 12, 2004
- Hurricane Isabel near Peak Intensity, Sep 11-13, 2004

Examples of GOES-R ABI Images from 8 May 2003

Figures 1-10 show synthetic GOES-R ABI images at different wavelength from the 8 May 2003 severe weather simulation.

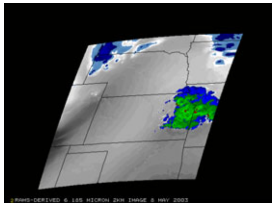


Figure 1. GOES-R ABI 6.185 µm.

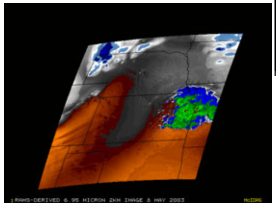


Figure 2. GOES-R ABI 6.95 µm.

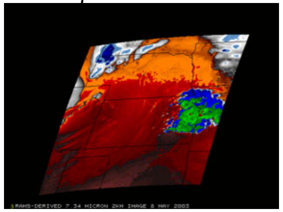


Figure 3. GOES-R ABI 7.34 µm.

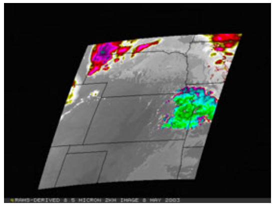


Figure 4. GOES-R ABI 8.5 µm.

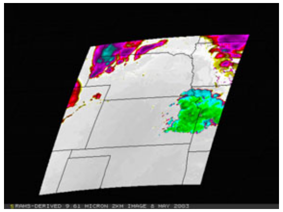


Figure 5. GOES-R ABI 9.61 µm.

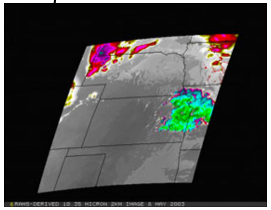


Figure 6. GOES-R ABI 10.35 µm.

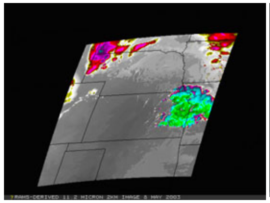


Figure 7. GOES-R ABI 11.2 µm.

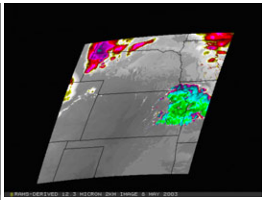


Figure 8. GOES-R ABI 12.3 µm.

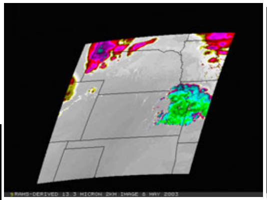


Figure 9. GOES-R ABI 13.3 µm.

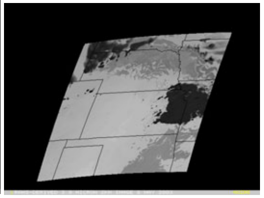
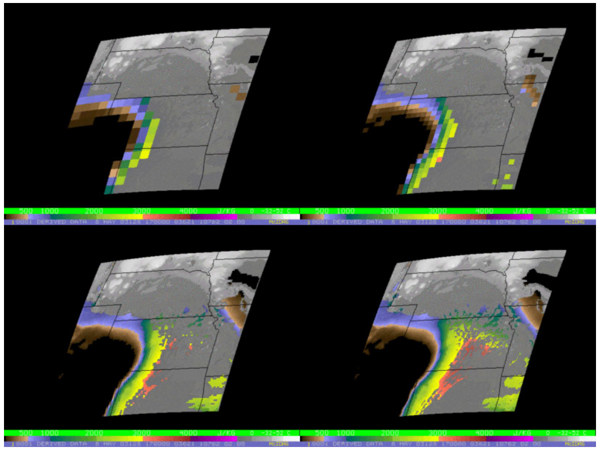


Figure 10. GOES-R ABI 3.9 µm.

50 km

30 km



10 km

4 km

Figure 12. DPI product (CAPE) with 50, 30, 10 and 4 km horizontal resolution for the 8 May 2003 severe weather case.

Examples of VIIRS (NPOESS) 400 m images

Figures 11 shows synthetic VIIRS imagery by using the approximate MODIS TERRA filter function coefficients . This image is from Grid 4 for the 8 May 2003 severe weather event over eastern Kansas.

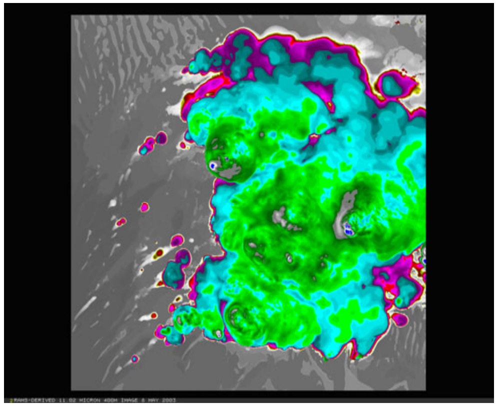


Figure 11. 400 m footprint at VIIRS 11.02 µm.

HES Resolution Impact Study

An advanced Geostationary sounder should have much improved spatial and vertical resolution relative to the current GOES sounder. For severe weather applications, the improved spatial resolution (4 km versus 10 km) will provide more views of cloud-free areas. As a first test of the utility of the HES, synthetic Derived Product Imagery (DPI) of Convective Available Potential Energy (CAPE) was created for two hours of the severe weather simulation on the inner-most grid (2 km resolution). Figure 12 compares the synthetic DPI for spatial resolutions of 50, 30, 10, and 4 km.