1.7A THE IMPACT OF GOES-11 DATA ON IHOP

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1. BACKGROUND

The International H_2O Project (IHOP_2002) was a field project designed to conduct intensive measurements of water vapor over portions of the United States southern Great Plains from 13 May to 25 June 2002. A vast array of ground-based, mobile, aircraft-based, and satellite-based instruments were employed by this project, which had four key areas of study:

- *Quantitative precipitation forecasting*–determining the degree to which improving the characterization of the water vapor field will lead to improvements in forecasting precipitation via numerical modeling, data assimilation, and nowcasting.
- *Convective initiation*–improving the understanding of the processes involved in the formation of convection, and thus in the ability to forecast the time and location where convection will occur.
- *Atmospheric boundary layer processes*–improving the understanding of how surface and boundary-layer processes affect the distribution of water vapor in the atmosphere, and consequently affect the formation of precipitation.
- *Instrumentation*–comparing of the performance of multiple in situ and remotely sensed observation platforms and determining the optimal mix of these observations for improving the depiction of the atmospheric water vapor field, and consequently improving the prediction of precipitation.

Although operational Geostationary Operational Environmental Satellite (GOES)-8 and GOES-10 satellite data were already available for use during IHOP_2002, it was suggested that data with higher resolution in time (i.e. 5 minutes instead of 15) would be extremely useful for comparison to the other high-time-resolution datasets that would be produced during IHOP_2002, as well as for operational forecast support during the field experiment. Since Rapid Scan Operations (RSO) interfere with imagery in other regions (making imagery south of the Equator available only once every 3 h), it was suggested that GOES-11 be retrieved from storage and activated for dedicated support of IHOP_2002, producing 5-min Imager and 30-min Sounder data. This coincided quite well with an inclination maneuver that was already planned during the summer of 2002 and would require partial activation of the satellite.

Negotiations with NESDIS senior management resulted in agreement to activate GOES-11 in support of IHOP_2002 for a portion of the field experiment, from 3-21 June 2002.

2. AVAILABLE DATA

GOES-11 data available during that time period included:

- 5-min Imager data over the CONUS (Fig. 1);

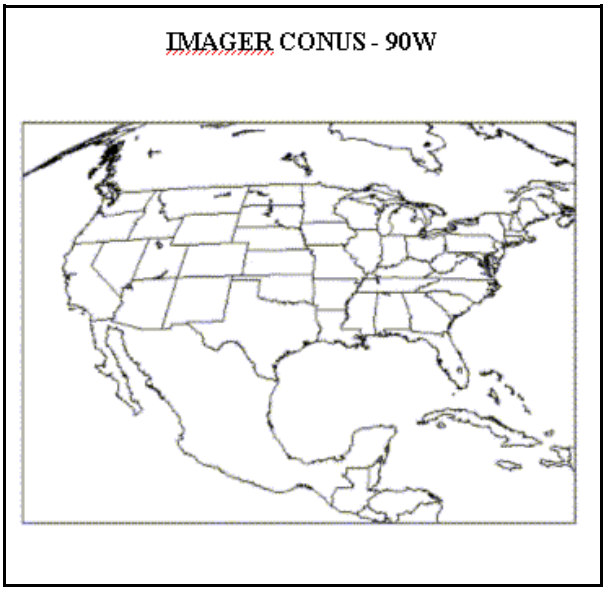

Figure 1. Area covered by the GOES-11 Imager scan during IHOP_2002.

- 30-min Sounder data over 2/3 of the CONUS (Fig. 2);
- Derived Product Imagery (DPI) produced by the Cooperative Institute for Meteorological Satellite

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Studies (CIMSS) (archives are available at http://cimss.ssec.wisc.edu/ihop/);

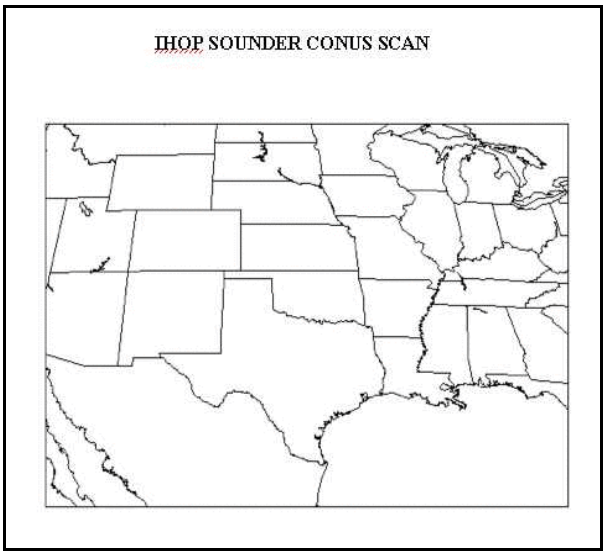

Figure 2. Area covered by the GOES-11 Sounder scan during IHOP_2002.

- Sounder-derived products (cloud top, precipitable water, and surface skin termperature) produced for ingest into the Local Area Prediction System (LAPS) model at the Forecast Systems Laboratory (FSL), which was run over the central US (Fig. 3).

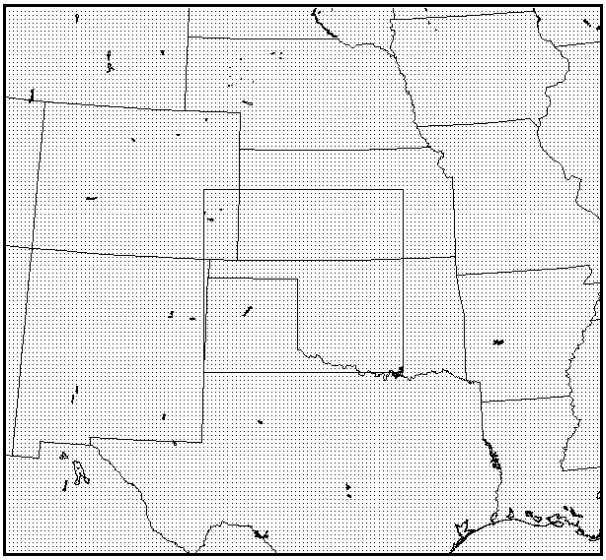

Figure 3. 12-km and 4-km (inner box) domains of the LAPS model in support of IHOP_2002.

GOES-11 Imager data were also available in real-time to IHOP scientists and support forecasters via a special Regional and Mesoscale Meteorology (RAMM) Team Advanced Meteorological Satellite Demonstration and Interpretation System (RAMSDIS) Web page and also on the University Corporation for Atmospheric Research Joint Office of Science Support (UCAR/JOSS) Web page at http://www.joss.ucar.edu/ihop/catalog/).

3. REAL-TIME IMPACTS

GOES-11 data were heavily used by IHOP_2002 support forecasters and nowcasters due to their 5-minute time interval, since the shorter time interval allowed the satellite data to be used much more effectively than 15-minute data when identifying surface boundaries and the initiation of convection along these boundaries. Specifically, IHOP_2002 scientists reported a 10-15 min advantage in advance notification for operational redeployment of aircraft when the GOES-11 data were available. In some cases, such as on 15 and 18 June, the benefit went beyond scientific, as the GOES-11 imagery alerted the operations staff to re-route aircraft from regions that posed potential aircraft hazards due to the rapid onset of convection. This is illustrated from a time series of GOES-11 visible imagery from 18 June 2002 that depicts a 30-min period of convective onset along a boundary in southwestern Kansas (Fig. 4).

The GOES-11 imagery were also crucial during non-convective missions; for instance, during boundary-level missions where clear to at most partly cloudy sky was required, the imagery allowed for more timely identification of changes in cloud cover that would affect the mission.

4. FUTURE WORK

A number of IHOP_2002 scientists plan work in which GOES-11 data will play a significant role. Examples include:

- FSL personnel (Drs. Steven Koch and Daniel Birkenheuer) are plan comparative runs of the LAPS model with and without various components of GOES-11 and GOES-8 data in order to determine more precisely how satellite data impact moisture fields and precipitation forecasts in numerical models.
- Dr. Frédéric Fabry at McGill University plans to compare surface humidity measurements retrieved from S-Pol radar with corresponding soundings from GOES-8 and GOES-11.
- Dr. Gérard Szewach of CNRS (France) plans to investigate the signatures associated with cloud and convective development on radar and satellite, respectively; the 5-min time resolution

of the GOES-11 data will permit much more robust comparison with 5-6 min radar data than would be possible with 15-min GOES-8 data.

- Drs. Wayne Feltz, Gary Wade, and John Mecikalski of CIMSS will be validating the GOES-11 Sounder products and comparing them with GOES-11; this work is being presented at the 12th Conference on Satellite Meteorology and Oceanography. In addition, they plan to use the IHOP_2002 data, including GOES-11, to produce simulated data fields for Geostationary Infrared Fourier Transform Spectrometer (GIFTS) and Advanced Baseline Sounder (ABS) experiments to help prepare for using data from these upcoming instruments.

5. ACKNOWLEDGMENTS

Thanks to the IHOP_2002 scientists mentioned in this manuscript, as well as to Dr. Steve Williams of UCAR/JOSS for his input.

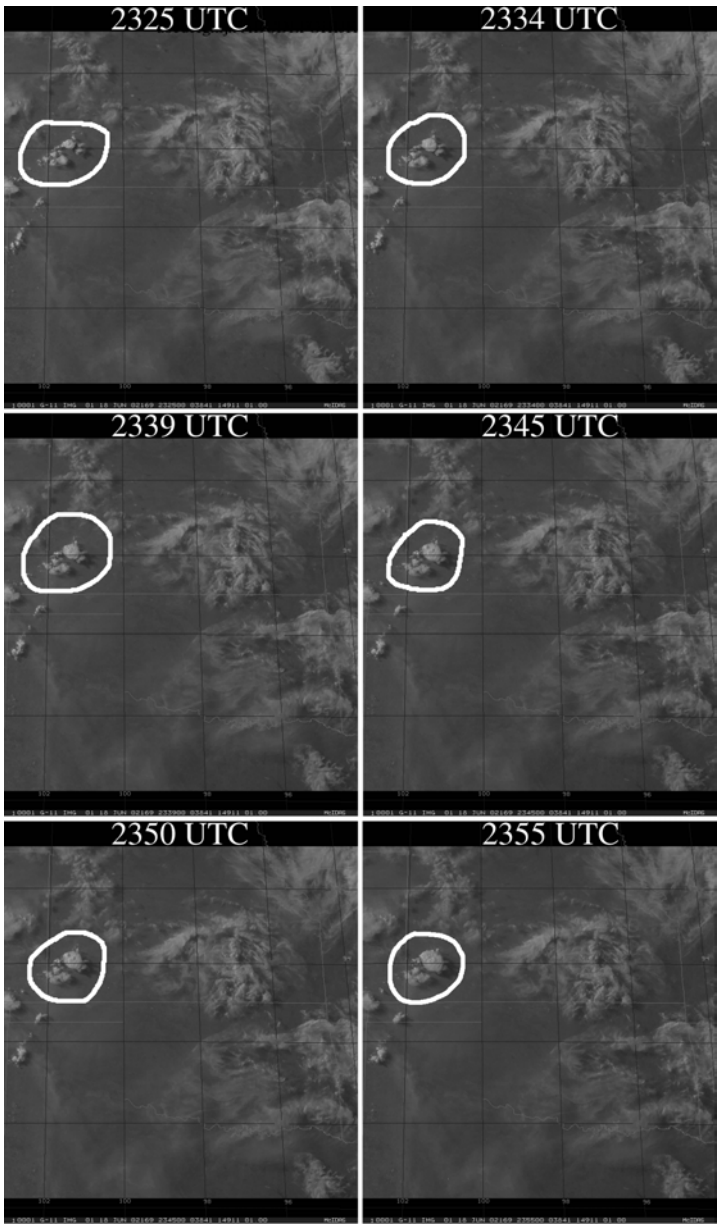

Figure 4. Time series of GOES-11 visible imagery from 18 June 2002 depicting the onset of convection along a boundary in southwestern Kansas.