Northern Alabama Satellite
Product Validation Tools

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Satellite Product Validation

- Is important
- Ground-based instruments help us verify and understand what the satellite is seeing
- North Alabama is well equipped for this:
  - **STORMnet** - Severe Thunderstorm Observations, Research, and Monitoring network
    - A unique network of advanced weather sensors utilizing multi-agency resources (UAH, NASA, Alabama A&M, NOAA/NWS, U.S. Army at Redstone Arsenal, and others).
National Space Science and Technology Center (NSSTC)
A partnership between NASA's Marshall Space Flight Center (MSFC),
Alabama universities, federal agencies and industry
STORMnet
ARMOR: Advanced Radar for Meteorological and Operational Research.

Collaboration between UAH and a local TV station (WHNT)

C-band dual-polarimetric Doppler.

Refurbished NWS WSR-74C donated to UAH in 2002

Upgraded to dual-polarimetry 11/04. Renamed: ARMOR.

- Location: Huntsville Intl. Airport
- Altitude (antenna MSL): 206 m
- Transmit frequency: 5625 MHz
- Peak Power: 350 kW
- Pulse width: 0.4 – 2.0 µs
- Maximum PRF: 250-2000 s⁻¹
- Antenna Diameter: 3.7 m (12 ft CF Parabolic)
- Antenna Beam width: 1.1°
- First side-lobe: -23 to -24 dB
- Maximum rotation rate: 18° s⁻¹
- Transmit polarization: Simultaneous H and V, or H
- Receive polarization: SIGMET dual-channel; H and V
- Signal Process: SIGMET RVP/8
- Variables: Z, V, W, ZDR, ϕDP, KDP, ρhv, LDR

- New solid state transmitter March 2005
  - More pulse stability, greater PRF, and improved pulse length agility.
  - Power increase to 350 kW
9/23/04 WSR-74C disassembly

Removing old radome, then the dish, and finally the pedestal

10/29-11/05 ARMOR Reassembly

New radome install

New SIGMET dual-pol receiver and wave guide assembly
**ARMOR: Advanced Radar for Meteorological and Operational Research.**

**Advantages over conventional Radar:**

- Obtain a better description of particle types and shapes in a given volume of space
  - 3-D hydrometeor ID (rain, hail, snow, graupel) and non-meteorological scatterers (birds, insects...)
- More accurate rain rates
  - Vastly improved quantitative precipitation estimation (QPE)
- Consistent calibration

**With other Doppler radars within STORMnet**

- Kinematics: 3-D Winds (dual-Doppler)
North Alabama Lightning Mapping Array (LMA)

- NMT heritage
- Network of 10 detectors centered about the NSSTC
- Detects TOTAL lightning (CG...and IC, CC, CA)
- Locates sources of VHF emissions associated with charge neutralization in consecutive 80µs time windows
- Sources can be grouped into flashes to map lightning flashes in 3-dimensions and time.
STORMnet

CHARM Gauges

LMA stations

LMA accuracy good out to ~150km
Can we relate satellite IR fields to total lightning to predict lightning from satellite data?

Total flash rate is related to storm kinematics and microphysics

- Suggested possibility of estimating updraft velocity over oceans using total lightning flash rate (polar orbiting, geos. sensors) (Christian and Peterson, 2005).

Prospects of geostationary Lightning Imager Sensor (LIS)!
NSSTC Operational Weather Cluster for Atmospheric Science Training and Research (NOWCASTR)

Mobile Integrated Profiling System (MIPS):
Wind, cloud, aerosol profiling

10 meter tower:
wind, temperature

Mobile Meteorological Measurement Vehicle (M³V) and MIPS:
Mobile Operations

SuomiNet GPS receiver:
precipitable water

Surface station:
solar radiation
T, RH pressure

12 ch. Microwave Profiling Radiometer:
Temperature, humidity profiling

rainfall
MIPS Components

Surface instr.

Satellite comm.

2 kHz Doppler sodar

Ceilometer

915 MHz wind profiler

12-channel Microwave Profiling Radiometer

Not shown: 2 rain gauges

6.2.2003
Regional Atmospheric Profiling Center for Discovery (RAPCD)

MSFC Ground-based 2μm Pulsed Doppler Wind Lidar

- Winds
- Aerosols
Cooperative Huntsville-ARea Rainfall Measurement Network

Local precipitation network (est. 1/2001)
- 96 sites (76 manual, 20 automated)
- NASA, Army, USGS, and NWS sites and weather enthusiasts
- Daily (24h) rainfall totals
- 3600 km² coverage

Supports local weather and climate research at the NSSTC
REAL TIME DATA ACCESS

- GOES East & West satellite ground stations and AVHRR LAC ingest
- Terra/Aqua near real-time data via internet from UW and USF - MODIS, AIRS, AMSR-E data and products via IMAPP

PRODUCT GENERATION

**GOES**
- LST/SST, insolation/albedo, TPW, cloud mask/height

**MODIS**
- color composites, snow cover, LST, SST, PW, clouds mask and height, fog product

SHORT TERM PREDICTION

Transfer NASA data and technology to NWS as part of the Short-term Prediction and Research Transition Center (SPoRT)

Unique data -
- MODIS data and products
- Total lightning / source maps
- MM5 and WRF predictions

Data in use at 6 NWS Forecast Offices

Smoke from Canadian Fires
UAH - NASA MSFC Satellite Product Validation Tools

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