



WindSat

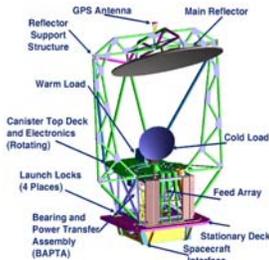
Space Borne Polarimetric Microwave Radiometer: Sensor Capability and NPOESS Risk Reduction

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WindSat Mission Overview

- WindSat is the First Space Borne Polarimetric Microwave Radiometer
- Demonstrate Ocean Surface Wind Speed and Direction Measurement Capability From Space With Polarimetric Microwave Radiometry
 - Wind Vector is a High Priority EDR for the Navy
 - Risk Reduction for NPOESS Microwave Imager
- Launched in January 2003 on the DoD Space Test Program Coriolis Satellite
- Jointly Sponsored by US Navy (SPAWAR PMW-180) and the NPOESS Integrated Program Office
- NRL Responsible for Science, Payload Development, Mission Management, Vehicle Integration, and Cal/Val
 - Collaboration Between NRL Remote Sensing Division and the Naval Center for Space Technology
 - Successful Ops (4.5 Years and Counting!)
 - An Inter-Agency (IPO/Navy/USAF) Cooperation Success Story
- Transitioned into Operational Use
 - Winds Assimilated into NOGAPS
 - Tropical Cyclone Tracking/Monitoring
 - Sea Ice Products to National Ice Center



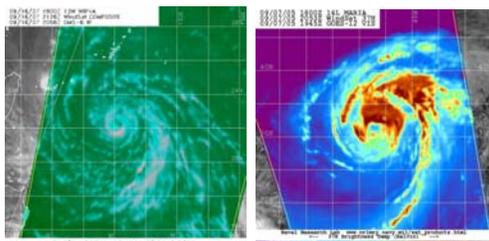
Height/Width	10.5 ft / 8.25 ft
Mass	661 lbs.
Power	311 Watts
Spin Rate	31.6 rpm

Freq. GHz	Channels	BW, MHz	EIA, deg	IFOV, km
6.8	v, h	125	52.5	40x60
10.7	v, h, +45, -45, rc	300	49.5	25x28
18.7	v, h, +45, -45, rc	750	55.3	16x27
23.8	v, h	500	53.0	12x26
37.0	v, h, +45, -45, rc	2000	53.0	8x13

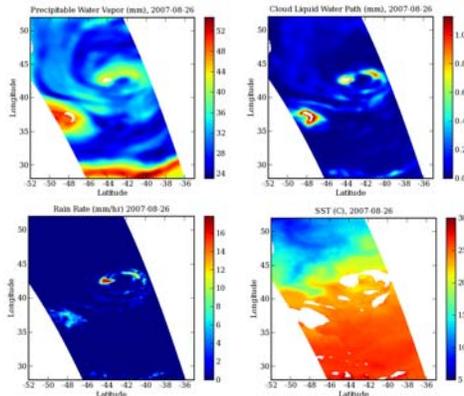
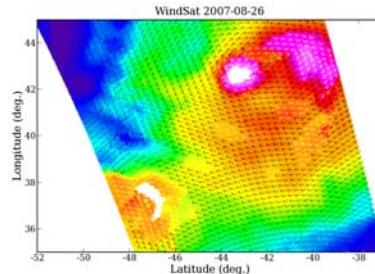
Operational Utilization of WindSat Products

- WindSat Data Processed in Near Real Time (NRT) at Fleet Numerical Meteorological and Oceanographic Center (FNMOC)
 - Data Provided to Operational Users on Shared Processing Network (NESDIS, NAVO, NRL-Monterey)
- Data Assimilation into Numerical Weather Prediction Models
 - Multiple Tests Show Positive Impacts on Forecasts
 - WindSat Wind Fields and Water Vapor are Operationally Assimilated into the Navy Operational Global Atmospheric Prediction System (NOGAPS) (Operational Assimilation Began in December 2006)
 - Testing of WindSat Assimilation Underway at NOAA/NCEP
 - Additional Testing Underway by JCSDAU, Wisconsin and the UK Met Office
- WindSat Products Used for Tropical Cyclone Monitoring and Tracking
 - National Hurricane Center, NRL-MRY, FNMOC, Joint Typhoon Warning Center

WindSat Operational Imagery Products



WindSat Ocean EDRs



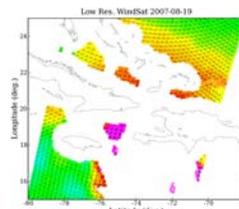
Recent Changes

- Geophysical Model Improvements for Vertical and Horizontal Channels
- Median Filter Algorithm Modified to improve ambiguity selection and reduce influence of NWP wind field used for initialization (nudging)
- Rain rate added (based on GPROF algorithm)
- Monthly sea ice climatology used to screen for ice
 - Increases coverage at high latitudes
- Three Resolutions
 - Low: 50 km x 71 km (operational)
 - Medium: 35 km x 53 km (in validation)
 - High: 25 km x 35 km (in validation)

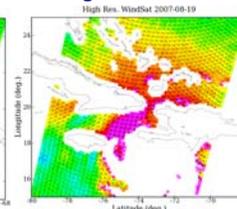
Improved Spatial Resolution

- Wind Speed Performance is Similar at Low, Medium and High Resolutions
- Wind Direction Performance Similar for Wind Speeds > 10 m/s
- High Resolution Retrievals Provide Data Much Closer to Coastlines
- Techniques Transferrable to NPOESS Microwave Imager Sounder

Low Resolution



High Resolution



Hurricane Dean

WindSat and NPOESS Risk Reduction

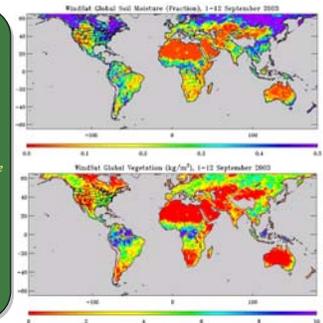
- WindSat Provides Risk Reduction to NPOESS and NPOESS Users in Many Ways
 - Space Borne Demonstration of Capability of Polarimetric Microwave Radiometry to Measure the Ocean Surface Wind Direction
 - WindSat Lessons Learned
 - Hardware Development and Testing (Antenna Characterization, Receiver Design and Testing)
 - Calibration and Data Processing (Warm Load Target Design, On-orbit Anomalies, RFI Detection and Mitigation)
 - WindSat Data Used to Develop NPOESS Microwave Imager Data Assimilation and Other Applications (Not Just Wind Vectors)
 - Coriolis/WindSat Mission Uses NPOESS Ground Segment for Data Downlink and Distribution
- WindSat Design Serves as Baseline for NPOESS Microwave Imager Sounder (MIS) Specification Studies
 - Feed Bench and Reflector Layout
 - Swath Width Trade Studies Including Impacts on Spatial Resolution and Retrieval Performance
- WindSat Data and Algorithms Play Key Role in Specification Trade Studies
 - Channel Set Selection
 - Noise Figure and Calibration Accuracy Requirements
 - Spatial Resolution Performance Impacts (Trade Between Spatial Resolution and Noise Reduction)

WindSat Team Adds to Pool of Microwave Remote Sensing Expertise Available to the IPO

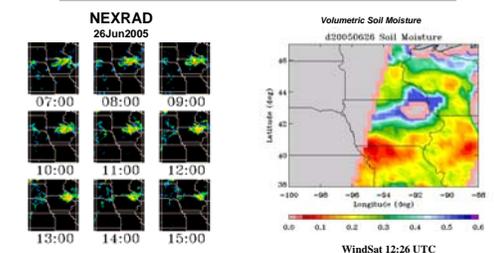
Land Products

- WindSat Data Used to Develop Pathfinder Algorithms for Microwave Imaging EDRs
- Soil Moisture is KPP Levied Upon MIS
- NRL Has Used WindSat Data to Develop Retrieval Algorithms for Soil Moisture and Vegetation Water Content

- Global soil moisture patterns are consistent with dry/wet patterns of climate regimes.
 - Sahara, Arabian, Gobi, Australia, South Africa
 - High lat. wet regions
 - The tundra region
- The U.S. continental climate
 - The humid East
 - The arid West
- Soil moisture is roughly correlated with vegetation with some exceptions
 - India
 - The tundra regions (Canada)



SMEX05 Validation, Precipitation Pattern



WindSat 12:26 UTC