AMSR Oceanic Precipitation Physical Validation Experiment

aka

Wakasa Bay Experiment

January/February 2003

Physical Validation

"Ground Truth" woefully inadequate for oceanic precipitation

Oceanic rain algorithms are physically-based

Physical validation = building an error model by examining the key model assumptions to establish their uncertainty.

Underflight Comparisons with AMSR-E

- Rain/Snowfall over Ocean
- Rain/Snowfall over Land
- Cloud Water Retrieval

Physical Validation Objectives

In the absence of significant "ground truth" over mid-latitude oceans, build an error model by establishing the uncertainty in the key model assumptions

- Length Scales of Precipitation (Beam Filling) (BF)
- Freezing Level Retrieval (FL)
- Bright-Bands Optical Properties (BB)
- Forward Radiative Transfer Modeling (FM)
- Surface emissivity/backscatter (SFC)
- Drop Size Distributions (DSD)

NASA P3 Payload

PSR	AMSR Simulator
MIR	183/220 GHz radiometer
AMMR	21/37 GHz upward viewing radiometer
APR	2 frequency precipitation radar
ACR	Cloud radar
TAMMS	Thermodynamic measurements

IR radiometer, digital camera

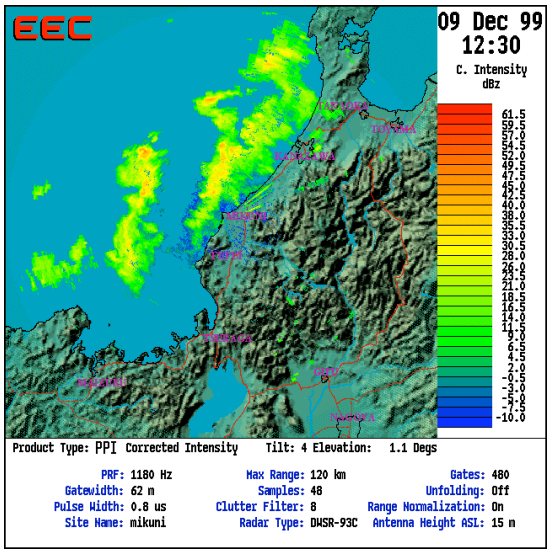
Primary Japanese Contributions

AMSR-E

2 C-band Dual-Polarized Doppler Radars (GR)

Unami (36.9N, 137.0E),

Mikuni (36.2N, 136.1E)

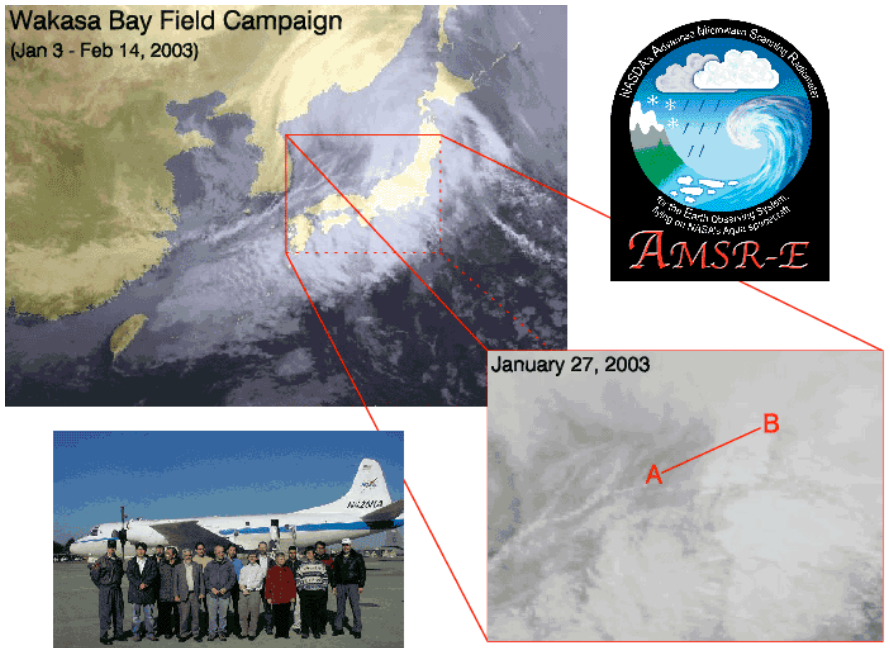


Gulfstream II aircraft with cloud physics payload (G2)

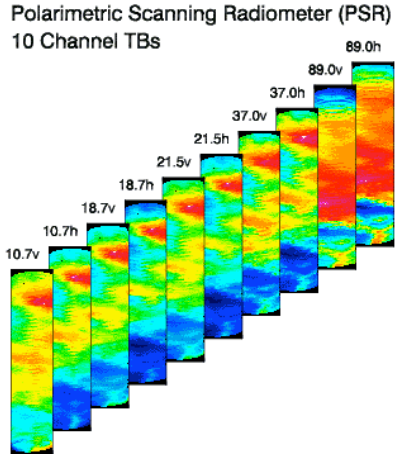
Limited hours/will focus on snow objectives

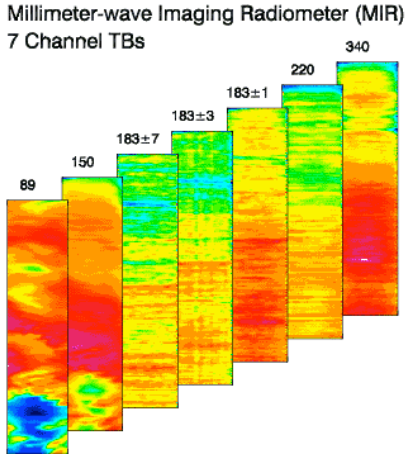
Ground and ship based observations incl. radiosondes

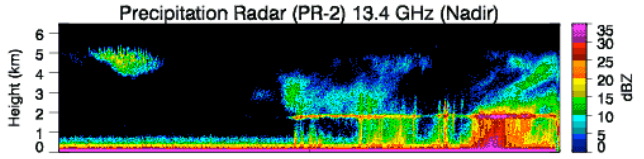
Forecast/mission planning support

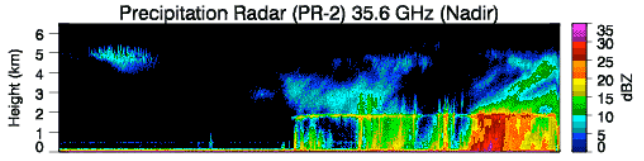

Wakasa Bay Field Campaign
(Jan 3 - Feb 14, 2003)
January 27, 2003
B
A

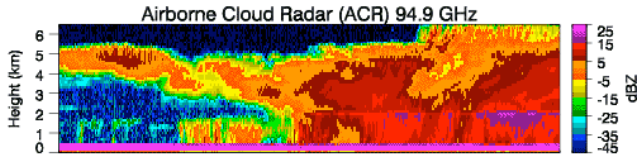
NASDA's Advanced Microwave Scanning Radiometer
for the Earth Observing System
flying on NASA's Aqua spacecraft
AMSR-E

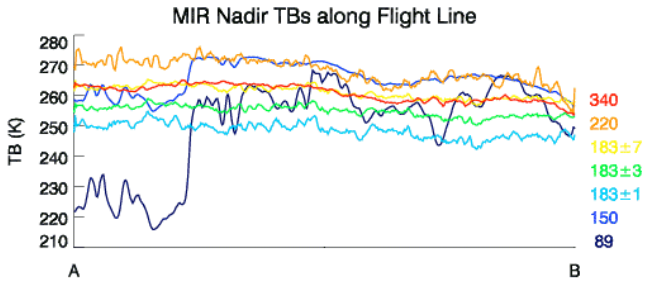

Polarimetric Scanning Radiometer (PSR)
10 Channel TBs
10.7v
10.7h
18.7v
18.7h
21.5v
21.5h
37.0v
37.0h
89.0v
89.0h

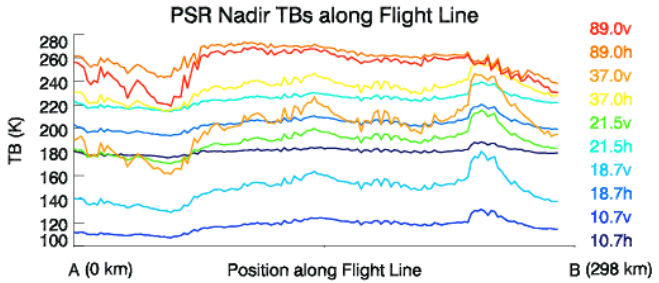

Millimeter-wave Imaging Radiometer (MIR)
7 Channel TBs
89
150
183±7
183±3
183±1
220
340


Precipitation Radar (PR-2) 13.4 GHz (Nadir)
Height (km)
dBZ
A
B


Precipitation Radar (PR-2) 35.6 GHz (Nadir)
Height (km)
dBZ
A
B


Airborne Cloud Radar (ACR) 94.9 GHz
Height (km)
dBZ
A
B


MIR Nadir TBs along Flight Line
TB (K)
340
220
183±7
183±3
183±1
150
89
A
B


PSR Nadir TBs along Flight Line
TB (K)
89.0v
89.0h
37.0v
37.0h
21.5v
21.5h
18.7v
18.7h
10.7v
10.7h
A (0 km)
Position along Flight Line
B (298 km)

Experiment Summary

• Excellent collaboration between PIs and Nature. Observed nearly all types of extra-tropical precipitation over both water and land.

• Approximately 60 hours of science flights with **all** instruments working nominally. Data was collected to meet all science objectives.

• Currently working towards incremental data release with sample flight line by May ‘03 and full data release by end of 2003.

• Expecting this data set to serve as a benchmark for a large number of sensitivity studies related to cloud and rainfall retrievals beyond AMSR-E.

AMSR-E rainfall validation
Specific Wakasa Bay Dataset Investigations

- Evaluate spectroscopic and thermodynamic assumptions used by AMSR-E freezing level retrieval (T. Wilheit)
- Make direct observations of radar and radiometric sensitivity to melting particles to incorporate in retrieval (T. Wilheit)
- Observe scale lengths of precipitation needed for beam filling correction and compare to tropical locations (T. Wilheit)
- Retrieve hydrometers consistent with all radar and radiometer observations to verify that radiative transfer and particle optical properties are properly formulated in satellite algorithm. (C. Kummerow)
- Understand microwave radiative properties of snow particles and develop database for snowfall retrievals from passive microwave sensors (G. Liu)
- Use ACR data to retrieve cloud liquid/ice water content as well as light liquid precipitation in preparation for CloudSat. Compare results to AMSR algorithms (R. Austin)
- Examine transitions between cloud & precipitation towards developing a physically consistent framework for cloud water/ice retrievals in- and outside of precipitation. (R. Austin/B. Griffith)
- Estimate uncertainty in AMSR rain/snow measurements through direct comparisons with dual-frequency retrievals from PR-2 (E. Im/S. Durden)
- Determine the sensitivity of snowfall detection over ocean and land surfaces from wide-band active and passive microwave measurements. (J. Wang)
- High-resolution airborne rainfall, cloud, and water vapor mapping for targeted meteorological observations (M. Klein) and radiance assimilation for numerical weather forecasting (A. Gasiewski)
- Tomographic cloud and raincell imaging using along-track scanning radiometry (A. Gasiewski)