Monitoring of Flooded Areas
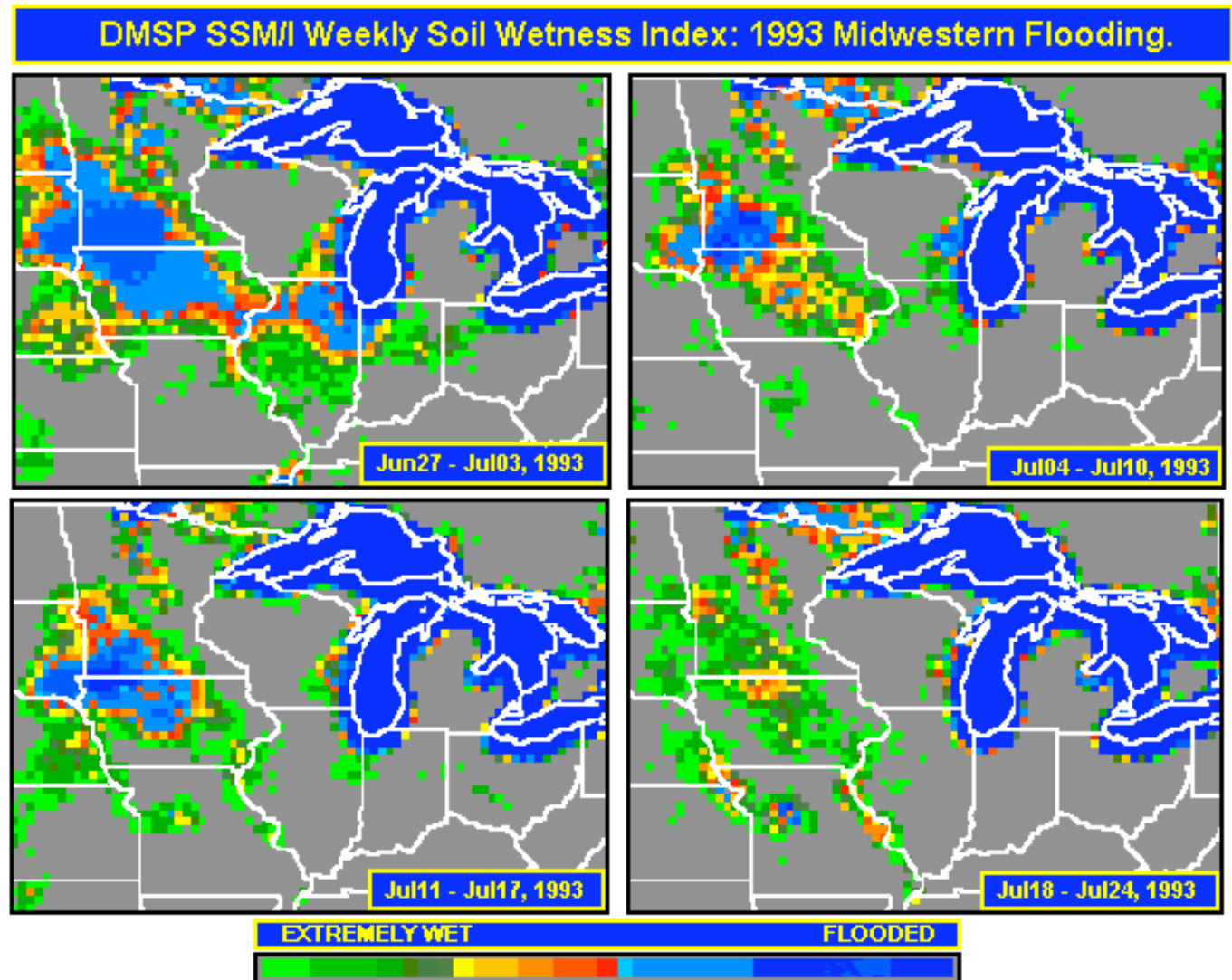# Example of using passive satellite data

Can we use microwave satellite data to monitor inundation at high spatial resolution?

Competing issues Passive (high repeat) data have poor (50km) spatial resolution.
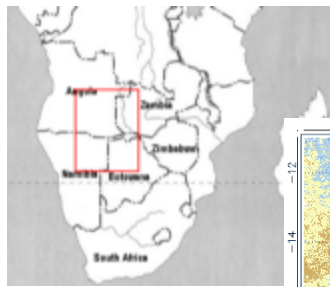
Active data (radar) have low repeat – 7 days to 30 days. Active data are very noisy and difficult to process.

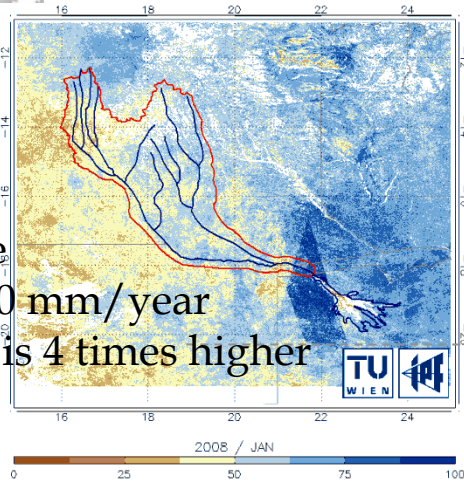Use active data to **disaggregate** passive estimates.

DMSP SSM/I Weekly Soil Wetness Index: 1993 Midwestern Flooding.

Jun27 - Jul03, 1993

Jul04 - Jul10, 1993

Jul11 - Jul17, 1993

Jul18 - Jul24, 1993

EXTREMELY WET   FLOODED

Schaaf, K. and V Lakshmi, 2001, Analysis of the 1993 Midwestern floods using satellite and ground data, *Transactions on Geoscience and Remote Sensing*, 39(8), pp. 1736-1743

Monitoring of Wetlands
Example of using active satellite data

The Okavango Basin

Semi-arid climate
Precipitation - 460 mm/year
Evaporation rate is 4 times higher

2008 / JAN

0   25   50   75   100

Image *http://www.ukzn.ac.za/sahg/share*

Niger R.

Benue R.

W. Mangrove
Flooding

Major Zone

Major Niger
Flood zones
Oct. 15, 2006

S. Mangrove
Flooding

Flooding
of the
Cross R.

Niger Delta
(Syvitski)

22.04.2005   09.05.2006

12.06.2005   12.06.2006

22.09.2005   25.09.2006

0   25   50   100 km
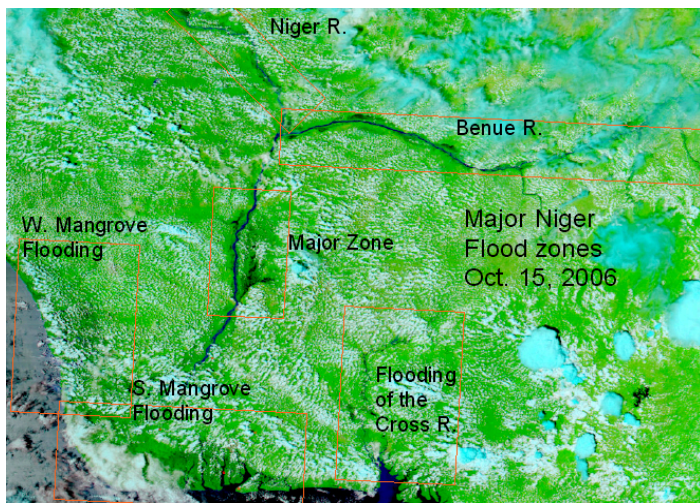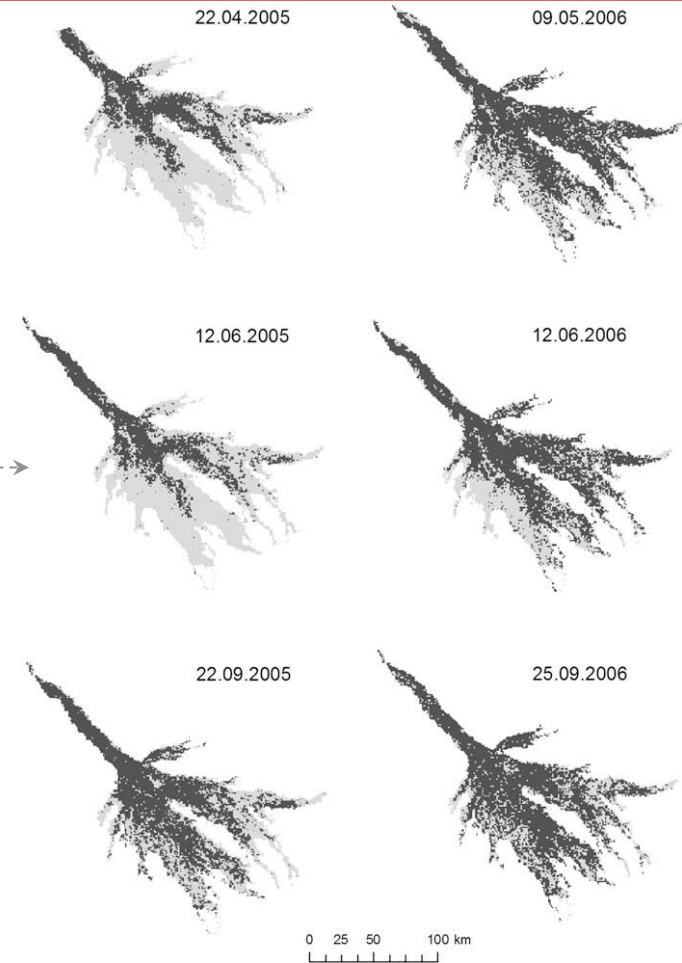
Comparison of the ASAR GM derived wet area in 2005 and 2006: (a) April end of rain season; (b) June dry season; (c) September maximum inundation extent.
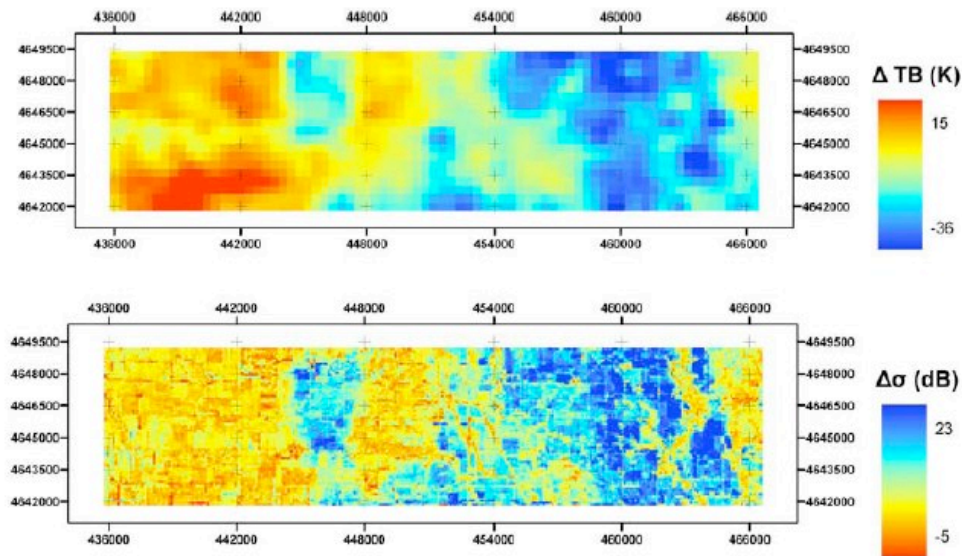Courtesy Bartsch *et al.,* 2009.

Disaggregation Methodology

Assuming x – radar resolution and X radiometer resolution;
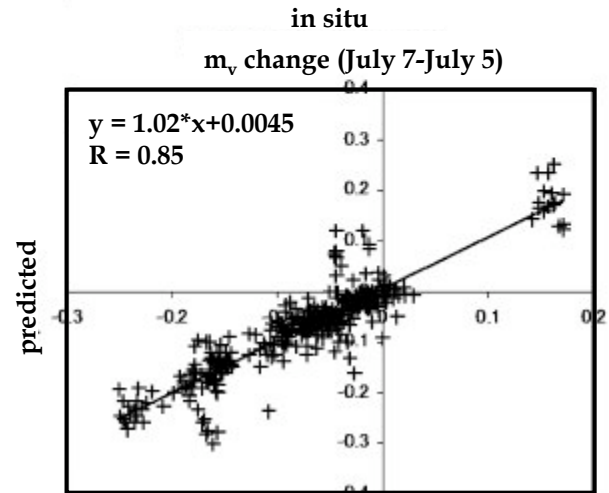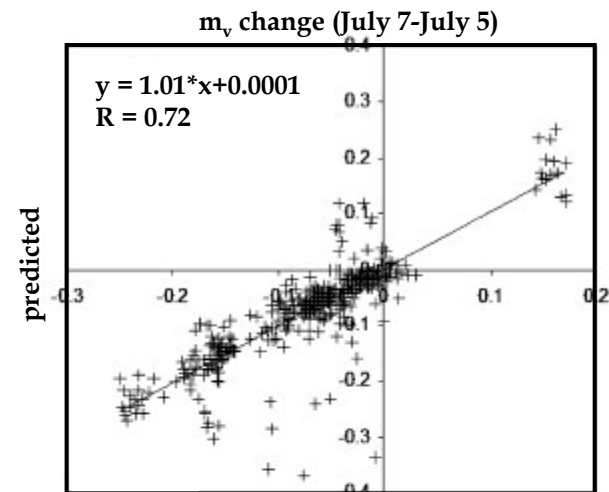Known parameters: $m_{v,X}$, σ°_x, τ_x.

$$\Delta m_{v,X} = (\frac{1}{N})\Sigma \Delta m_{v,x}$$

$$\Delta m_{v,X} = (\frac{1}{N})\Sigma \left[\frac{\Delta \sigma^o_x}{S_o}\right] => S_o = (\frac{1}{N})\Sigma \left[\frac{\Delta \sigma^o_x}{\Delta m_{v,X}}\right]$$

$$\Delta m_{v,x} = \frac{\Delta \sigma^o_x}{S_o}$$

Change in PALSAR T at 400m resolution and AIRSAR $\sigma \circ$ at 30m resolution for the period July 5 to July 7 2002.

m_v change (July 7-July 5)

y = 1.01*x+0.0001
R = 0.72

m_v change (July 7-July 5)

y = 1.02*x+0.0045
R = 0.85

Predicted vs. In-situ soil moisture change at 100m.

Narayan, U., Lakshmi, V., and T. Jackson, A Simple Algorithm for Spatial Disaggregation of Radiometer Derived Soil Moisture Using Higher Resolution Radar Observations, Vol. 44, No. 6, pp 1545-1554, *IEEE Transactions on Geoscience and Remote Sensing*, 2006