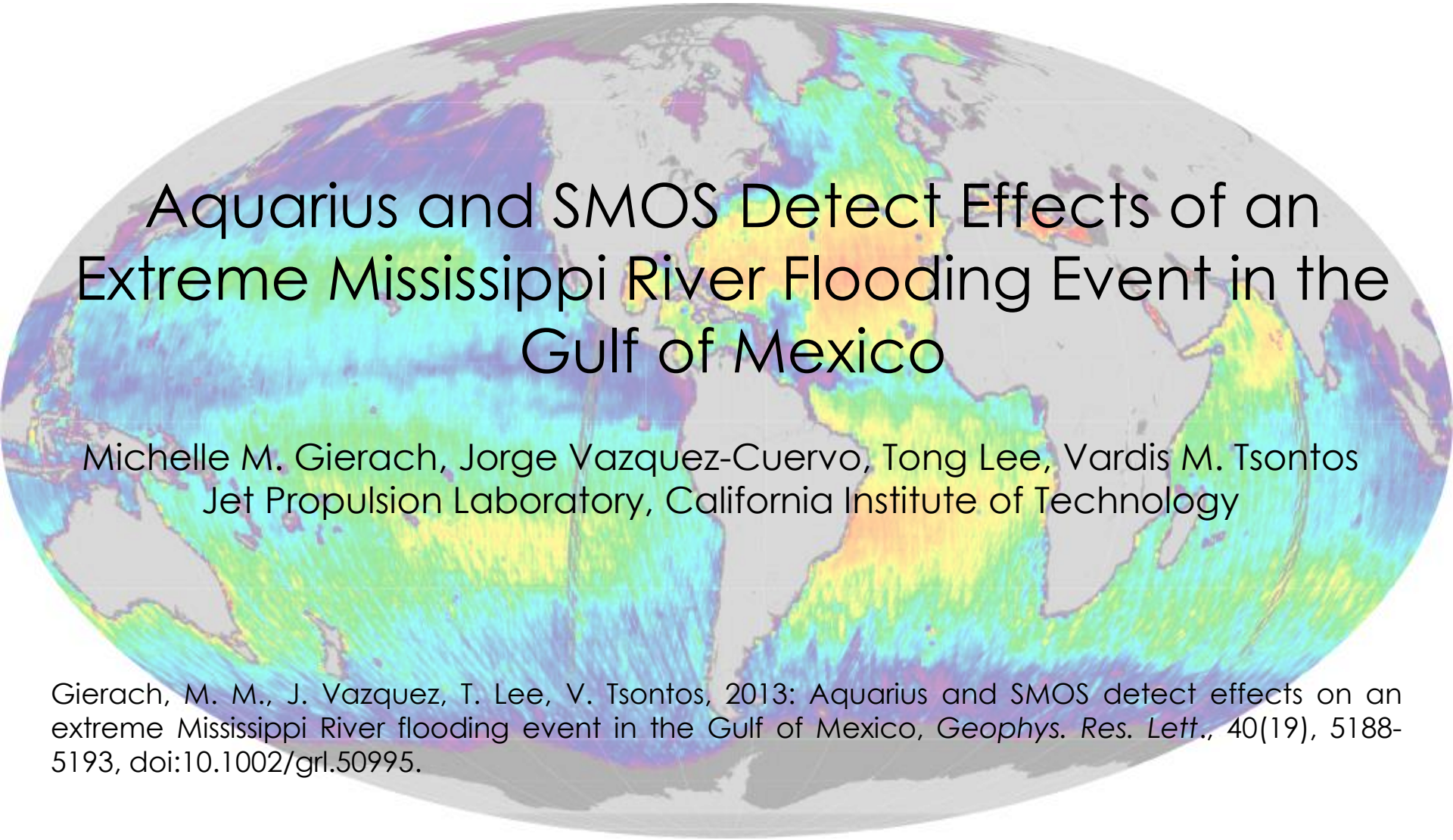

# Aquarius and SMOS Detect Effects of an Extreme Mississippi River Flooding Event in the Gulf of Mexico

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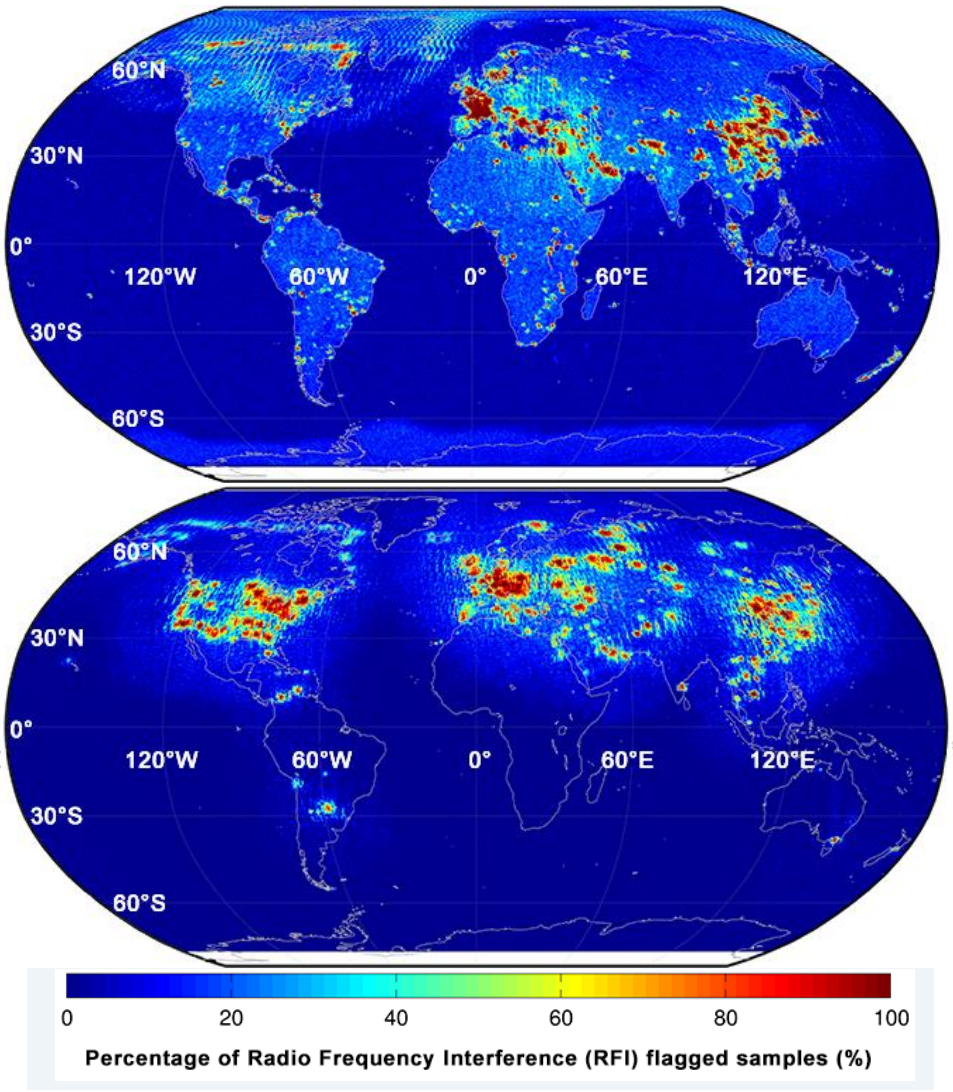
Jet Propulsion Laboratory, California Institute of Technology

Gierach, M. M., J. Vazquez, T. Lee, V. Tsontos, 2013: Aquarius and SMOS detect effects on an extreme Mississippi River flooding event in the Gulf of Mexico, *Geophys. Res. Lett.*, 40(19), 5188-5193, doi:10.1002/grl.50995.

# Why is This Important?



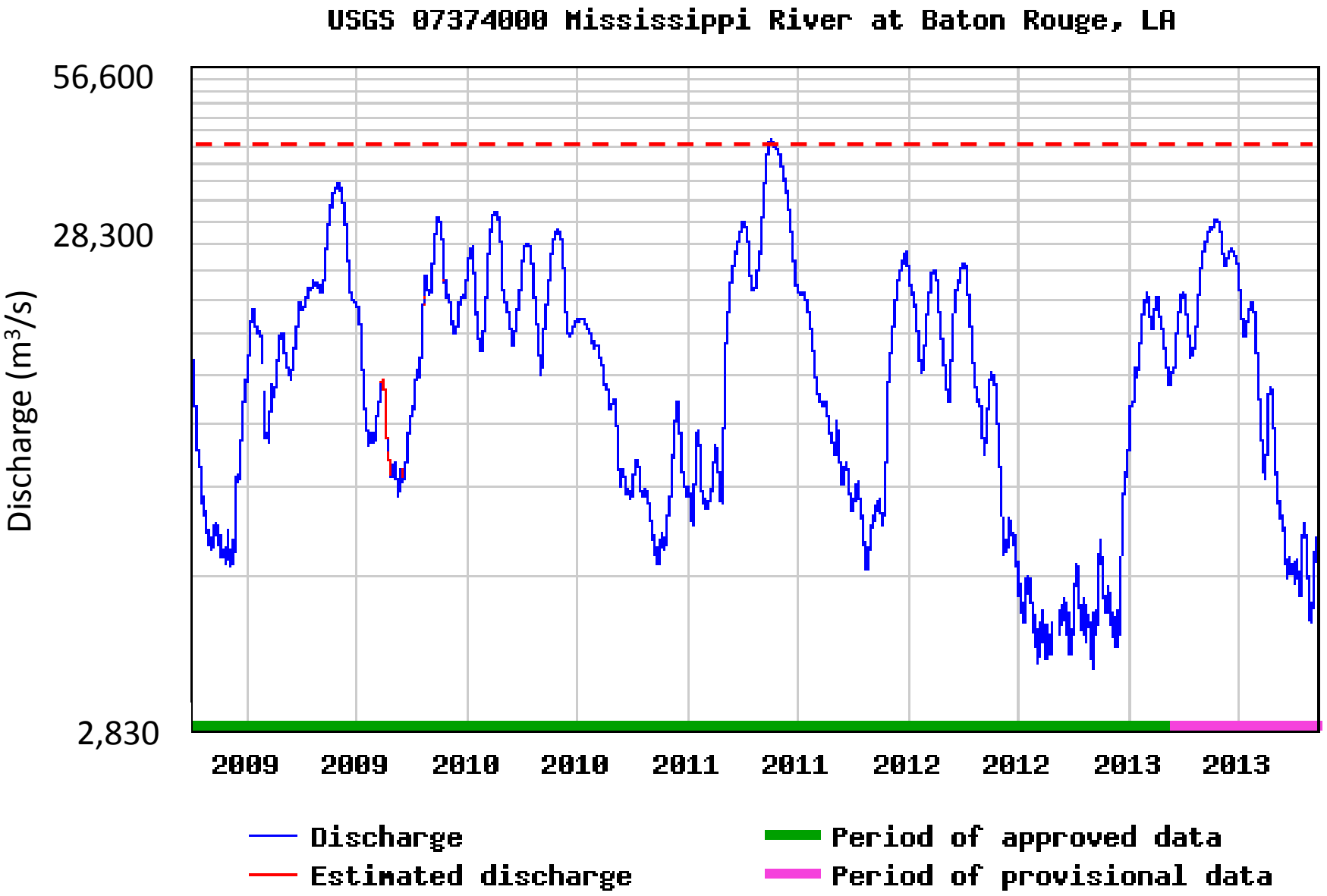

- It remains unclear as to what extent Aquarius and SMOS data can be used to study salinity variation in marginal seas due to smaller spatial scales of salinity features and the potential contamination of the SSS signal near land


SCHOOL BUS
SCHOOL BUS

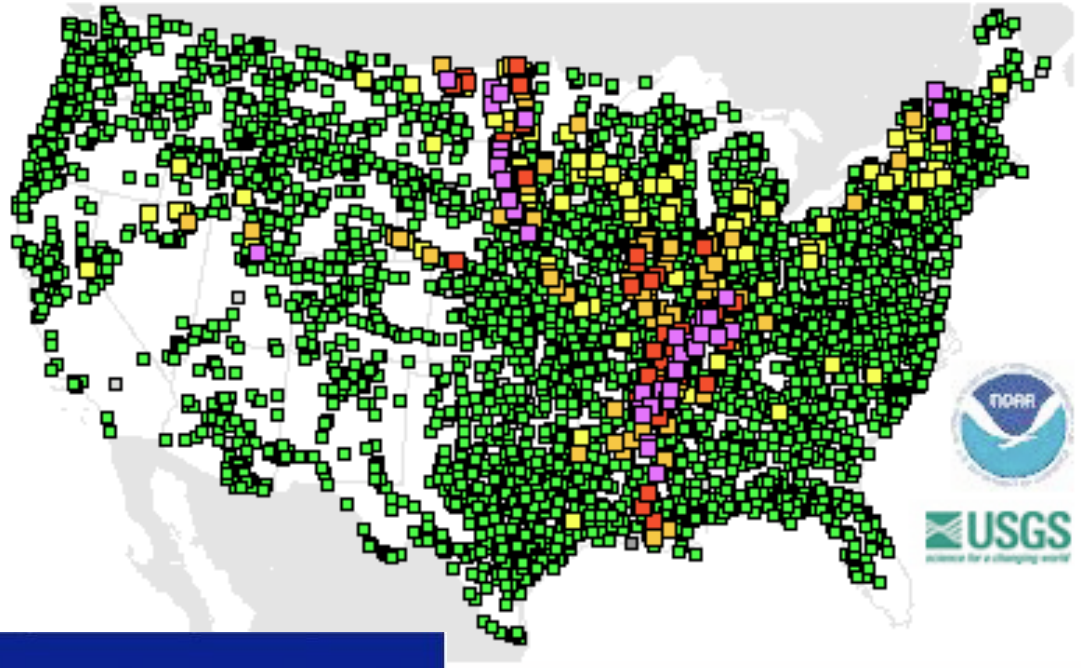

May 4, 2011
Mississippi River
Ohio River
Cairo
floodway

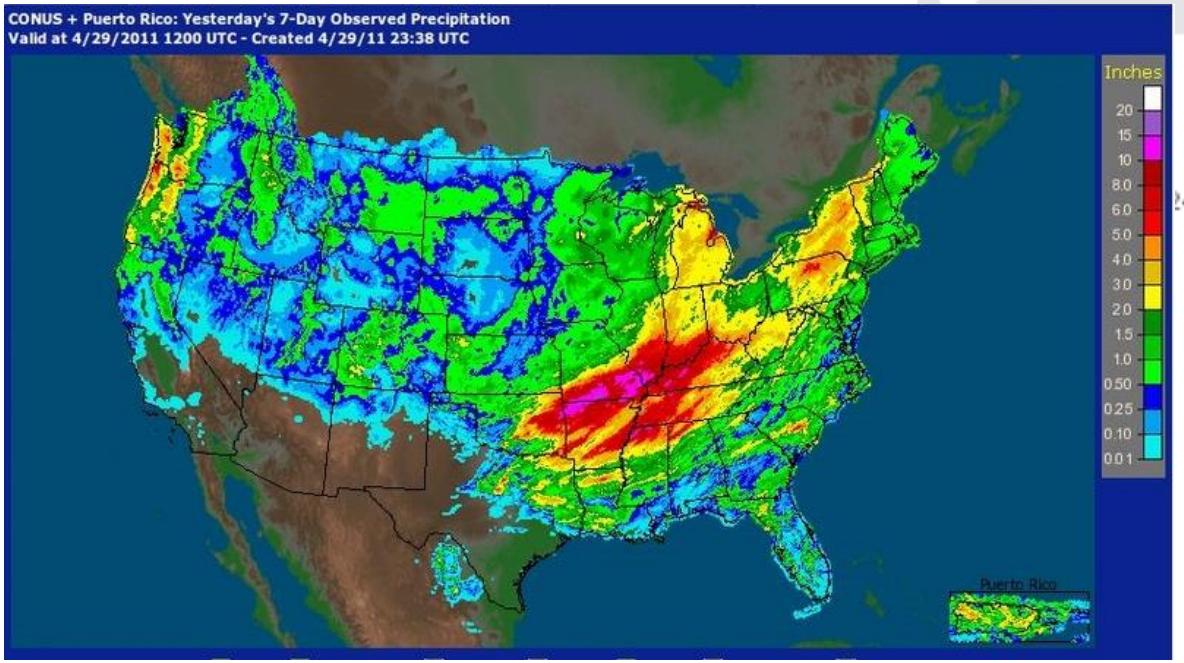

April 29, 2010
Mississippi River
Ohio River
Cairo
floodway
25 km

# The Mississippi River



# 2011 Mississippi River Flood

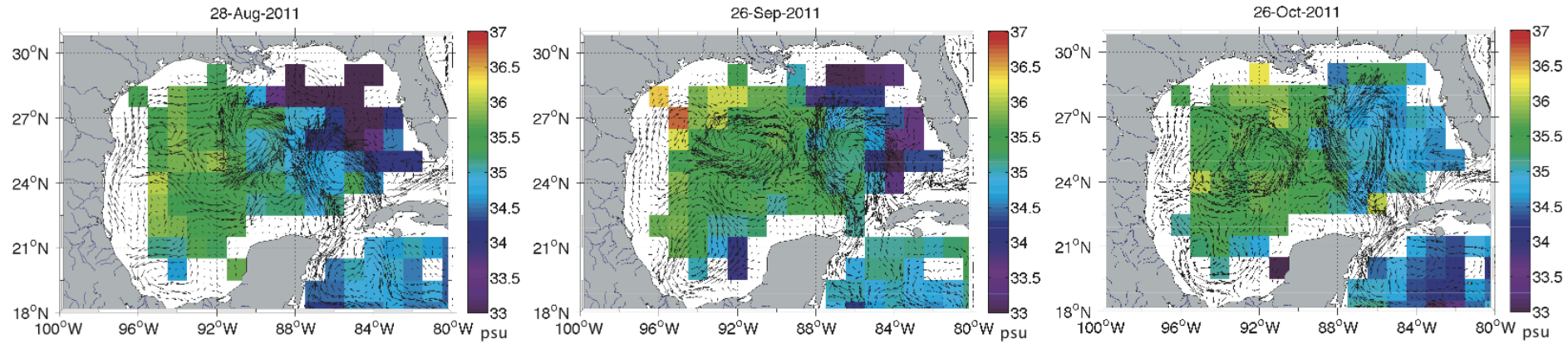



24 hours

48 Gauges: Major Flooding
52 Gauges: Moderate Flooding
93 Gauges: Minor Flooding
118 Gauges: Near Flood Stage
4231 Gauges: No Flooding

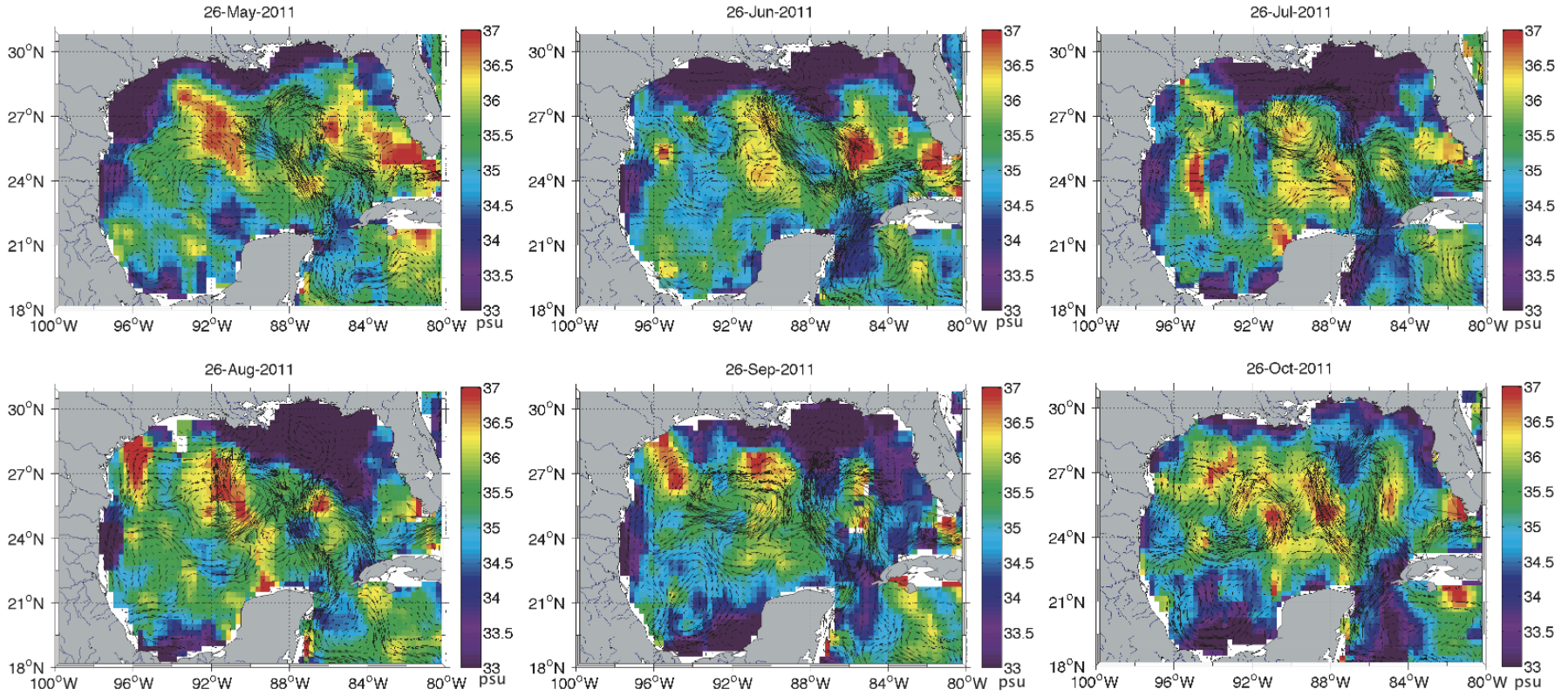
# Aquarius Detects River Discharge




- Aquarius data began in late August 2011 and captured part of this discharge event in the Gulf of Mexico
- Aquarius observed low SSS values (< 34 psu) in the northeastern Gulf of Mexico from August-September 2011 (3– 4 months after peak discharge) that were no longer visible by October 2011 (5 months after peak discharge)
- Seasonal winds and general circulation variability in the Gulf of Mexico impacted the observed salinity response to the record 2011 Mississippi River flooding event

[Gierach et al., 2013]

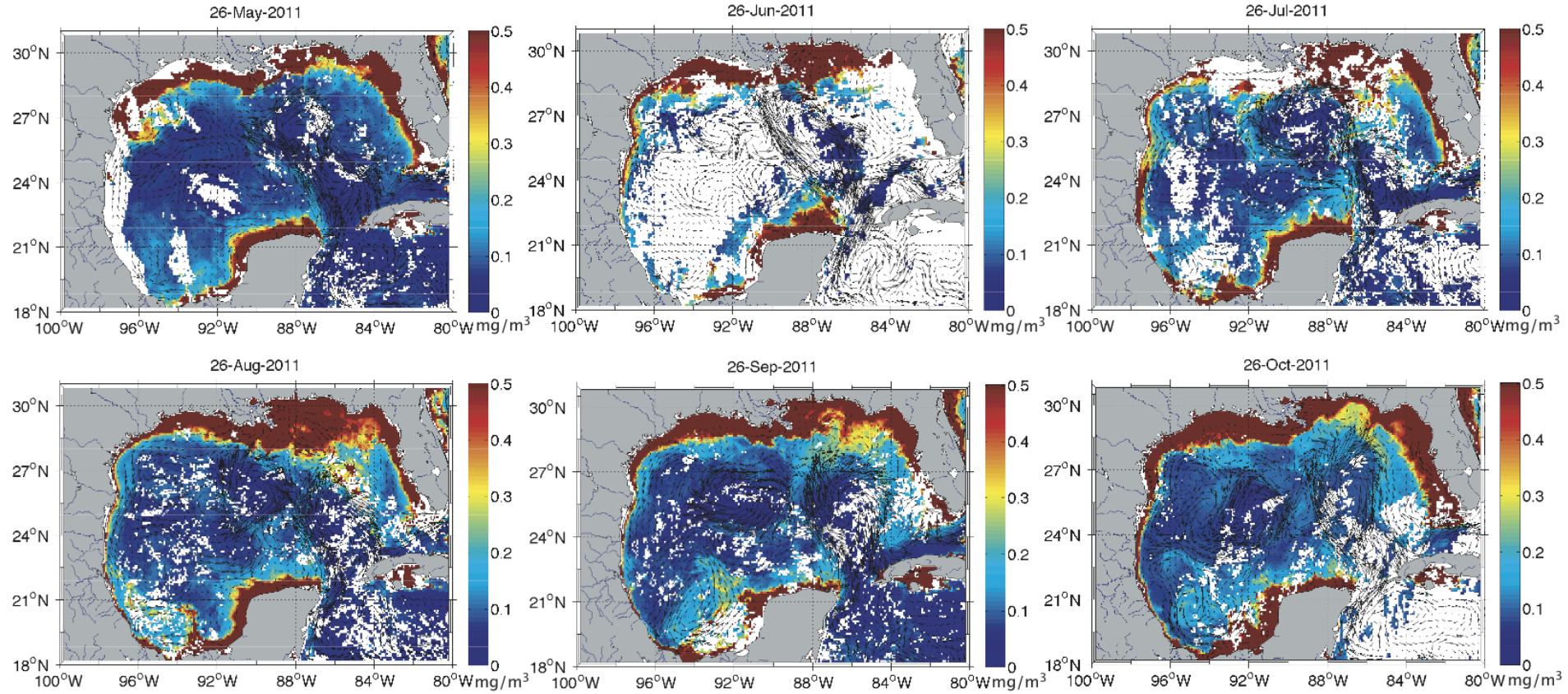
# SMOS Detects River Discharge




- SMOS data began in 2010 and captured the entire discharge event
- Low SSS values (< 34 psu) from SMOS were confined along the Mississippi-Alabama-Florida coasts in May 2011 and began to spread into the Gulf of Mexico from June-July 2011 (1–2 months after peak discharge)
- A similar SSS response was shown from August-October 2011 consistent with Aquarius

[Gierach et al., 2013]

# Chlorophyll-a Validates Aquarius and SMOS Observed River Discharge

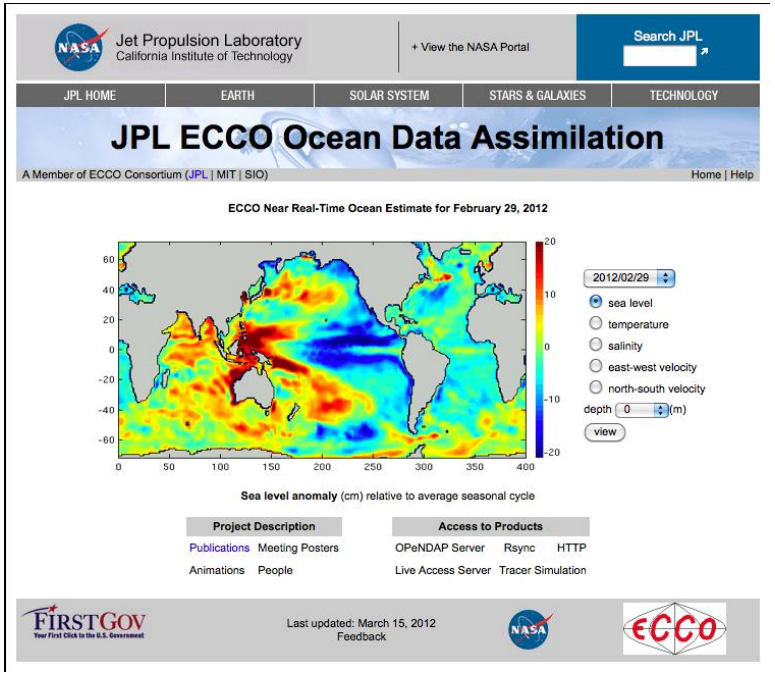



- The observed salinity responses from SMOS and Aquarius to the discharge event were consistent with MODIS chlorophyll-a concentrations from May-October 2011

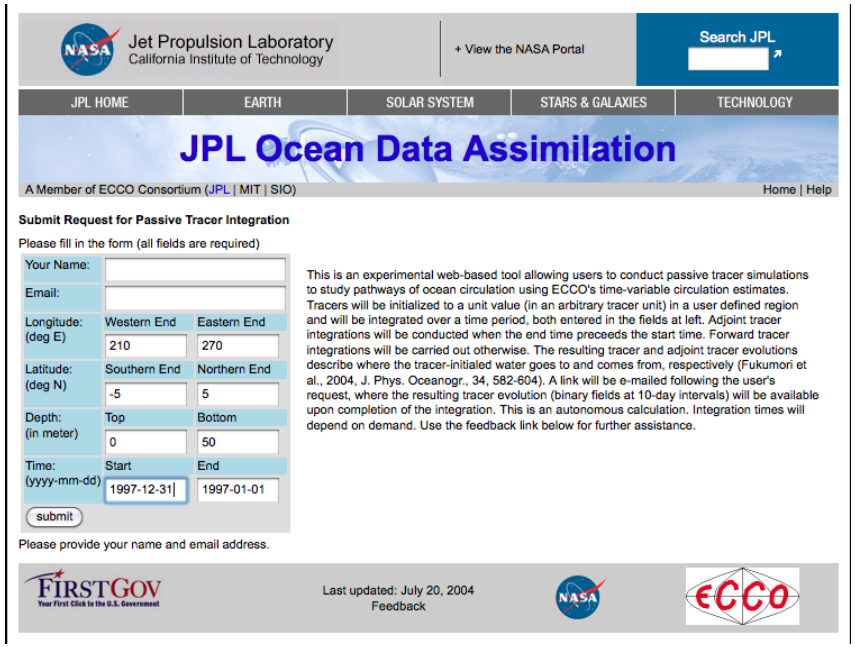
[Gierach et al., 2013]

# Using ECCO to Further Investigate River Discharge during the 2011 Mississippi River Flooding Event

- A passive tracer tool based on ECCO state estimation was used used to assess the pathway and transit time of the low SSS signal in the Gulf of Mexico (Fukumori et al., 2004)
  - A uniform tracer was initialized in May 2011 in the top 40 m at the mouth of the Mississippi River (28°N–29°N, 89°N–90°W) and ran forwards in time for 6 months (June – November 2011)



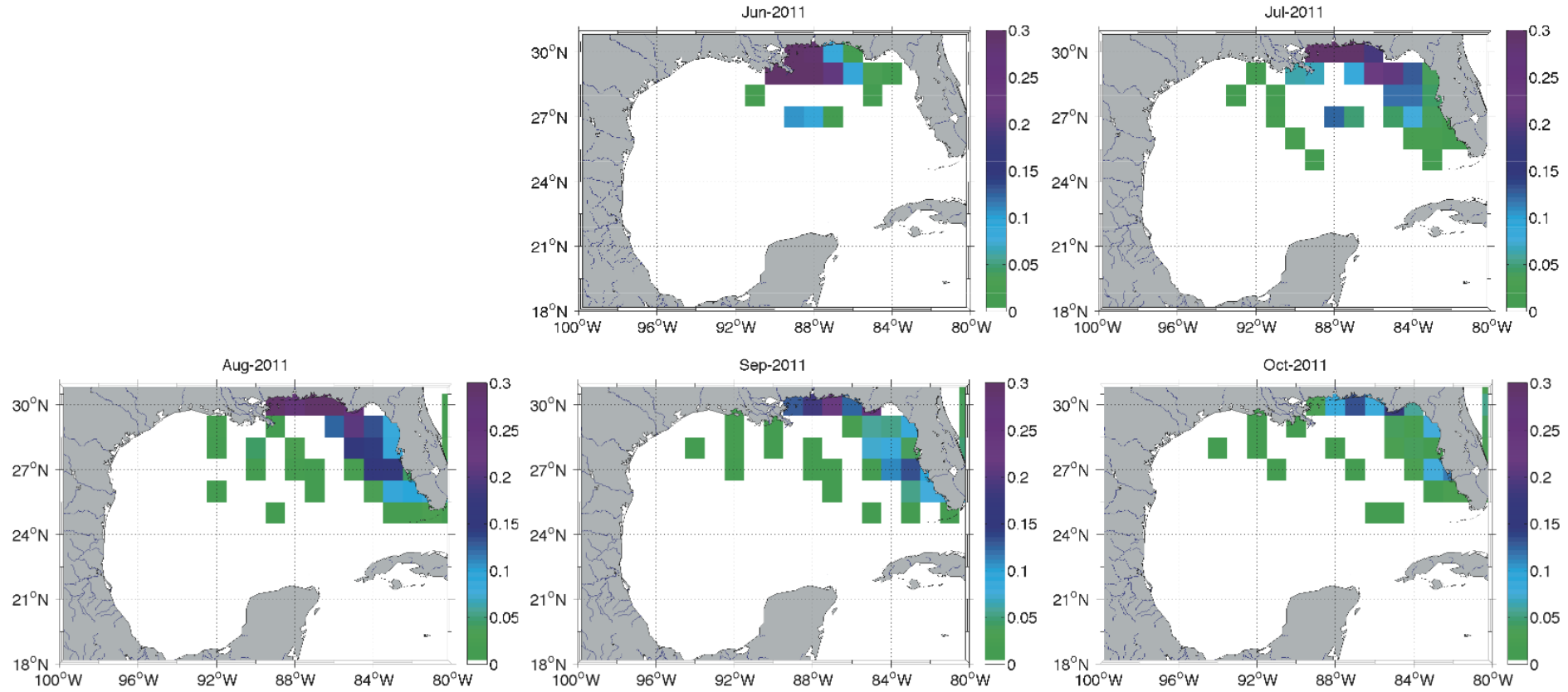

http://ecco.jpl.nasa.gov/external/




http://ecco.jpl.nasa.gov/tracer/

[Gierach et al., 2013]

# Tracer Concentrations Validate the Pathway and Transit Time of River Discharge



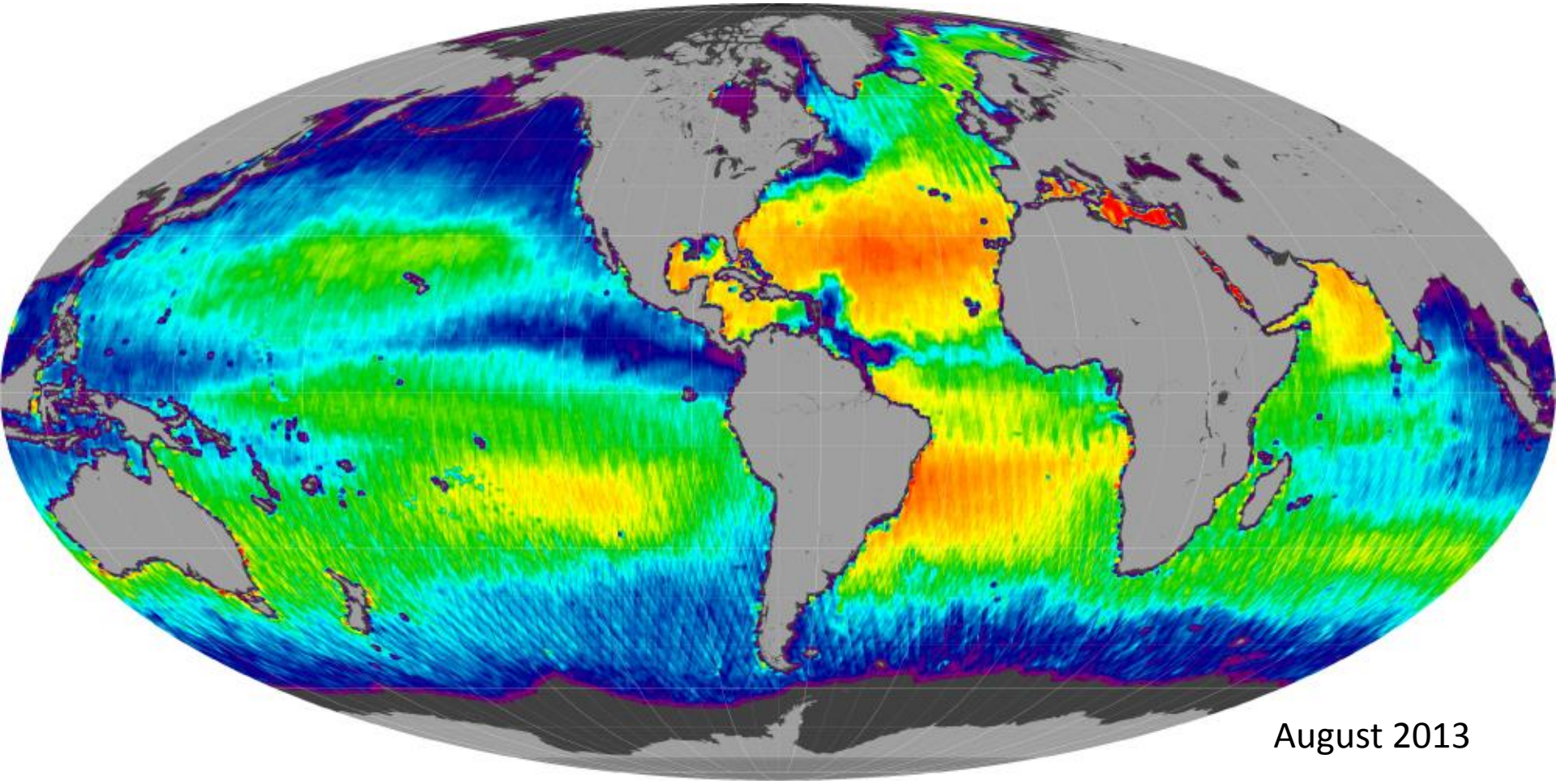

- Results are consistent with the transit time of freshwater spreading from Aquarius and SMOS

[Gierach et al., 2013]

# Summary

- First successful application of satellite SSS to study salinity variation in marginal seas
- Aquarius observed salinity freshening associated with the record 2011 Mississippi River flooding event in the Gulf of Mexico
- The salinity response from Aquarius was consistent with SMOS and chlorophyll-a concentrations
- Seasonal winds and the general ocean circulation impacted the observed salinity response
- Freshwater plumes and salinity variability in marginal seas have implications on large-scale ocean circulations and climate

# Questions…



August 2013