Impact of nitrogen deposition on coastal waters

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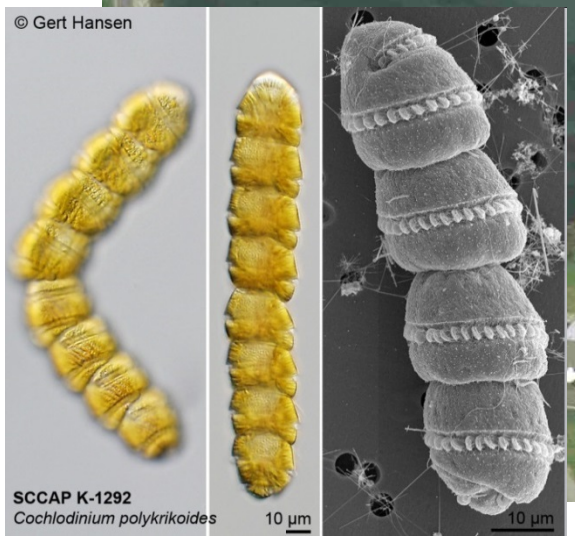
Cochlodinium bloom (Aug 2007)



Courtesy Margie Mulholland

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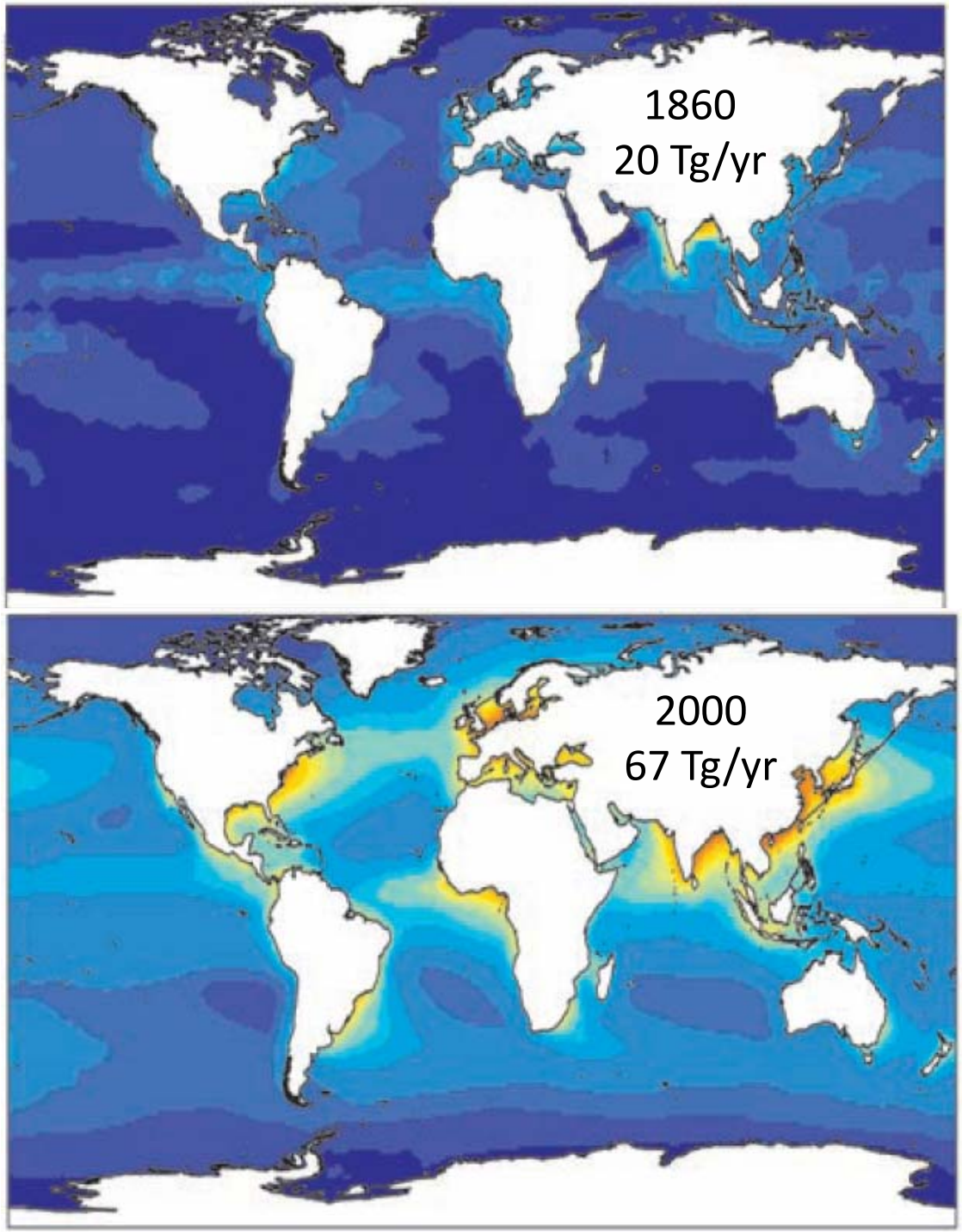
Modeled atmospheric N deposition to the ocean, past and present



Duce et al. (2008)

Two published studies:

- Analysis of nitrate trends of the East Asian Seas (Kim et al., 2011)
- Analysis of remotely sensed chlorophyll in coastal waters of the Eastern US (Kim et al., 2014)

Tae-Wook Kim

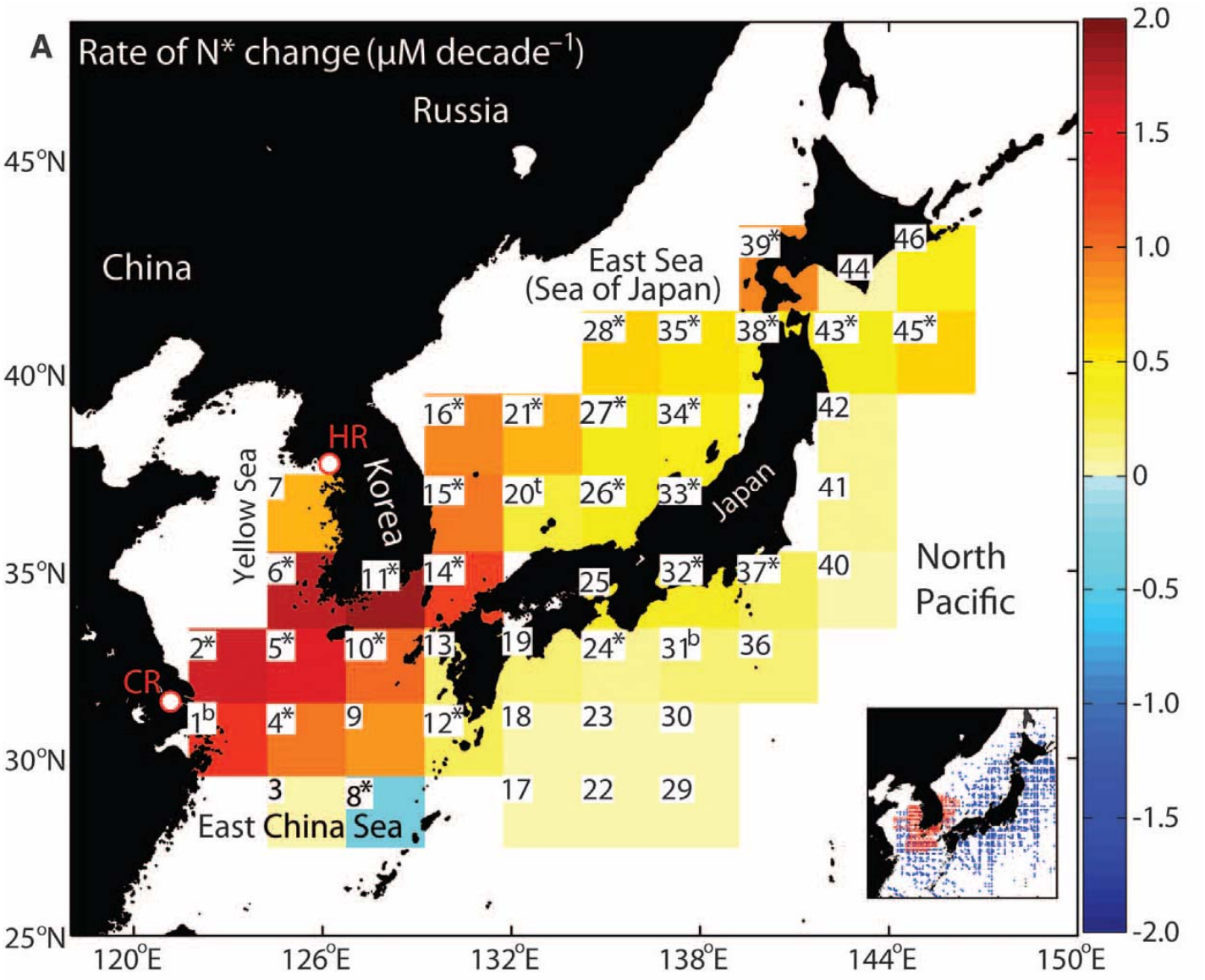
Kitack Lee

One ongoing study:

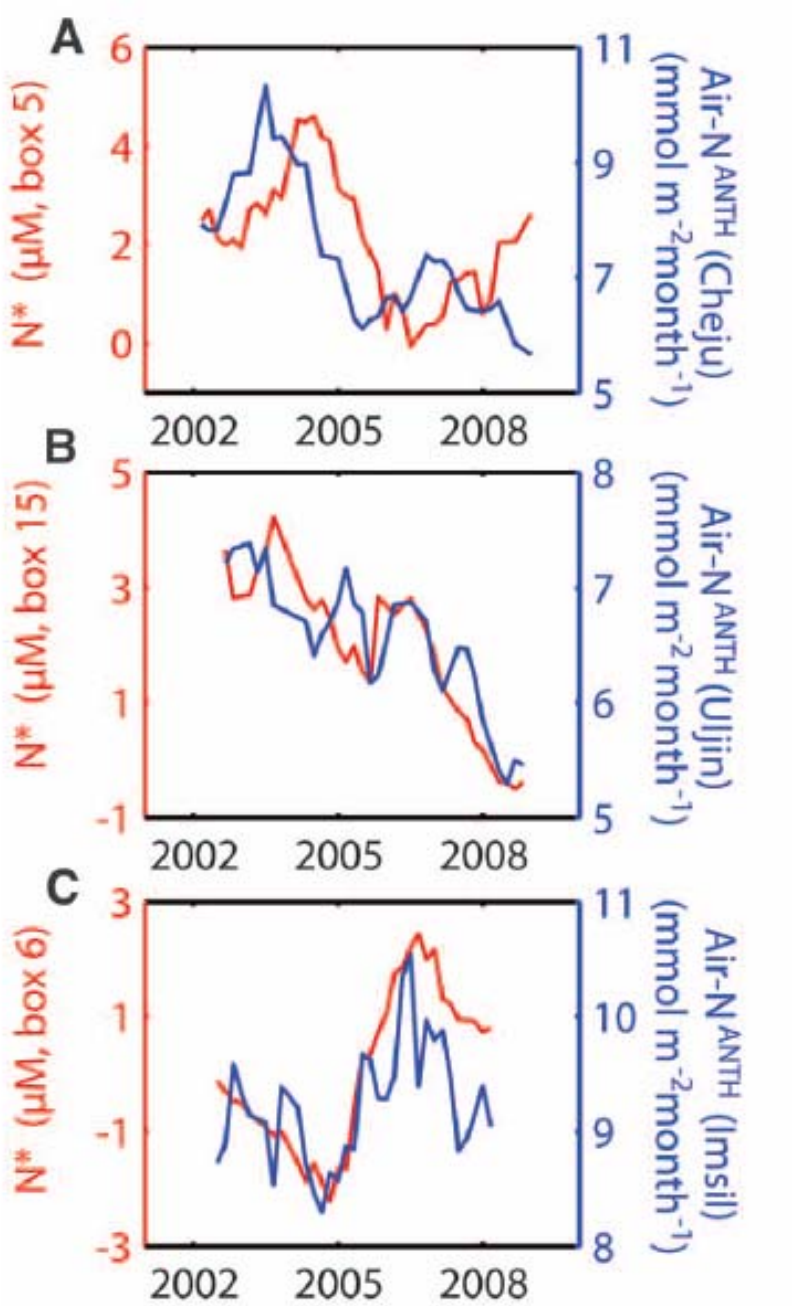
- Impact of rain events in oligotrophic coastal waters of Eastern US : observations and modeling

Observed trends in surface-water N*

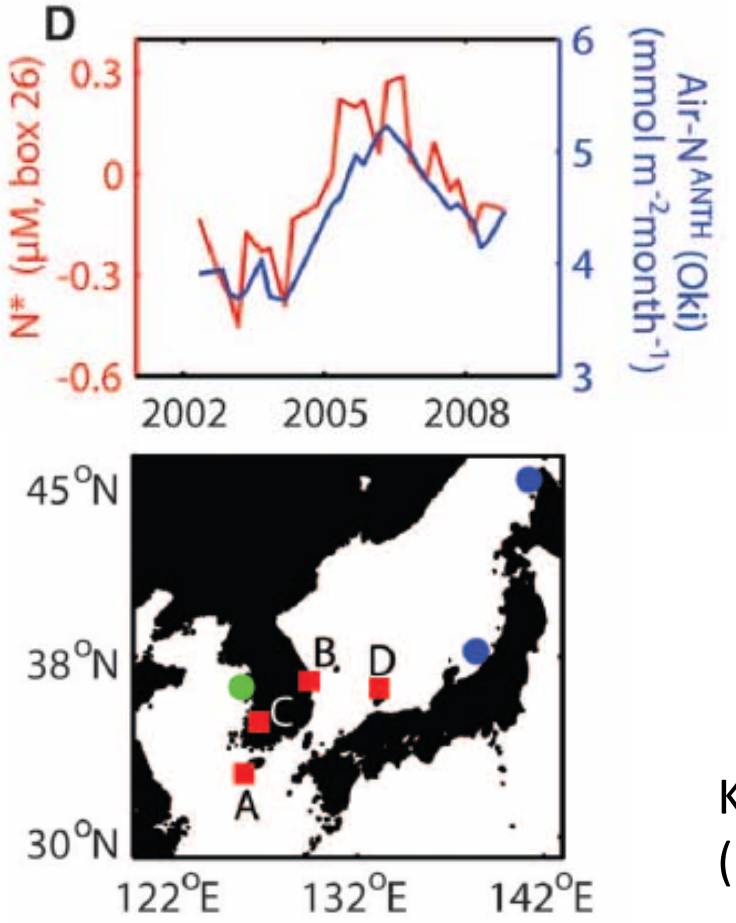
$N^* = [NO_3^-] - 16[PO_4^{3-}]$



Kim et al. (2011)



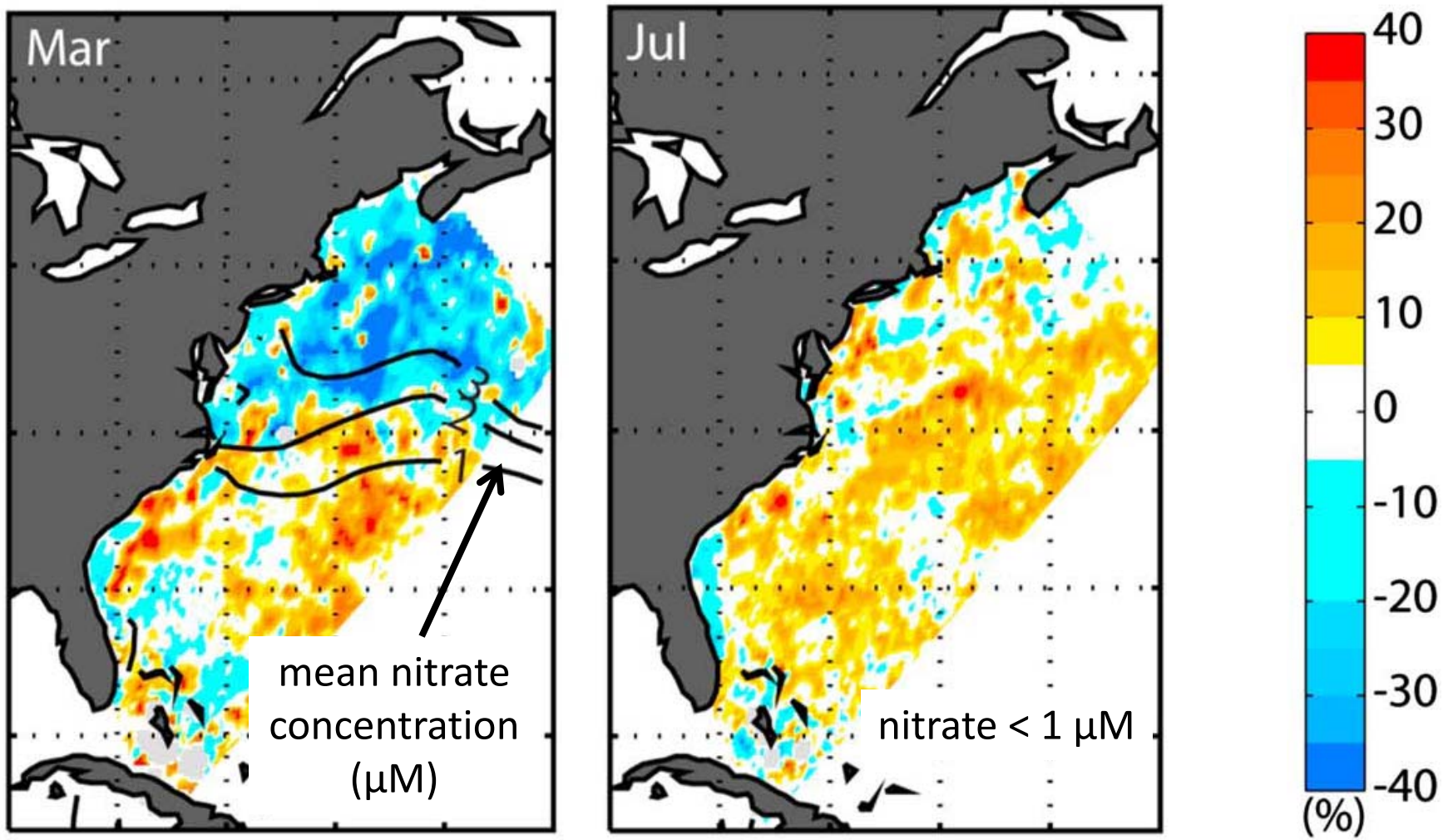
Relationship between N* changes in surface waters and atmospheric deposition



Kim et al. (2011)

Wet days and dry days were compared for the amount of chlorophyll (Chl) in surface waters (1997-2010)

$$(Chl_{wet} - Chl_{dry}) \div Chl_{mean}$$



Kim et al. (2014)

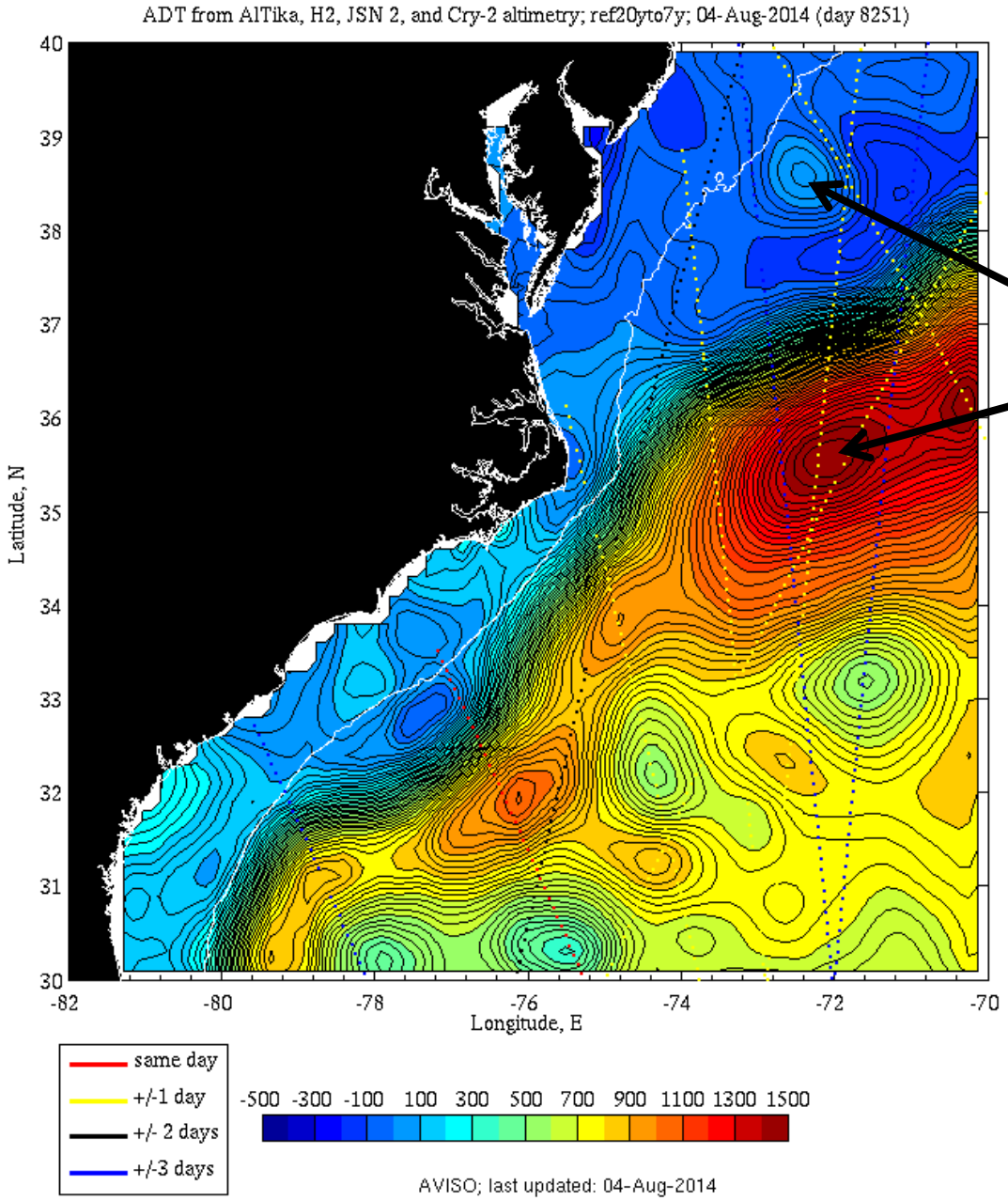
DANCE = Deposition of Atmospheric Nitrogen to Coastal Ecosystems

Collaborative NSF project with Old Dominion University and Virginia Institute for Marine Science

Central hypothesis: *Wet atmospheric nitrogen deposition events stimulate primary productivity and accumulation of algal biomass in coastal waters following summer storms; this effect exceeds the associated biogeochemical responses to wind-induced mixing and increased stratification caused by surface freshening*

Fieldwork: R/V Hugh Sharp, July 30 – August 15, 2014

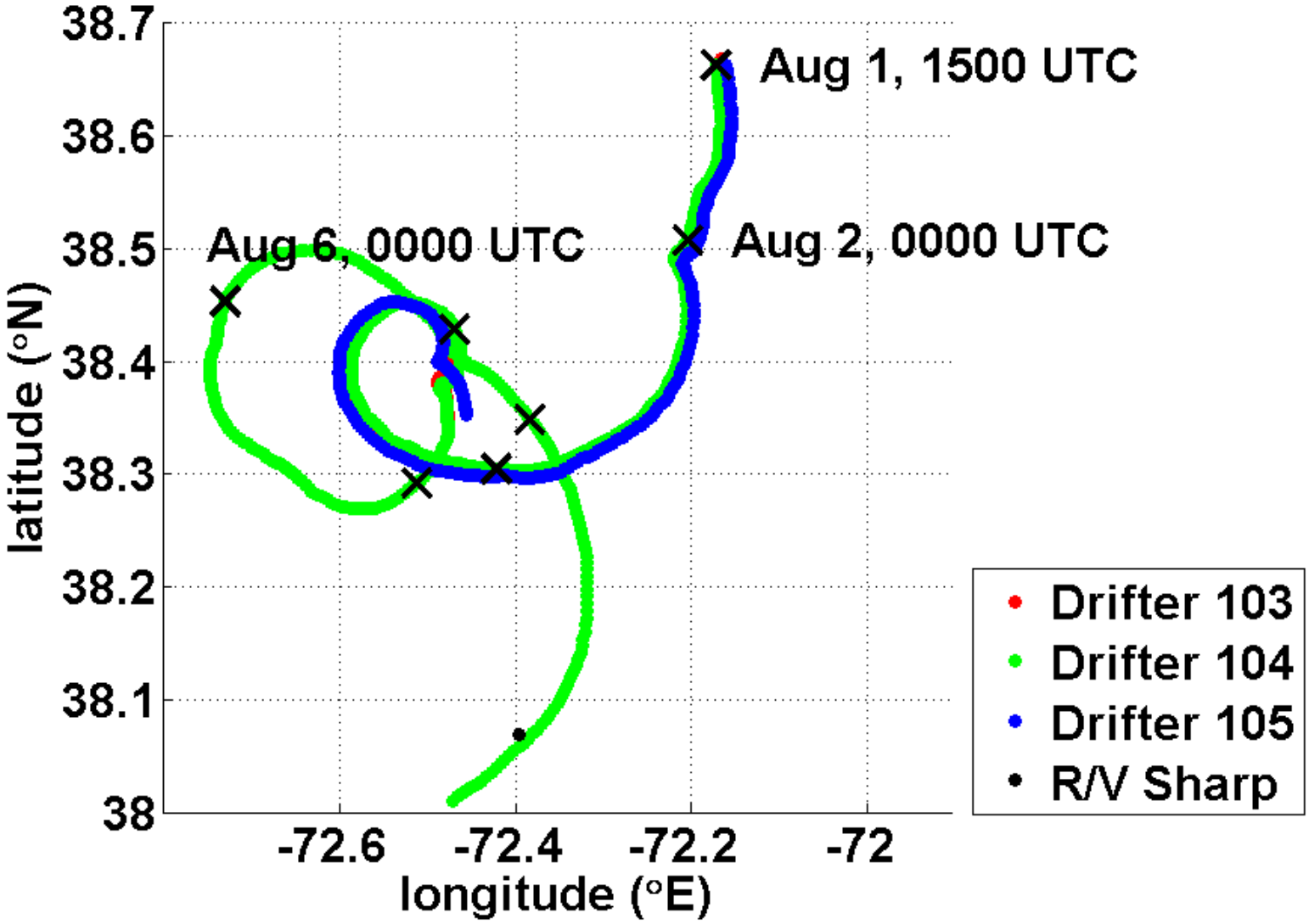
Modeling: Atmospheric and marine N cycle models applied to coastal waters of Eastern U.S.



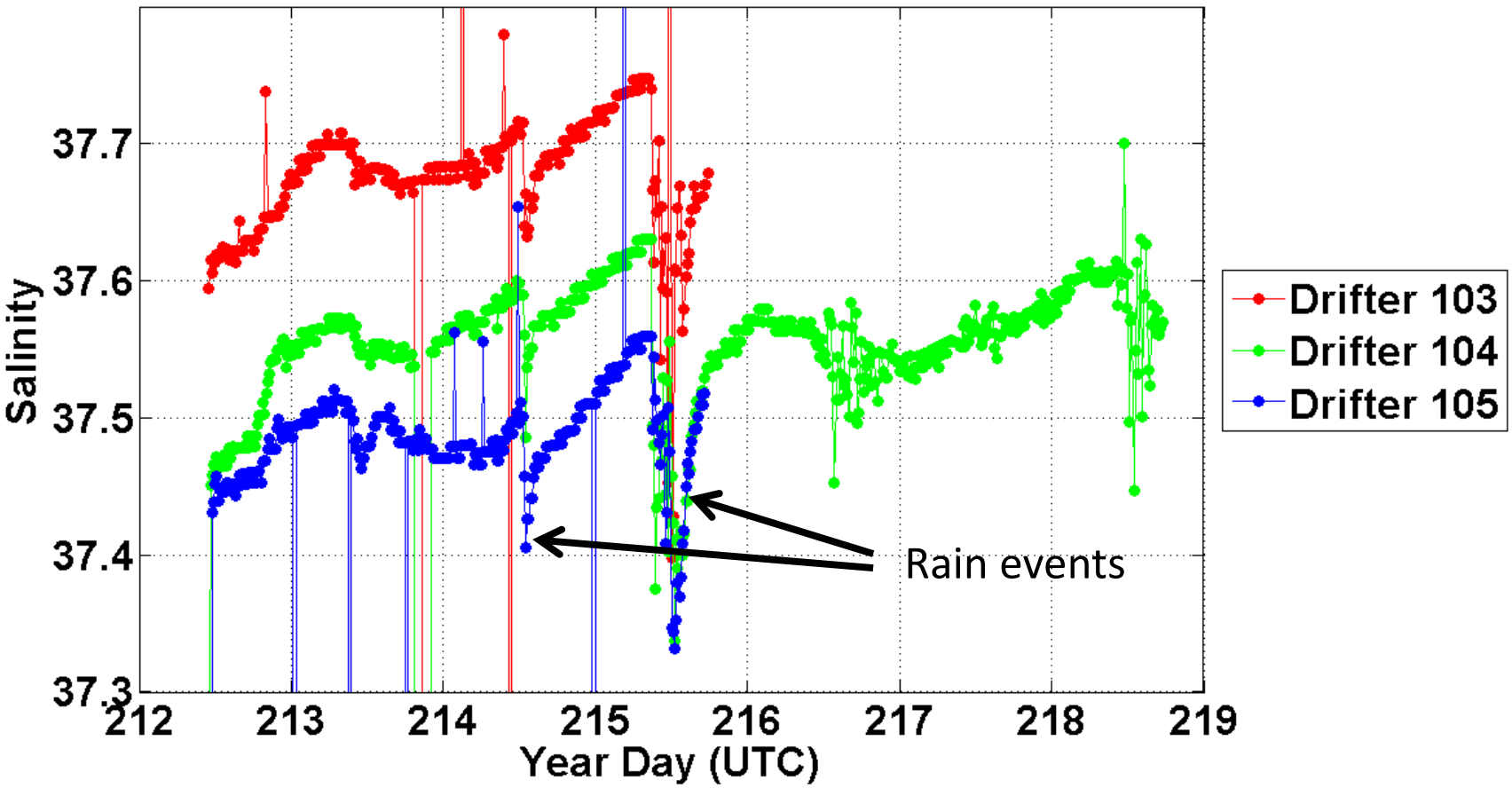
Satellite image of relative sea surface height (mm)

Anticyclonic eddies sampled

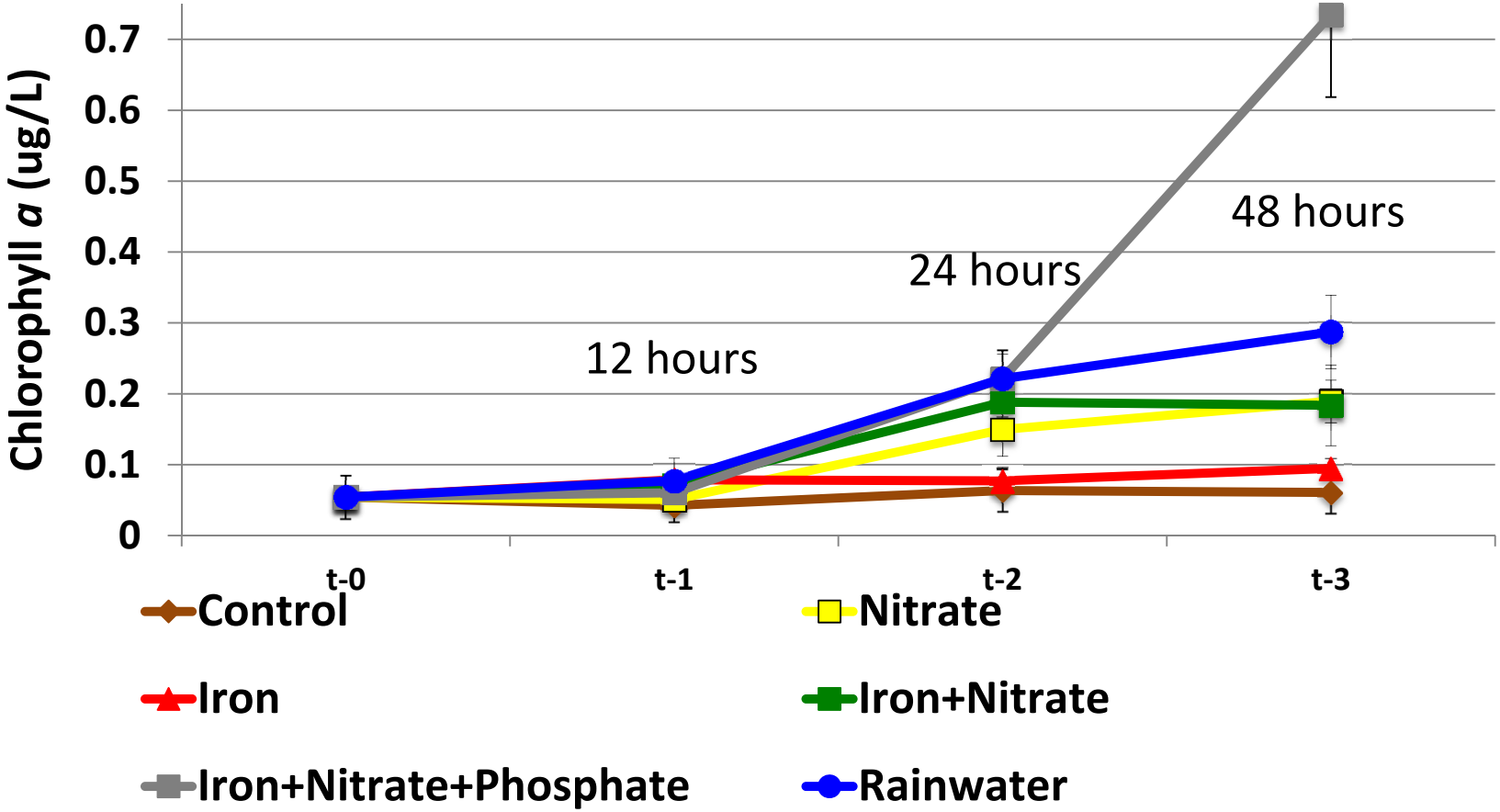
Drifter Positions



Drifter Salinity



Response of surface water phytoplankton to nutrient additions



Summary

Nitrate is increasing in the East Asian Seas, mainly as a result of N deposition

Chlorophyll in oligotrophic coastal waters of the Eastern US increases during rain events, but wind plays a dominant role

Bioassays in oligotrophic coastal waters of the Eastern US suggest N limitation and mild P limitation, but no Fe limitation