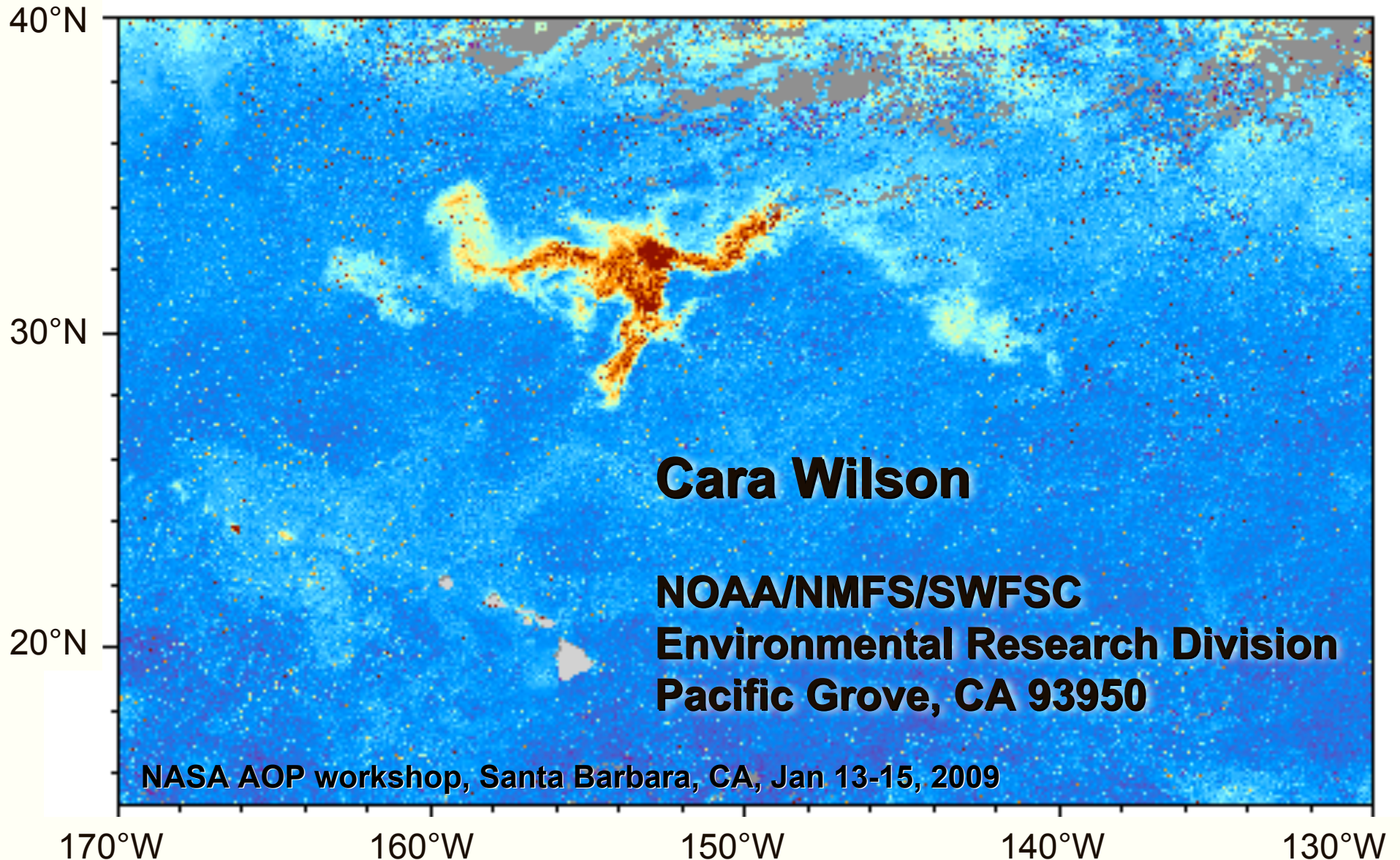
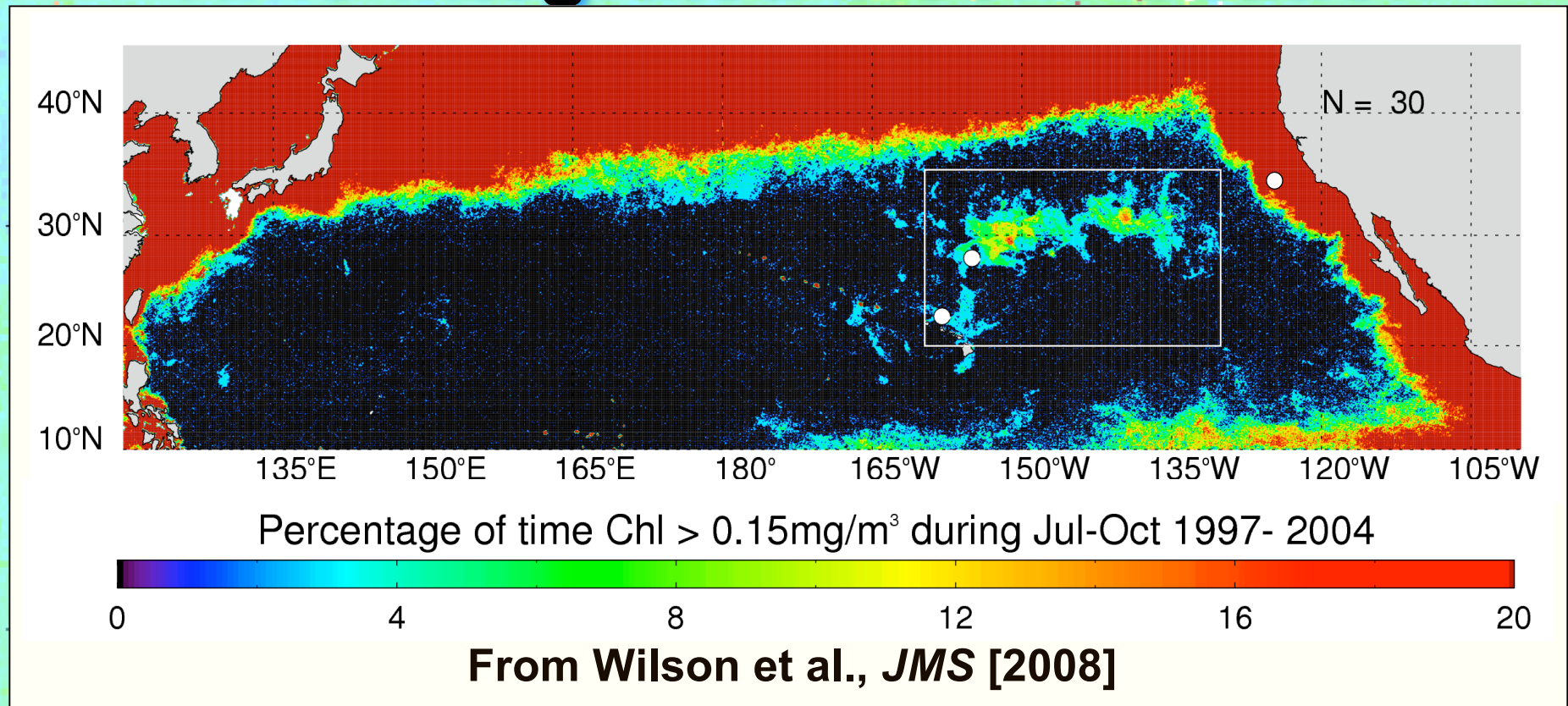


A Case for making AOP measurements in the NE Pacific bloom region



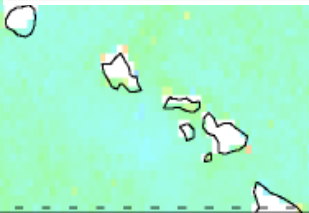
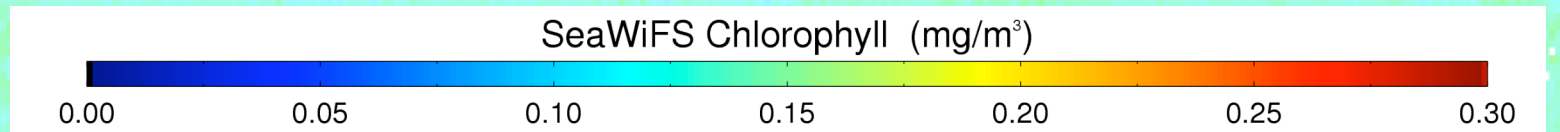
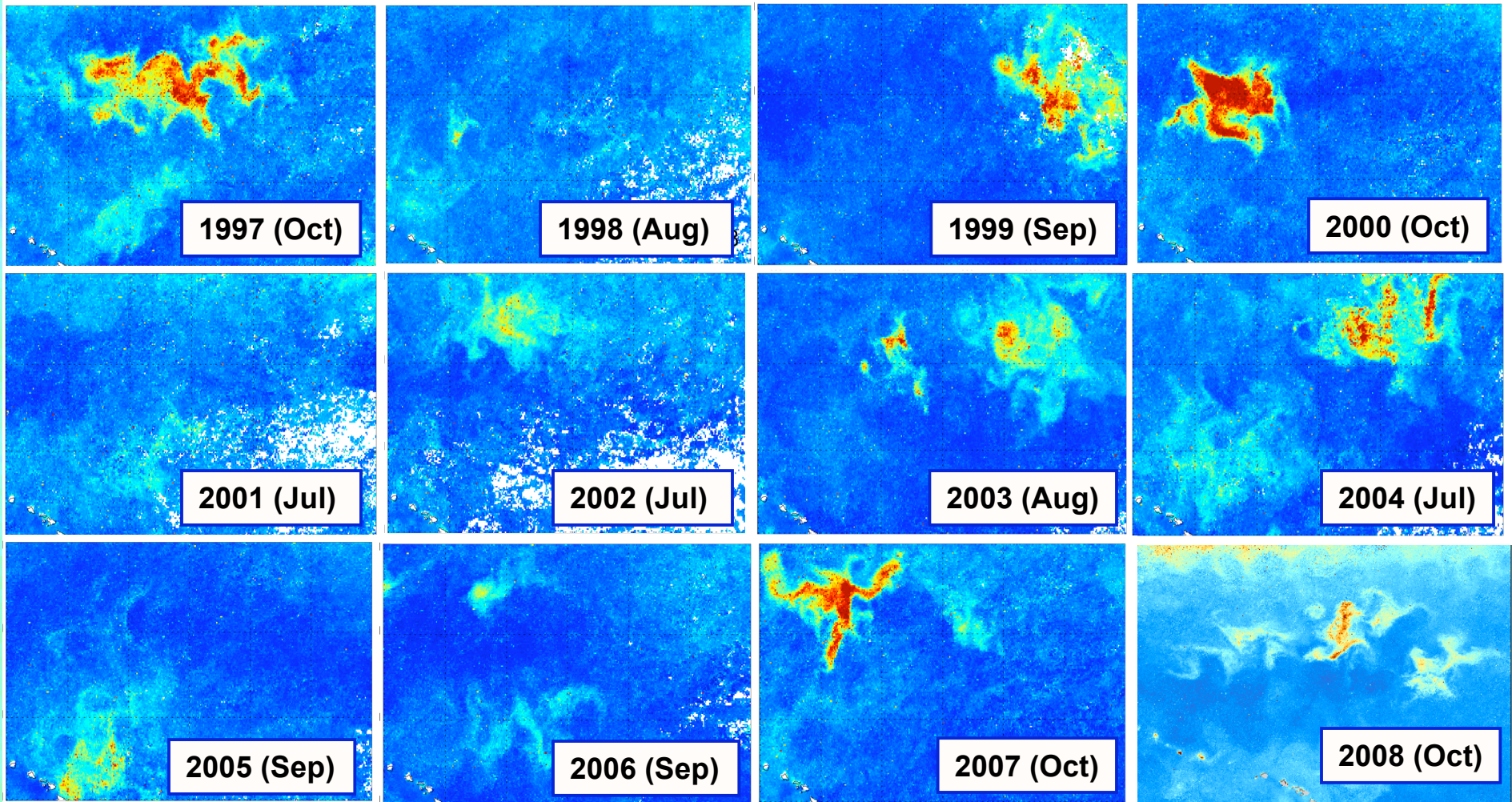
Time-integrated bloom location



- Blooms develop between Hawaii and the TZCF, about 10° south of the TZCF
- Three nearby closest sites with long-term measurements, the HOTS, Climax and weather M stations, are all outside of the bloom region

<http://www.pfeg.noaa.gov/~cwilson/bloom>

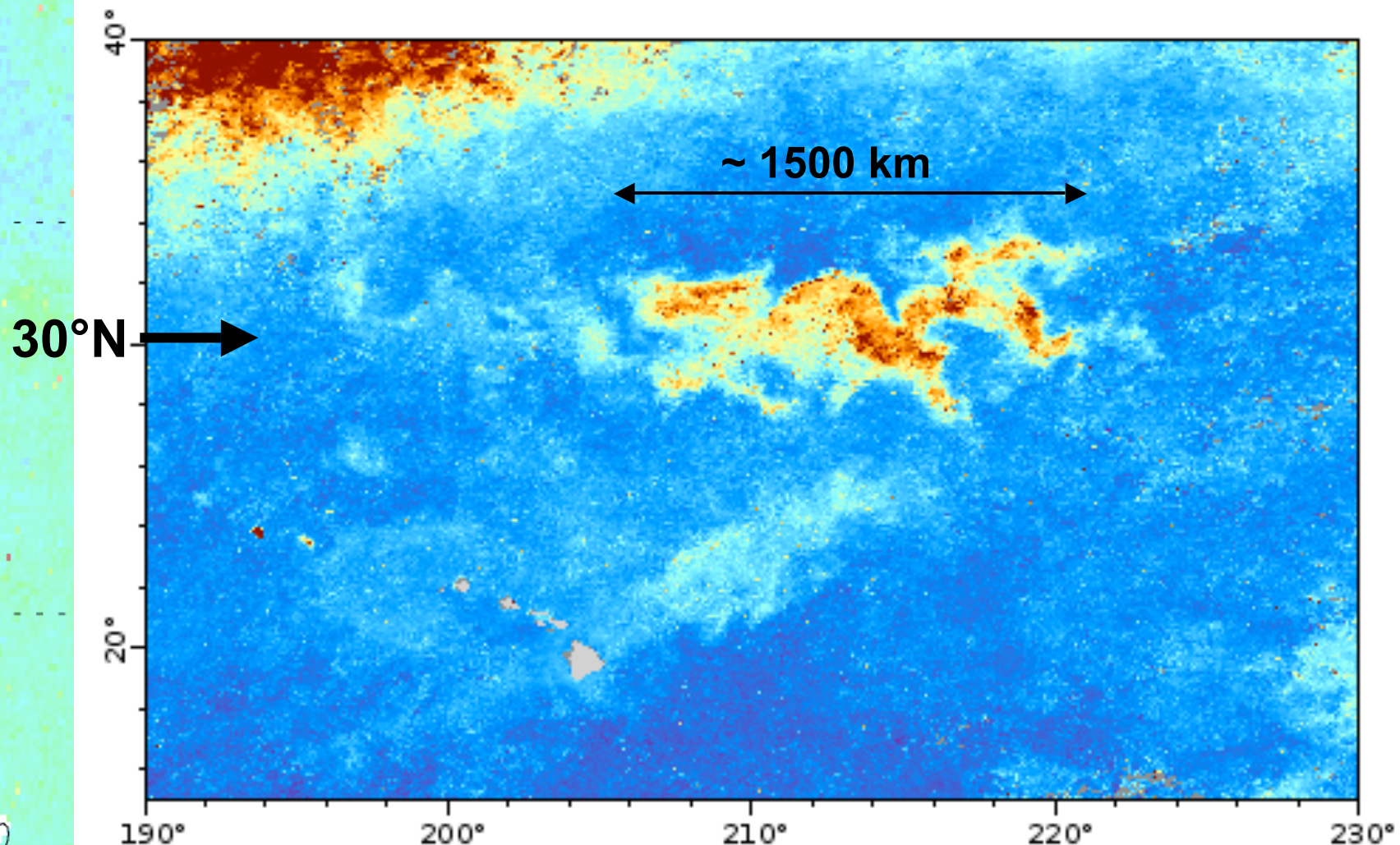
Largest Blooms - Monthly Composites



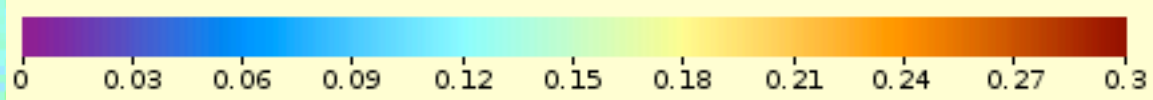
NE Pacific Bloom Region



October 1997



NOAA CoastWatch

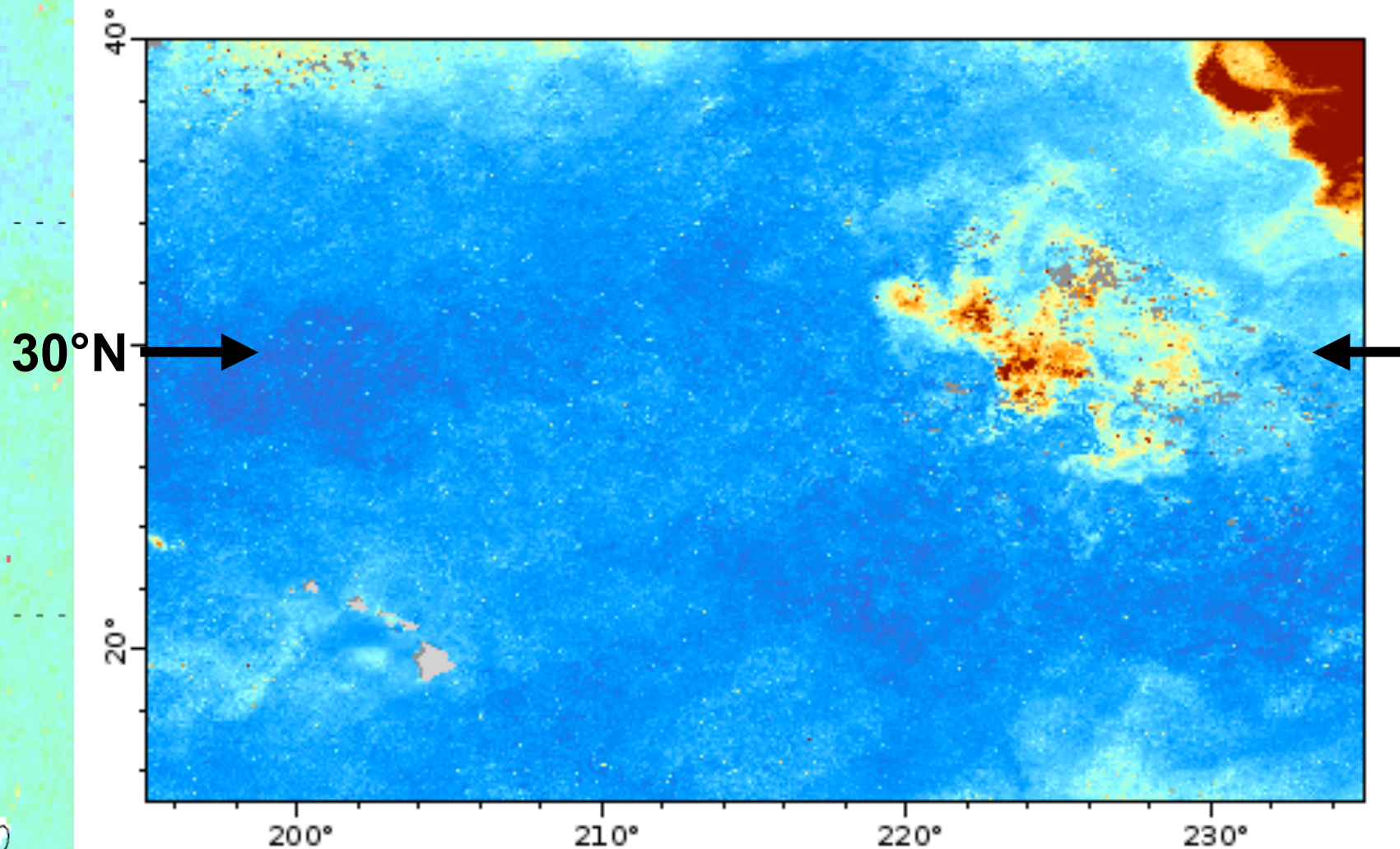


Chlorophyll-a, Orbview-2 SeaWiFS, 0.1 degrees, Global

NE Pacific Bloom Region



September 1999

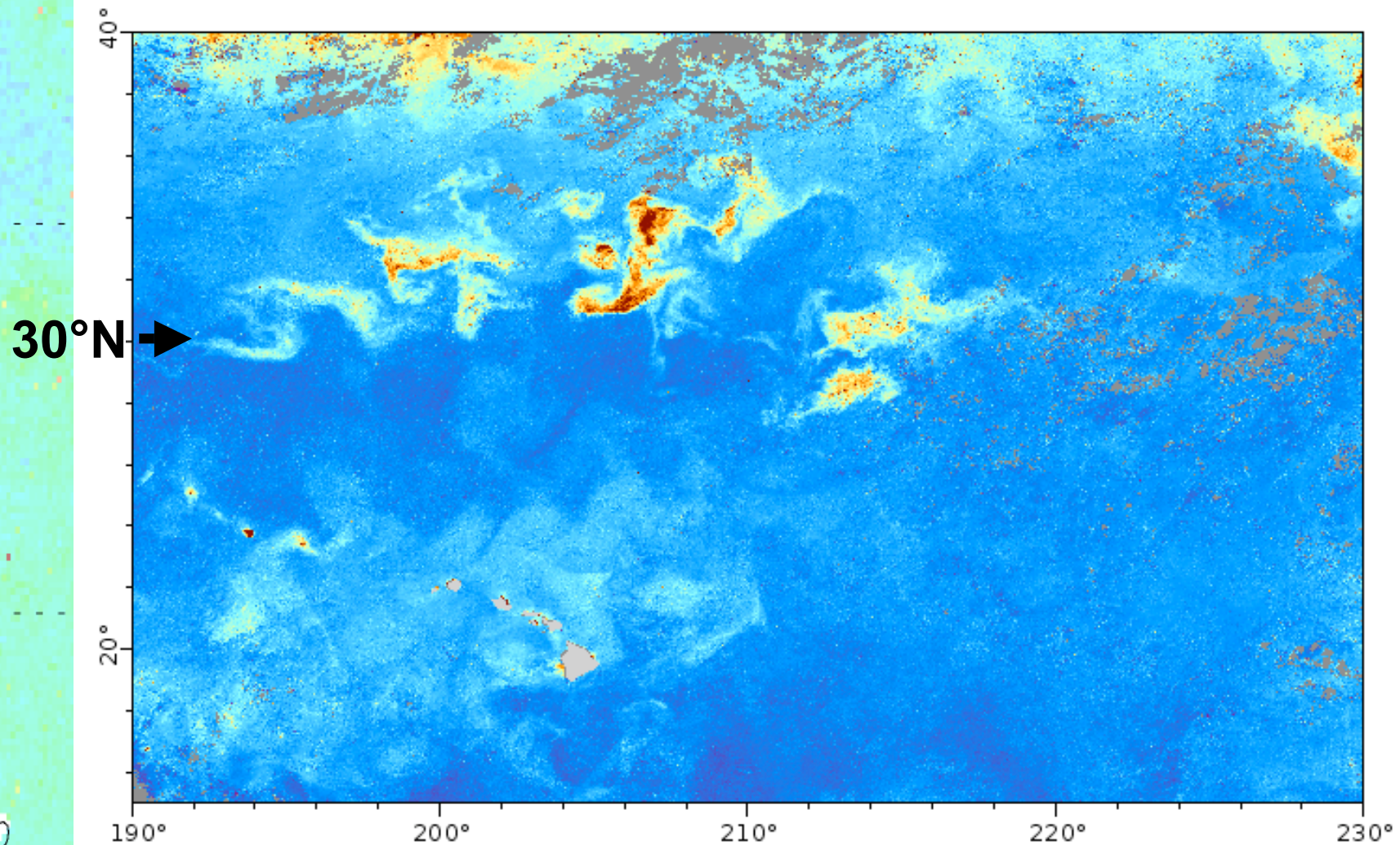


See also <http://www.pfeg.noaa.gov/~cwilson/bloom>

NE Pacific Bloom Region



October 2008

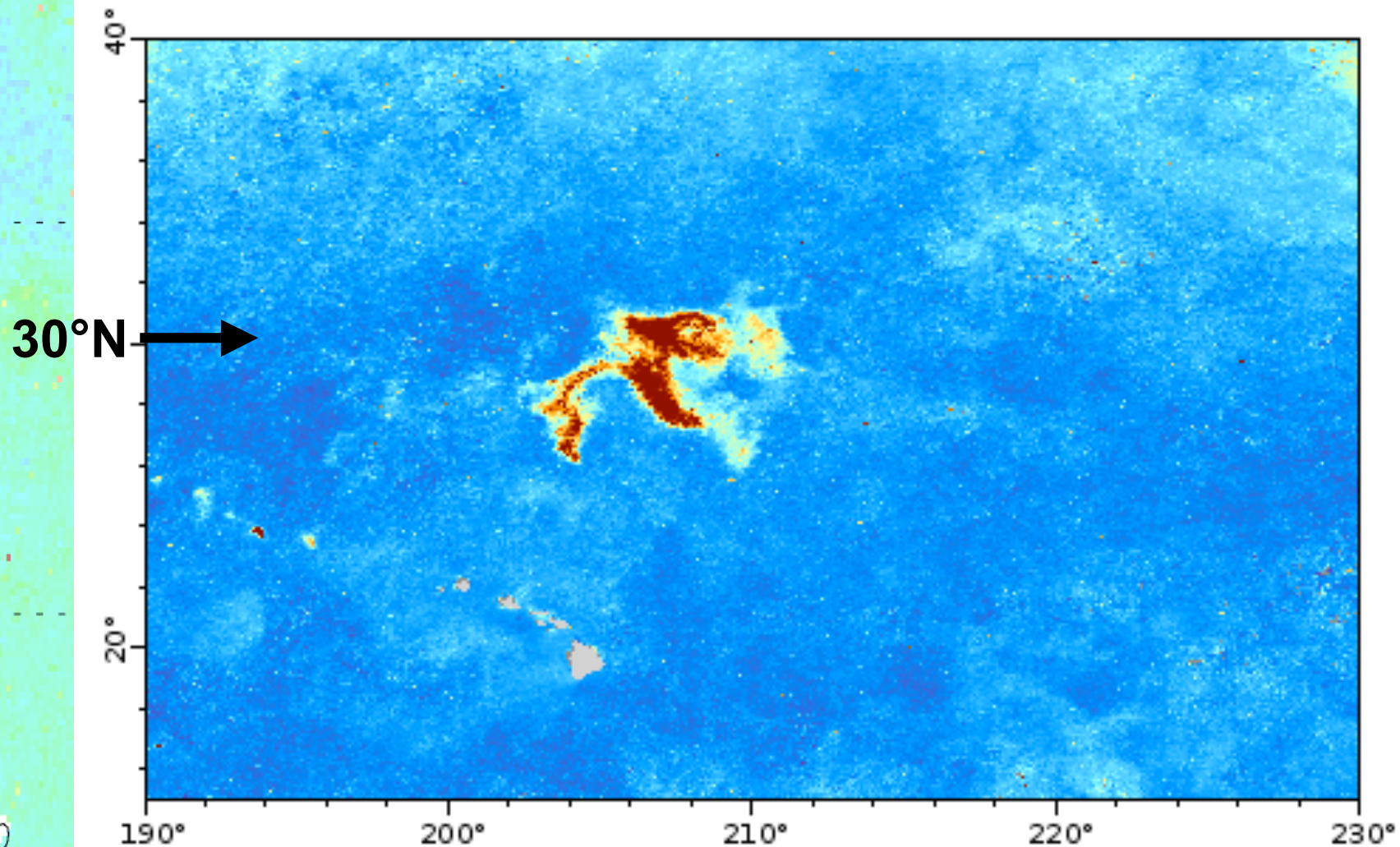


See also <http://www.pfeg.noaa.gov/~cwilson/bloom>

NE Pacific Bloom Region



September 2000

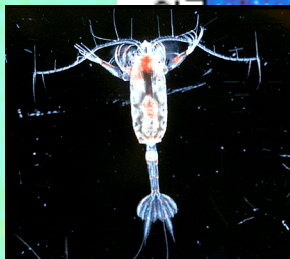
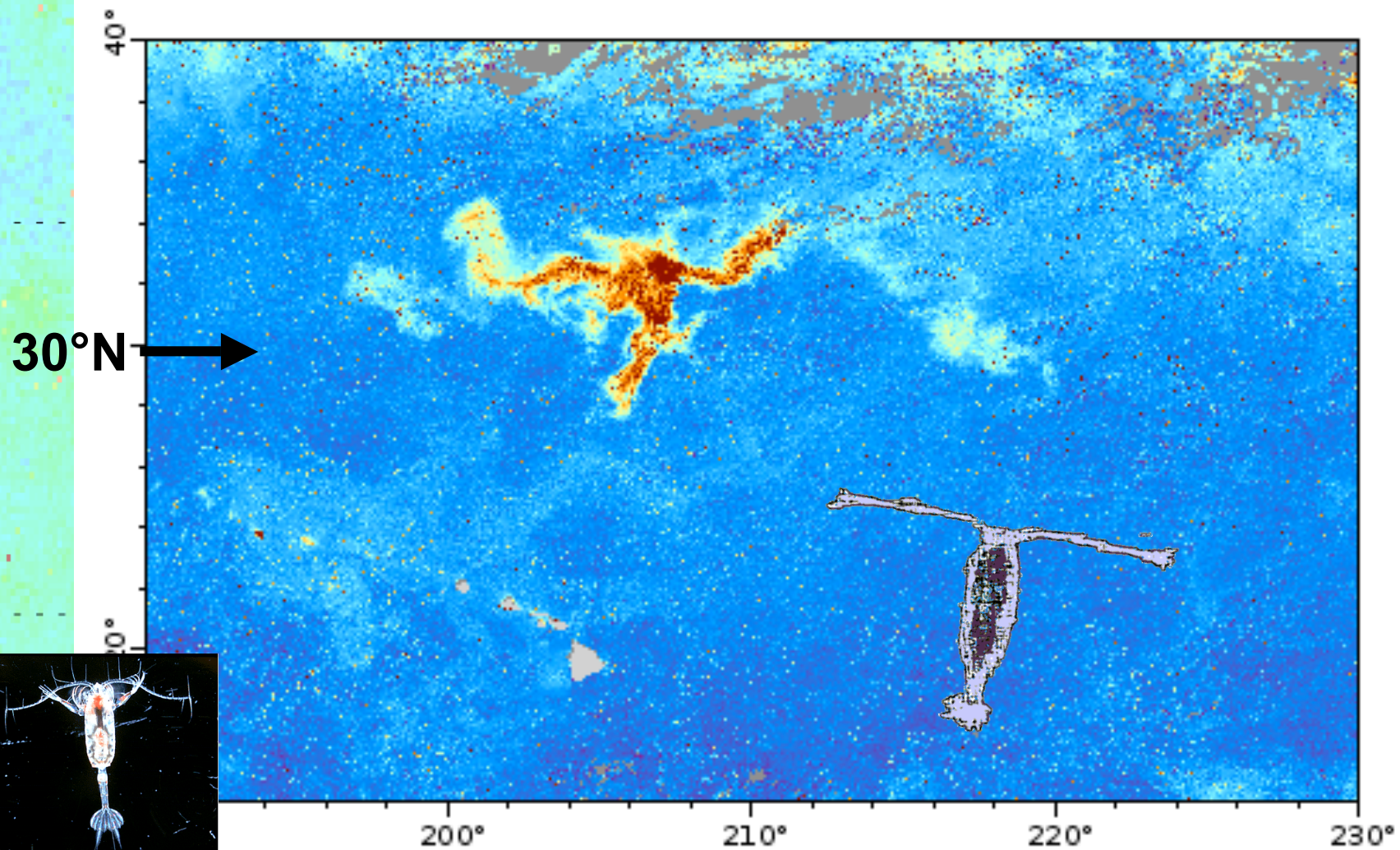


See also <http://www.pfeg.noaa.gov/~cwilson/bloom>

NE Pacific Bloom Region



October 2007



See also <http://www.pfeg.noaa.gov/~cwilson/bloom>

Summary of Bloom Characteristics

- The blooms develop in late summer (Jul-Aug.) at 30°N between 140-160°W.
- The blooms are quite large, reaching > 400,000 km², and persistent, lasting as long as 4 months.
- Blooms are a recurrent phenomena, occurring in 14 of the 20 years of ocean color satellite data (CZCS, OCTS, SeaWiFS & MODIS).
- Blooms develop in the open ocean, with no nearby landmasses or sources of higher chlorophyll.
- No anomalous SST signals with blooms.
- Blooms discussed in:
 - Wilson, Geophys. Res. Lett., [2003]; Wilson *et al.*, J. Mar. Sys., [2008]
 - Dore *et al.*, Prog. Ocean., [2008]; Wilson & Qiu, Prog. Ocean., [2008].

Hypothesized Biological Forcings

[Wilson, 2003 and Wilson *et al.* 2008]

■ Nitrogen Fixation

...**Rhizosolenia/Richelina**: Summer blooms of *Rhizosolenia* and *Hemiaulus* diatoms containing the nitrogen-fixing endophyte *Richelia intracellularis* have been observed at the CLIMAX site at 28°N [Venrick, 1974; Mague *et al.*, 1974].

...**Other diazotrophs**: High rates of nitrogen fixation have been reported in this part of the Pacific by unicellular diazotrophs [Montoya *et al.*, 2004]

■ Biological Mediated Vertical Transport of NO₃

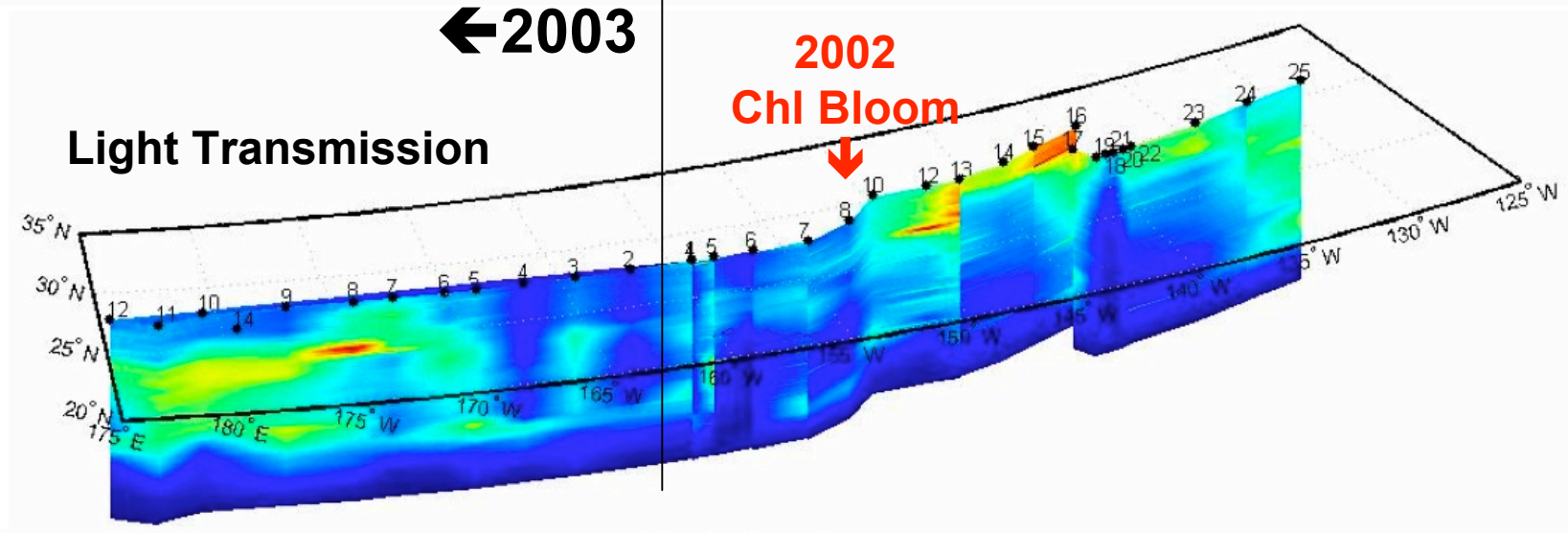
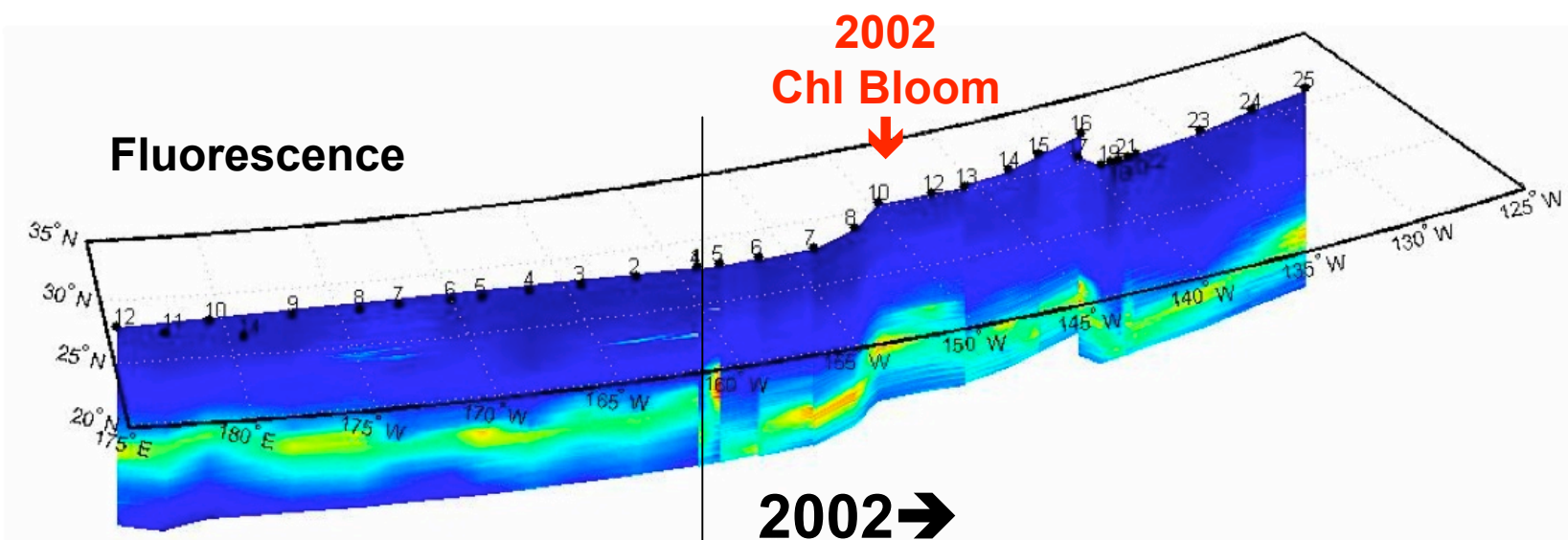
...Extensive **mats of vertically migrating Rhizosolenia** have been observed in the summer along 30°N in the NPSG [Villareal & Carpenter, 1989; Villareal *et al.*, 1996 and Villareal *et al.*, 1999].

...Their supply of NO₃ comes from vertical migration into the nutricline via carbohydrate ballasting.

Questions...

- **Where are the nutrients coming from?
Even nitrogen fixation needs PO₄ and iron...**
- **Are the blooms merely physical aggregations and do not represent biomass growth?**
- **Blooms occur (relatively) near the “Great Garbage Patch” - maybe they are not chlorophyll but just debris in the water...**
- **“Can we really trust this NASA satellite data?”
- quote from a biologist colleague who shall remain nameless.**

RoMP 2002 & 2003 data



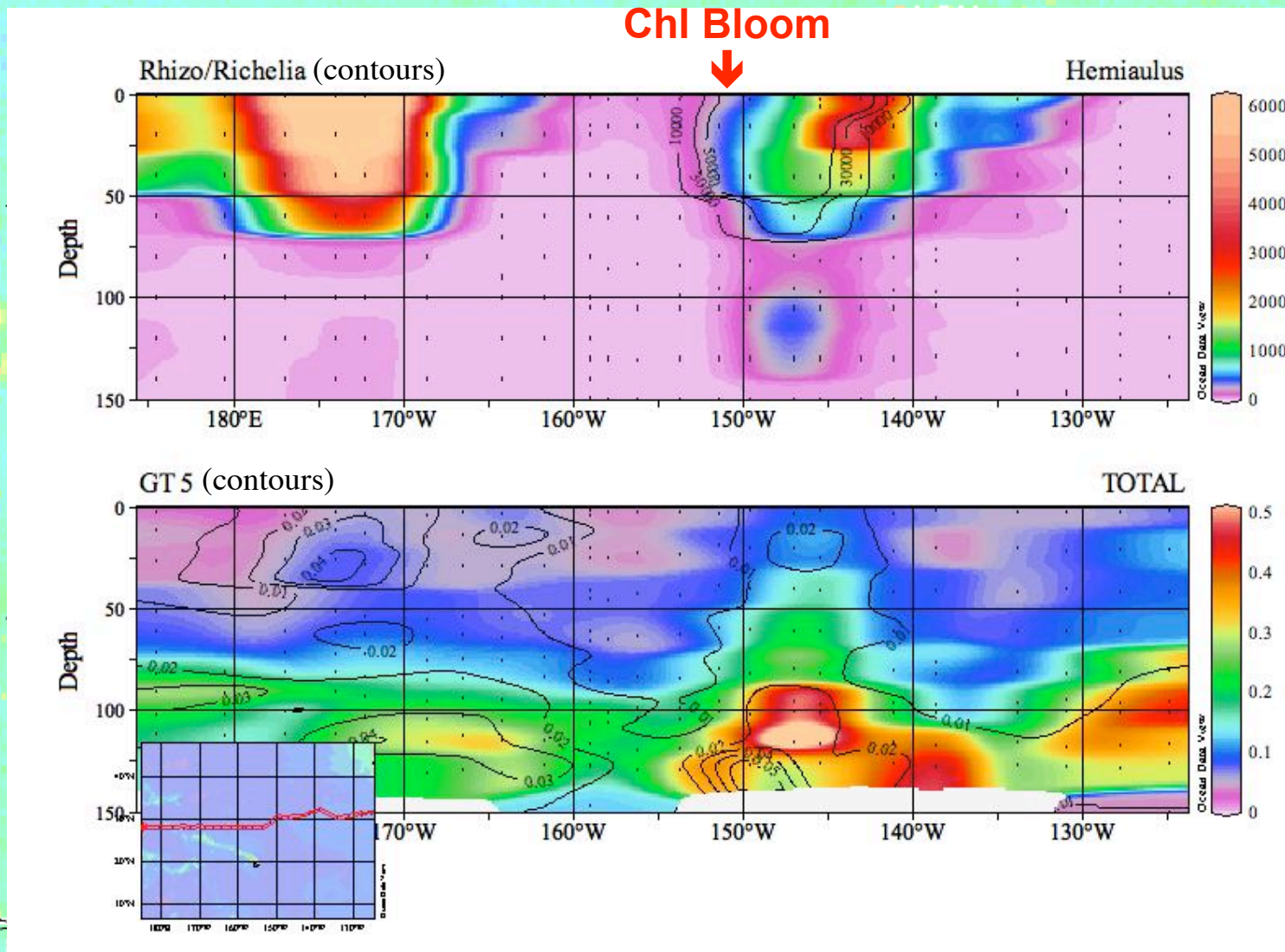
←2003

2002→

RoMP 2002 & 2003 data

2002

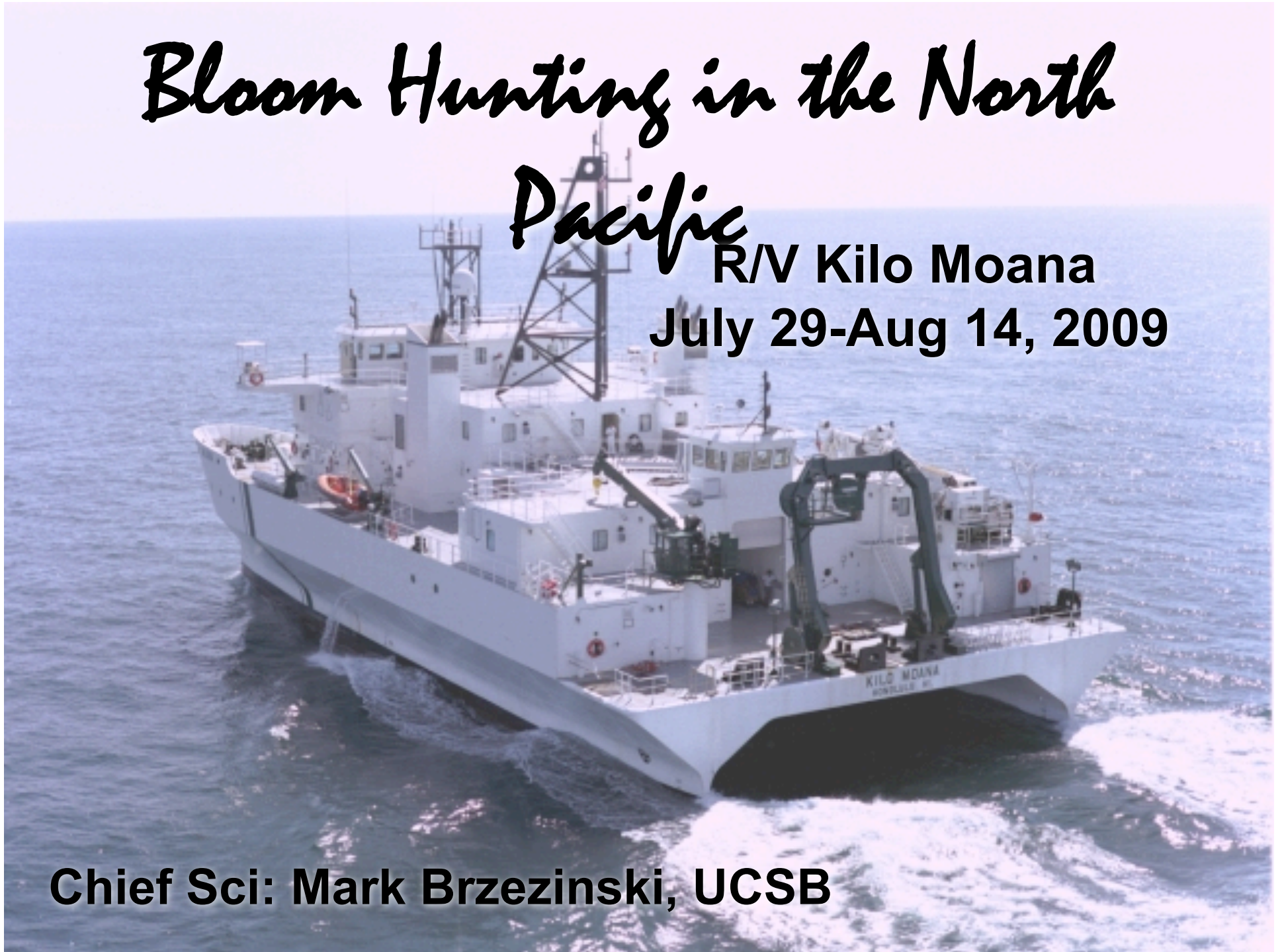
Chl Bloom



Bloom Hunting in the North Pacific

**R/V Kilo Moana
July 29-Aug 14, 2009**

Chief Sci: Mark Brzezinski, UCSB



The at hand Issue

Have:

- A compelling scientific reason to want to ground-truth satellite chlorophyll data from the bloom region.
- Funded shiptime to sample in the bloom region during bloom season (early Aug. 2009) during bloom season.

Don't Have:

- Any equipment to make AOP measurements.
- And funding to buy equipment, or to pay salary or travel of potential AOP-expert participants to come on the cruise (but will have room for volunteers!)