Coastal Upwelling Index Databases Derived from Satellite Winds

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Project Objectives:

- Develop global databases of coastal upwelling indices from satellite scatterometer-derived wind products.
- Develop methods for extending application of upwelling indices to coastal regions with complex shelf geometry.
- Use this global product to examine spatio-temporal variability of upwelling/downwelling over Earth's coastal regions at multiple scales.
- Provide web access to analysis tools and data download

Global Coastal Upwelling Data Products:

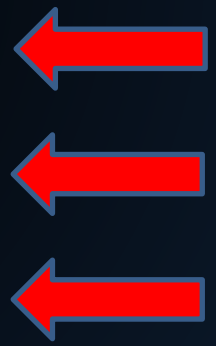
- Ekman upwelling indices:
  - CCMP (1.1) 1987-2011
  - QuikSCAT (L2b Swath) 1999-2009

- Daily Climatology (CCMP and QuikSCAT)

- Modified Upwelling Index for better application to complex coastlines
  - Metrics to gauge applicability of the upwelling indices

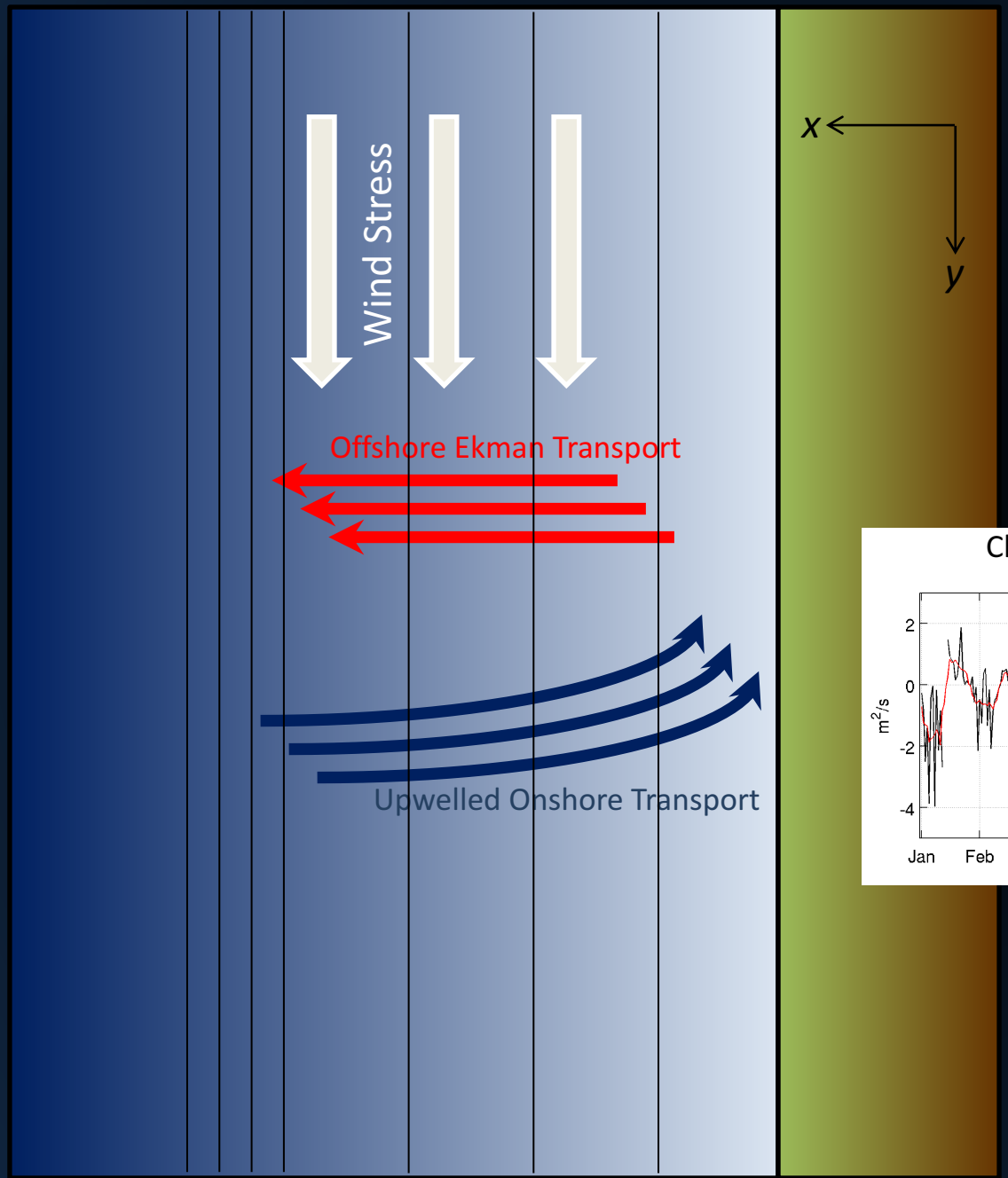
- Data Products served via THREDDS/OPeNDAP (open access)

- Web-based GUI for basic analyses
  - Time series with optional filtering
  - Maps of time-averaged upwelling indices
  - Maps of upwelling anomalies
  - Upwelling climatology



Now Live

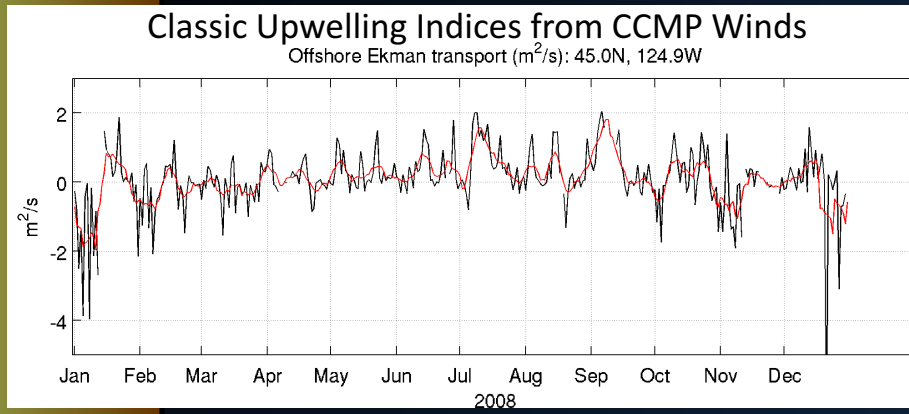
Classic Ekman Coastal Upwelling



The offshore Ekman transport is

$$S_x = \frac{\tau_y}{\rho_0 f}$$

S_x is used as an upwelling Index



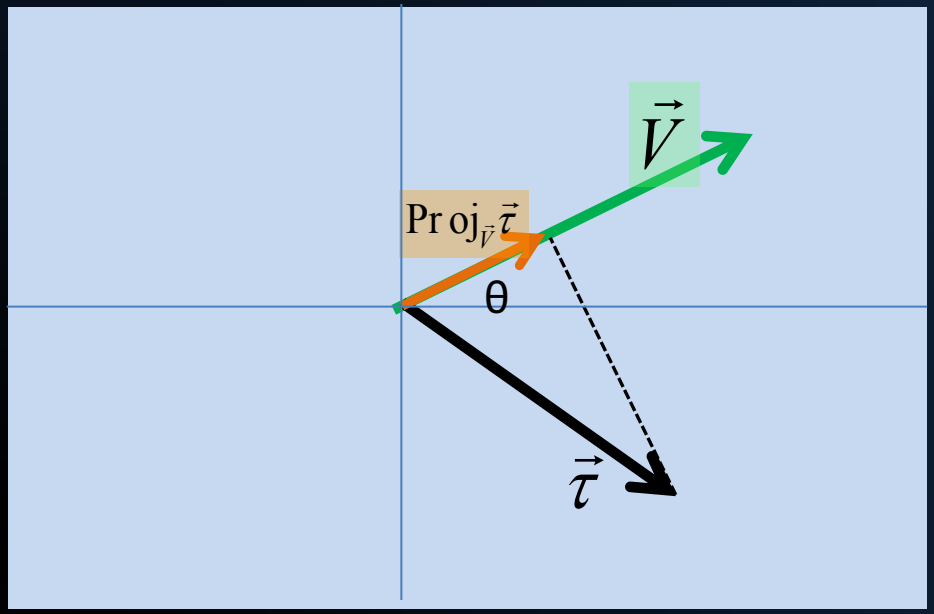
A Modified Upwelling Index

For each coastal point:

1. Project τ onto the vector V rotating through all angles.

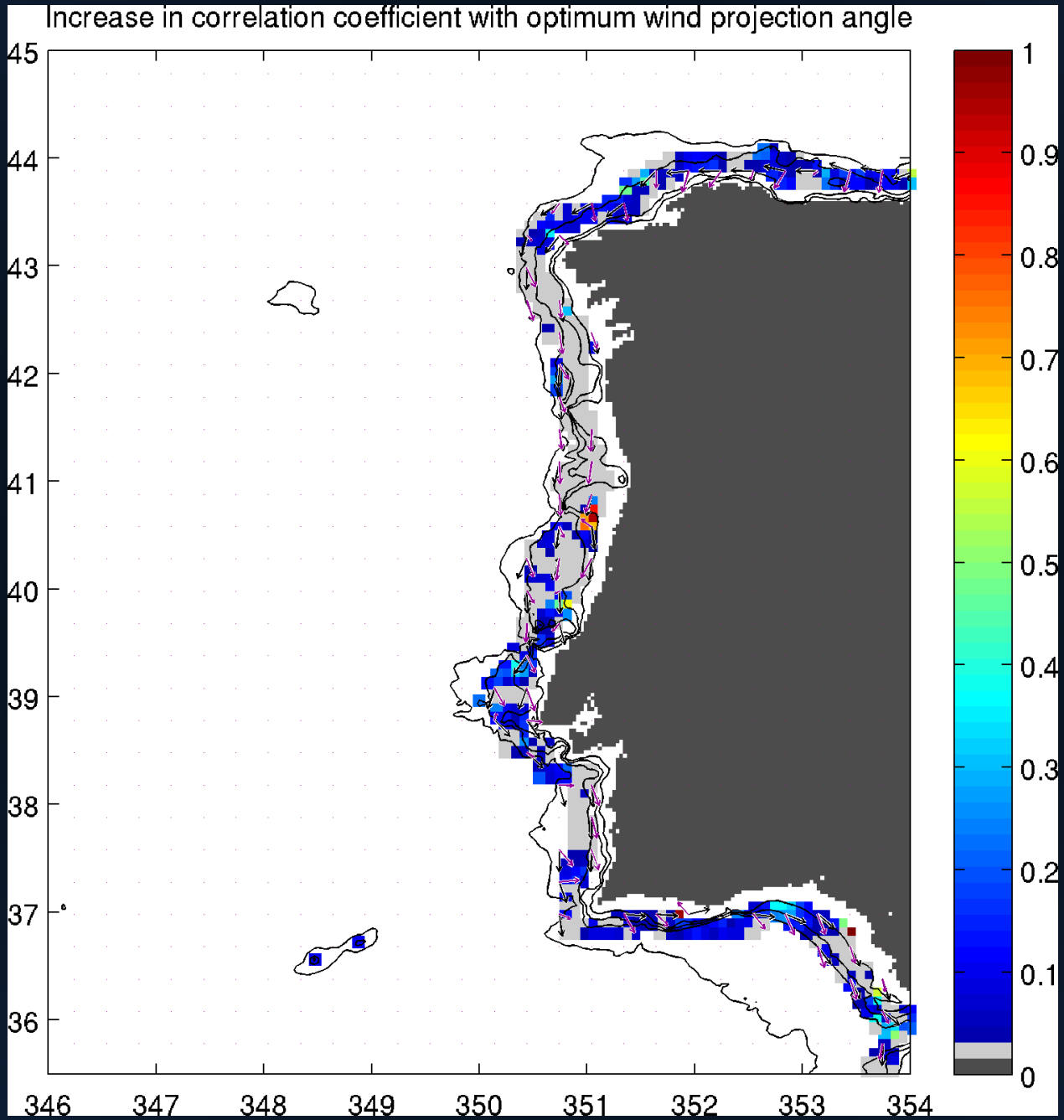
2. For each angle, compute correlation between the projected wind stress time series and the near-bottom cross-isobath ocean velocity from a global model (HYCOM).

3. Determine the rotation angle of maximum correlation



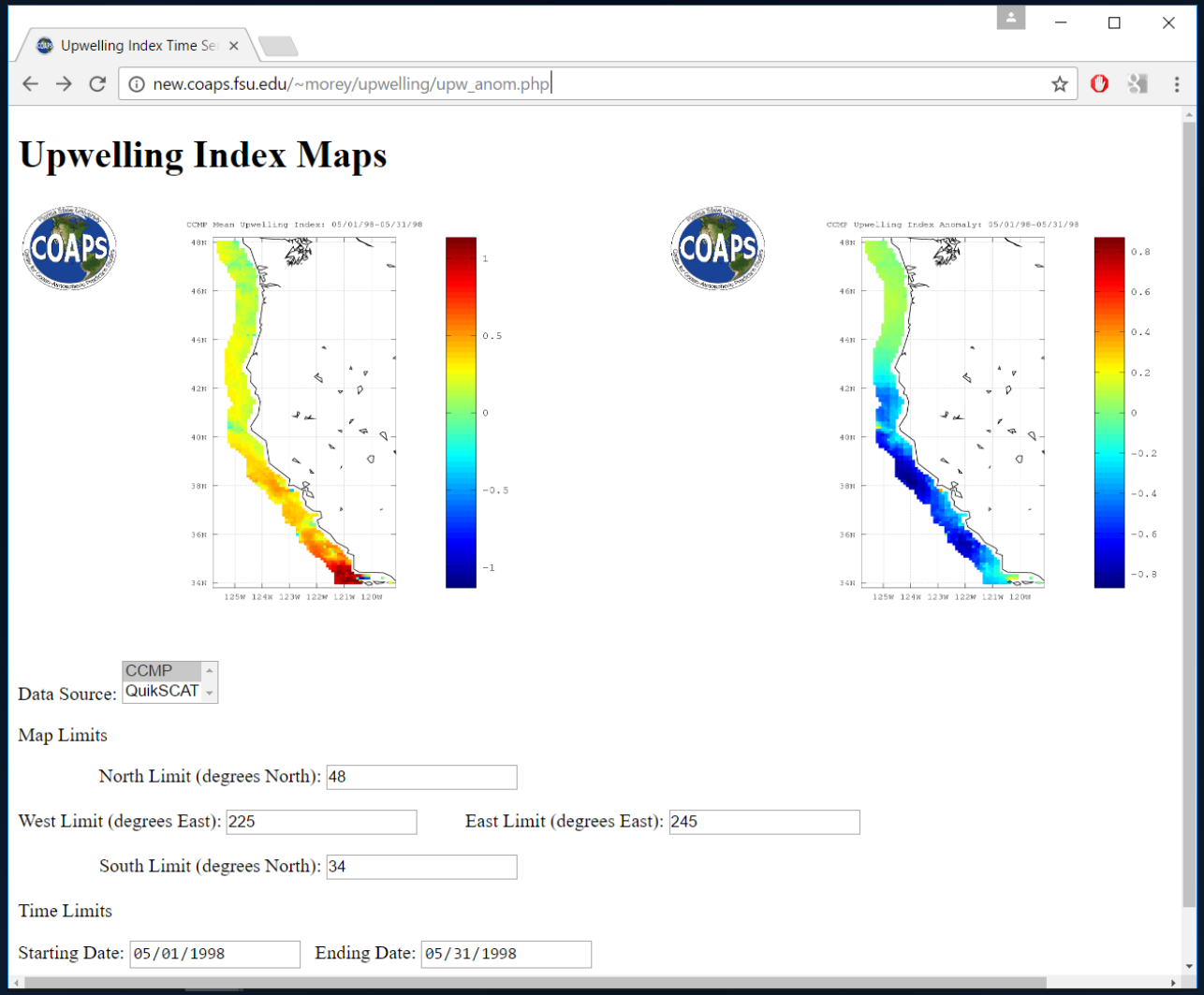
4. CCMP wind stress time series are then projected onto the angle of maximum correlation at each grid point to produce modified upwelling indices.

Iberian Peninsula Example

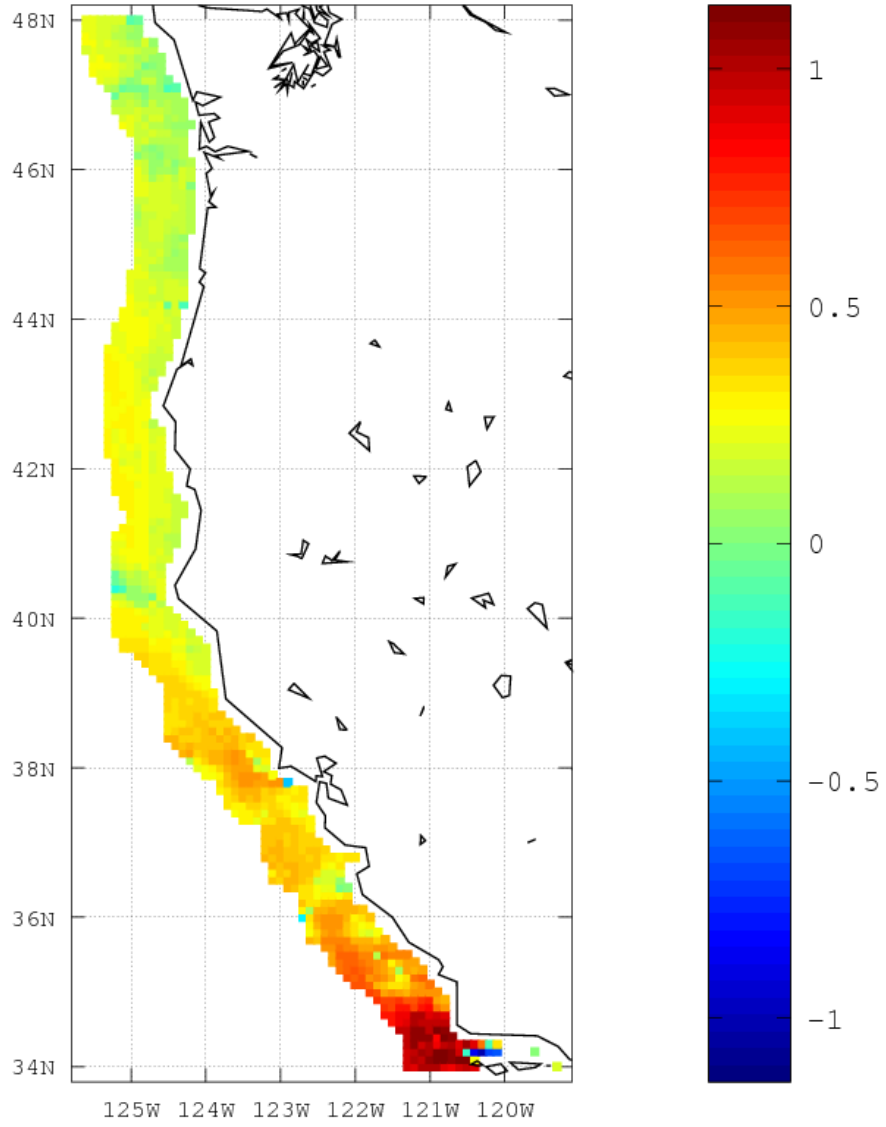


Analysis Tools and Data Downloads available at:

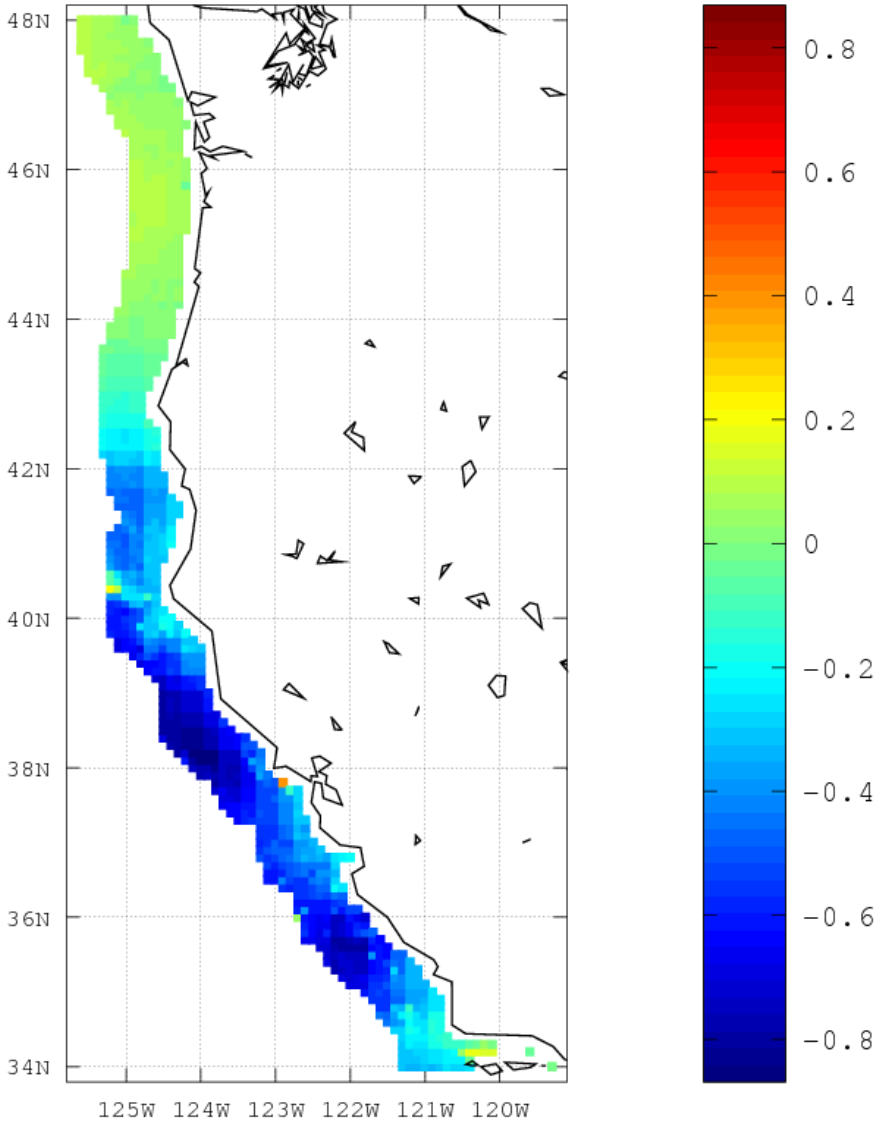
http://coaps.fsu.edu/scatterometry/derivedProducts/



CCMP Mean Upwelling Index: 05/01/98-05/31/98



CCMP Upwelling Index Anomaly: 05/01/98-05/31/98



CCMP Upwelling Index: 8°N, 50.9°E

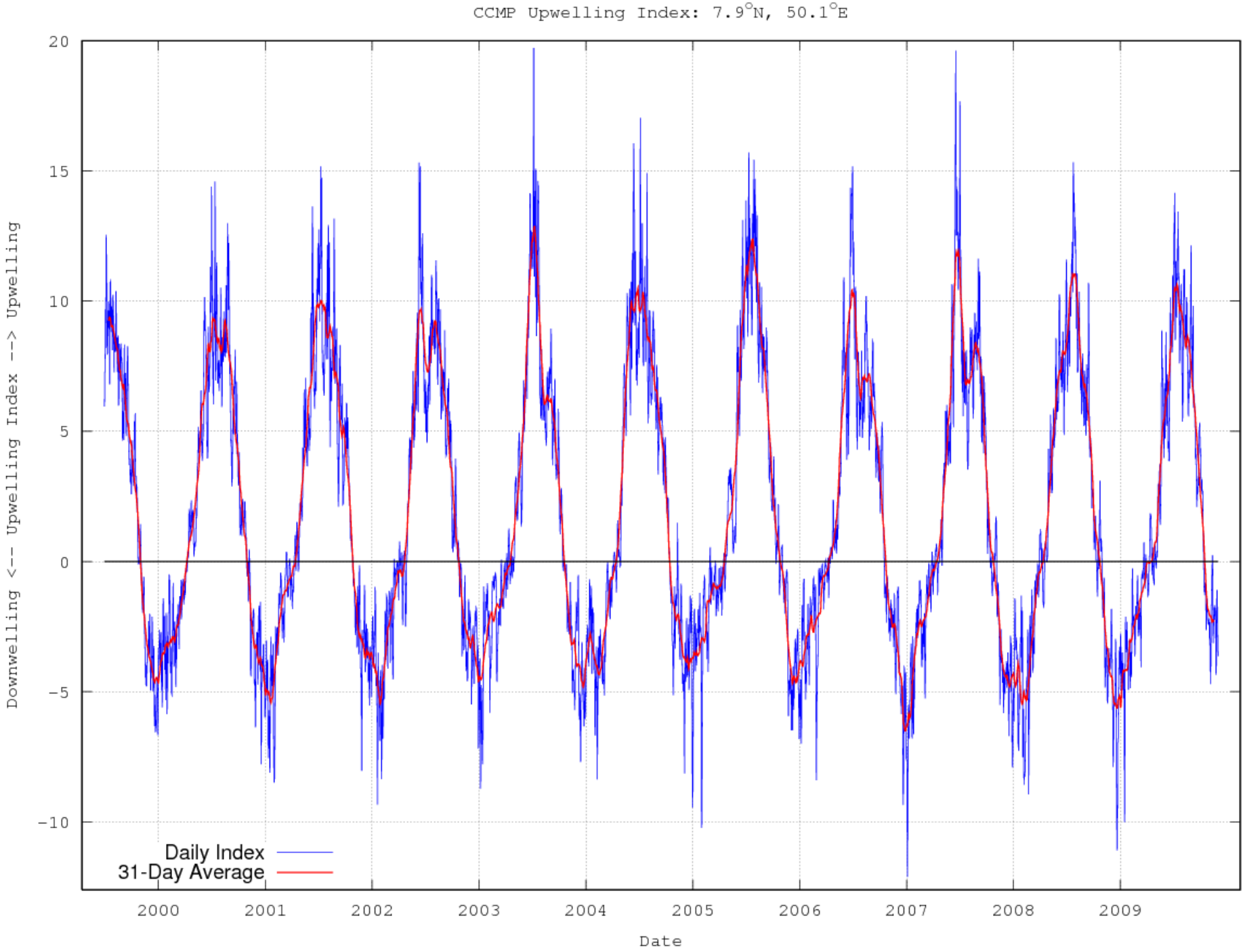
Downwelling <-- Upwelling Index --> Upwelling

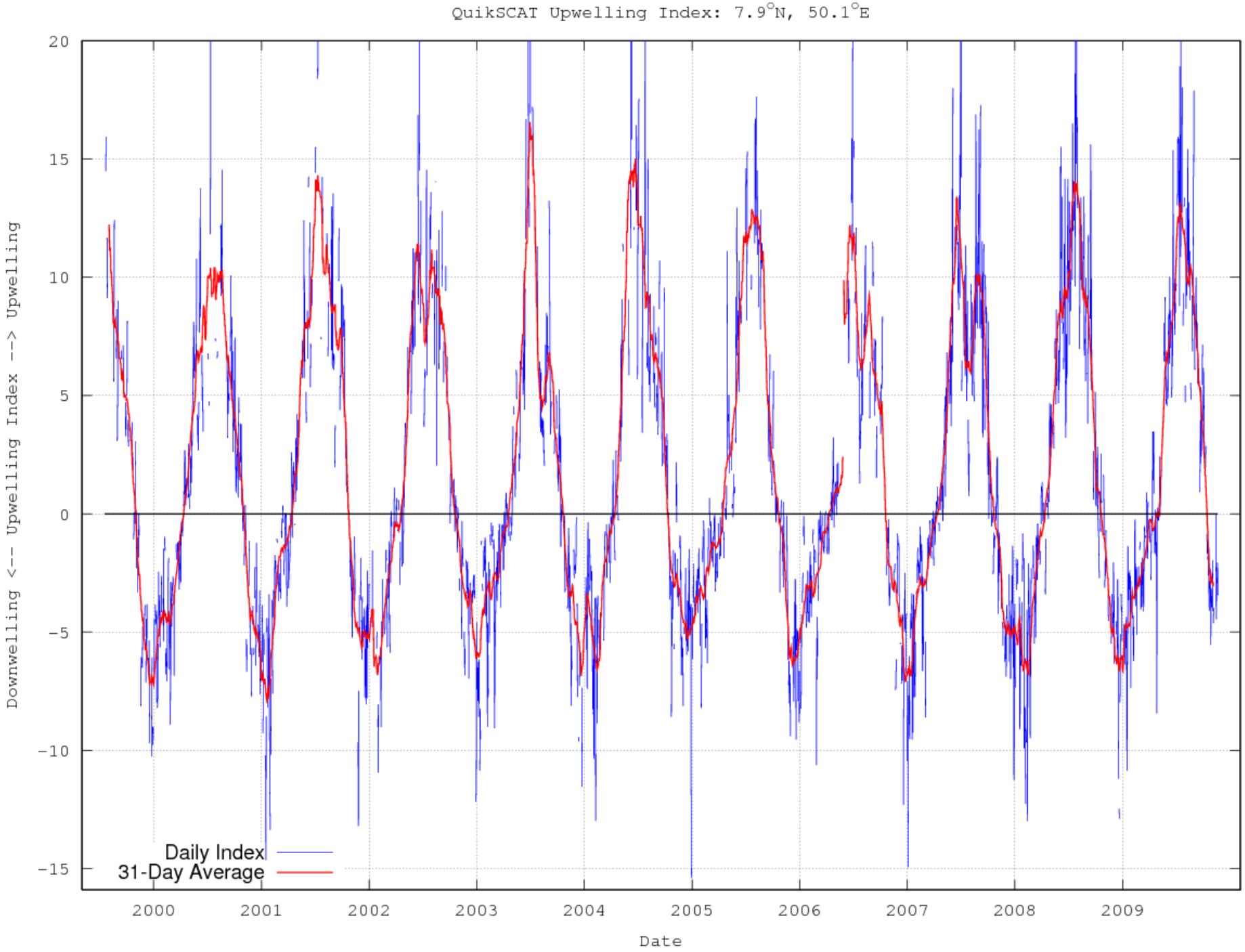
15
10
5
0
−5
−10

Daily Index
31-Day Average

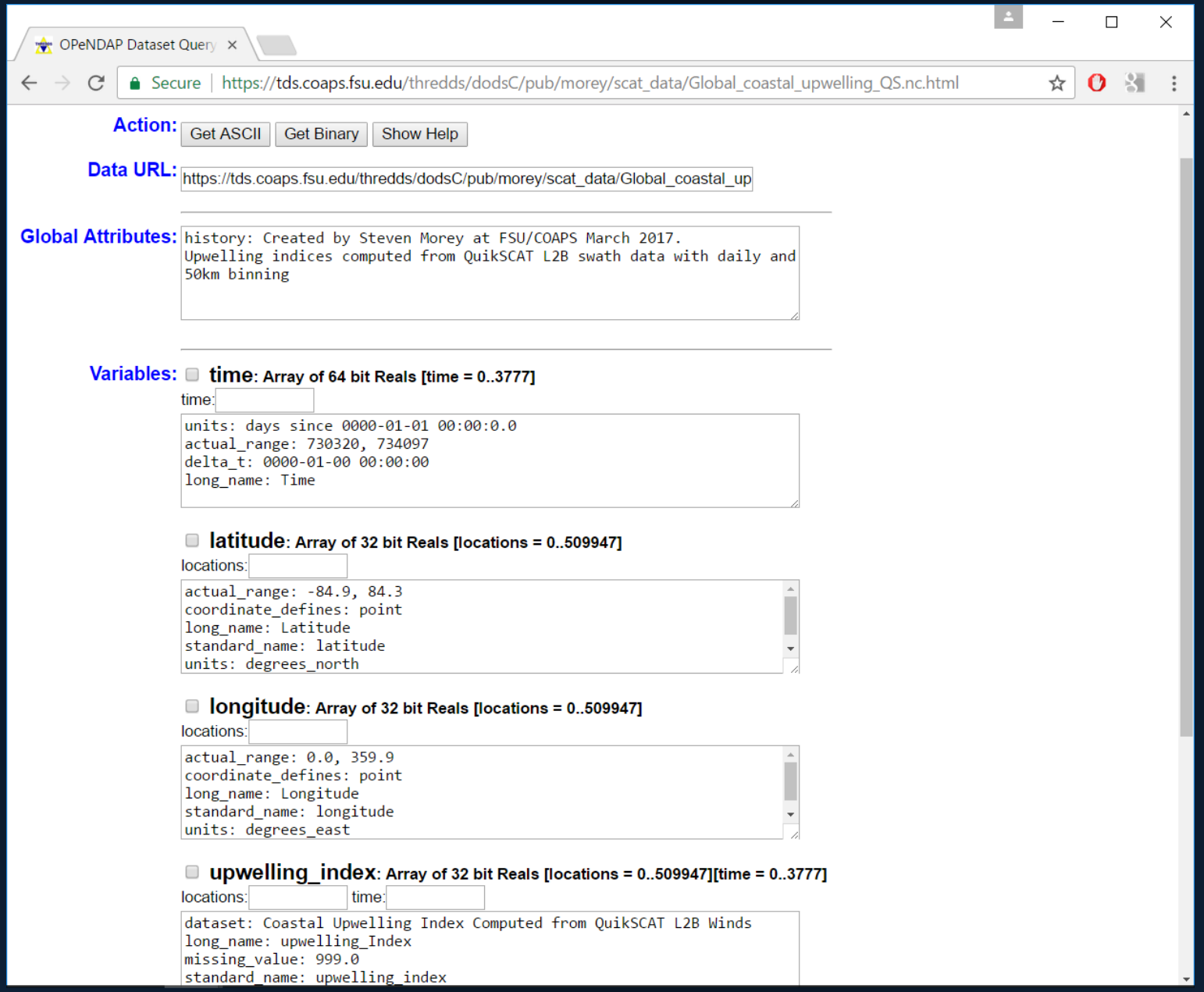
1988 1989 1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011

Date


CCMP Upwelling Index: 7.9°N, 50.1°E
Downwelling <-- Upwelling Index --> Upwelling
20
15
10
5
0
-5
-10
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
Date
Daily Index
31-Day Average

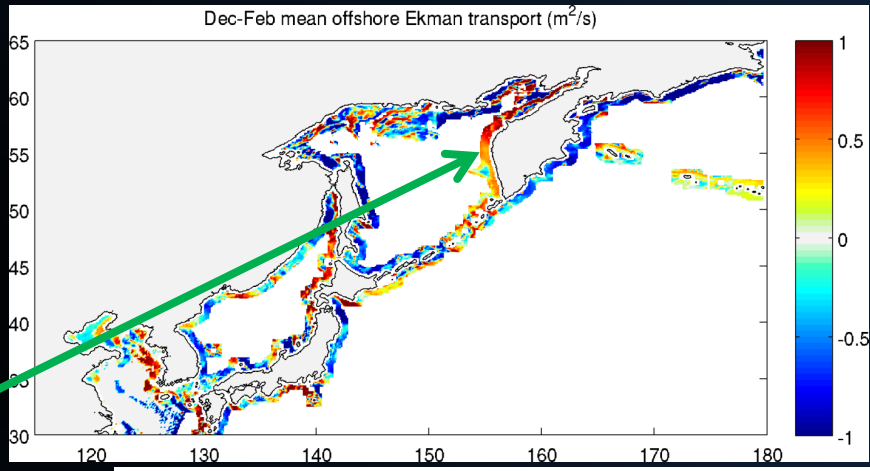

QuikSCAT Upwelling Index: 7.9°N, 50.1°E
Downwelling <-- Upwelling Index --> Upwelling
20
15
10
5
0
-5
-10
-15
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
Date
Daily Index
31-Day Average

THREDDS Data Server for Remote Subsetting of Upwelling Index Databases



Next Steps:

- Complete Global Modified Coastal Upwelling Index Database
- Provide Upwelling Index Quality Metrics
- CCMP 2.0 Coastal Upwelling Database
- Combine with SST and Ocean Color



Wintertime Sea of Okhotsk Upwelling inferred from winds and ocean color