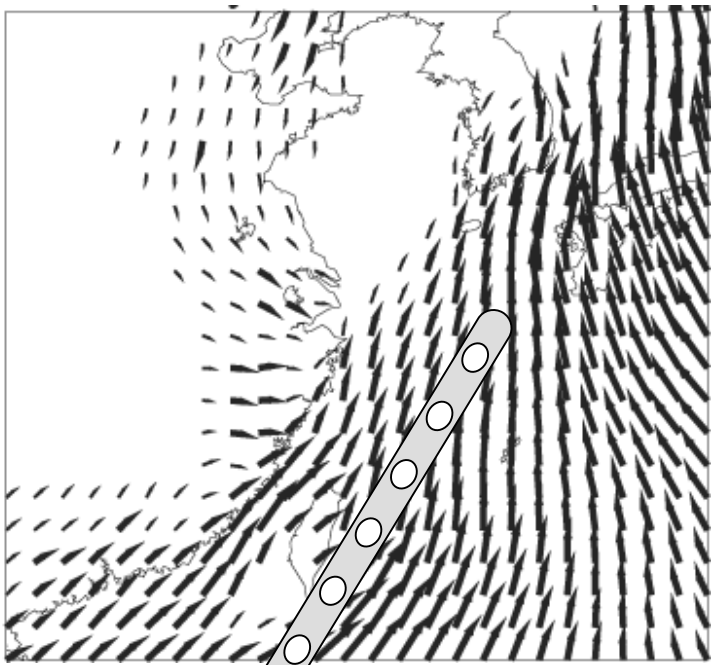
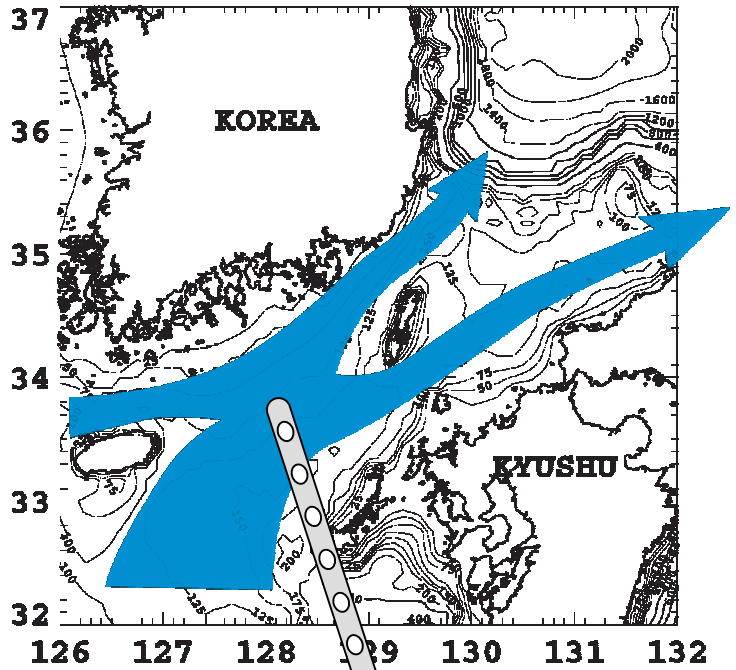
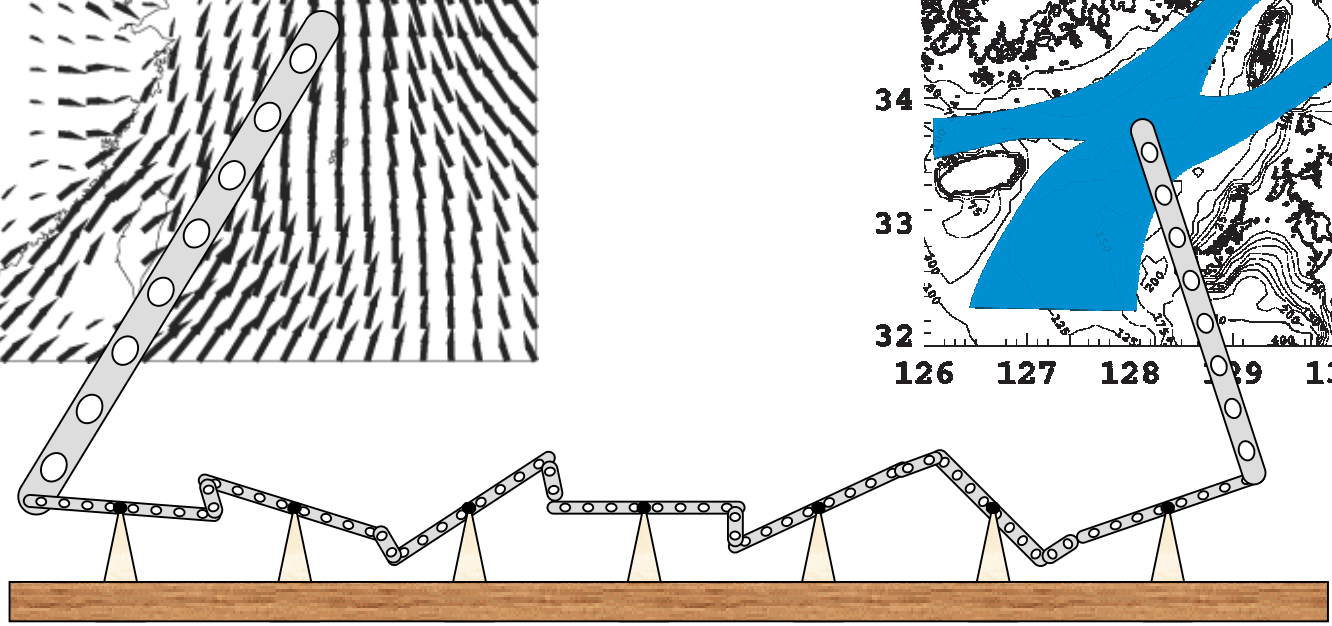
Synoptic Forcing of Korea Strait Transport

G. A. Jacobs, D. S. Ko, H. E. Ngodock, R. H. Preller, S. K. Riedlinger



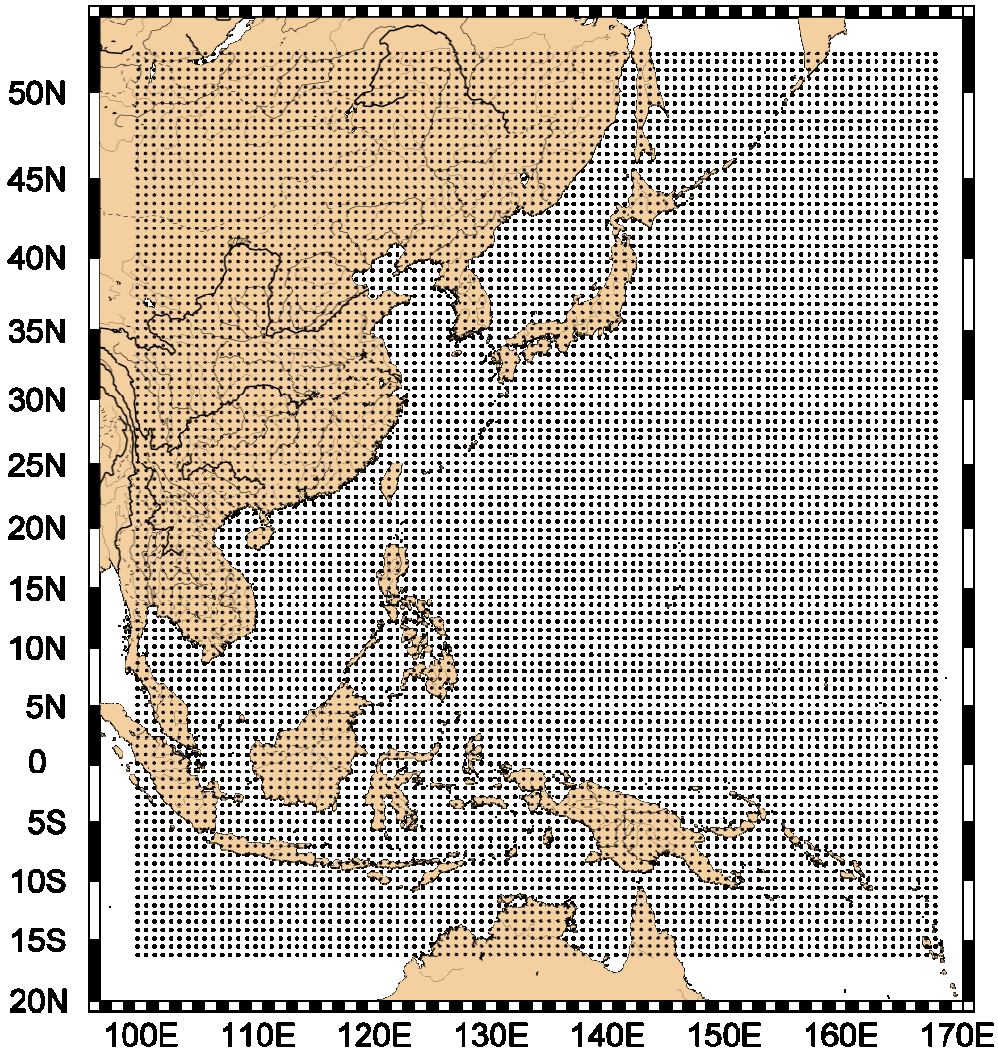




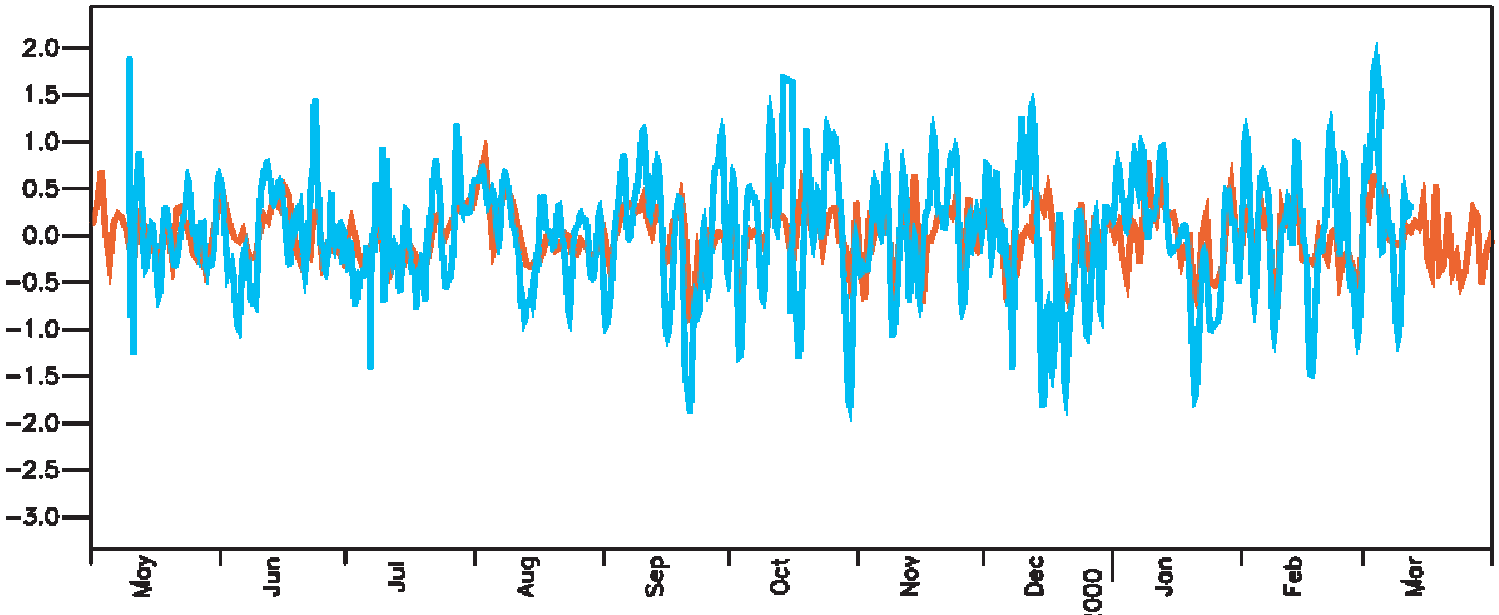
What is this mechanism connecting the wind stress to the transport?

Model Domain

- NCOM, implicit forward stepping
- Run from July 1994 to present
- 1/8 Horizontal resolution
- 26 Sigma layers
- Forced by synoptic wind stress and surface heat flux
- Relaxed to climatology below 500 m on a time scale of 250 days
- Open boundary conditions from larger ¼ degree resolution Pacific model assimilating altimeter and SST data



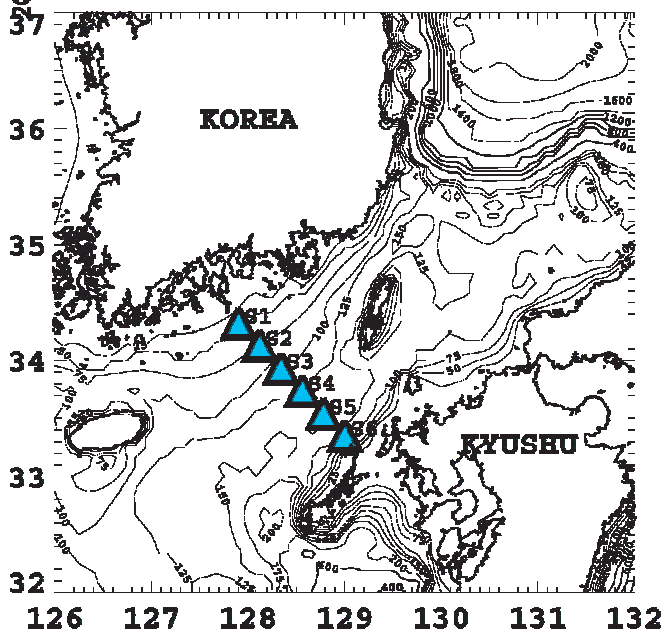
Observed and Modeled Synoptic Transports



ADCP Transport

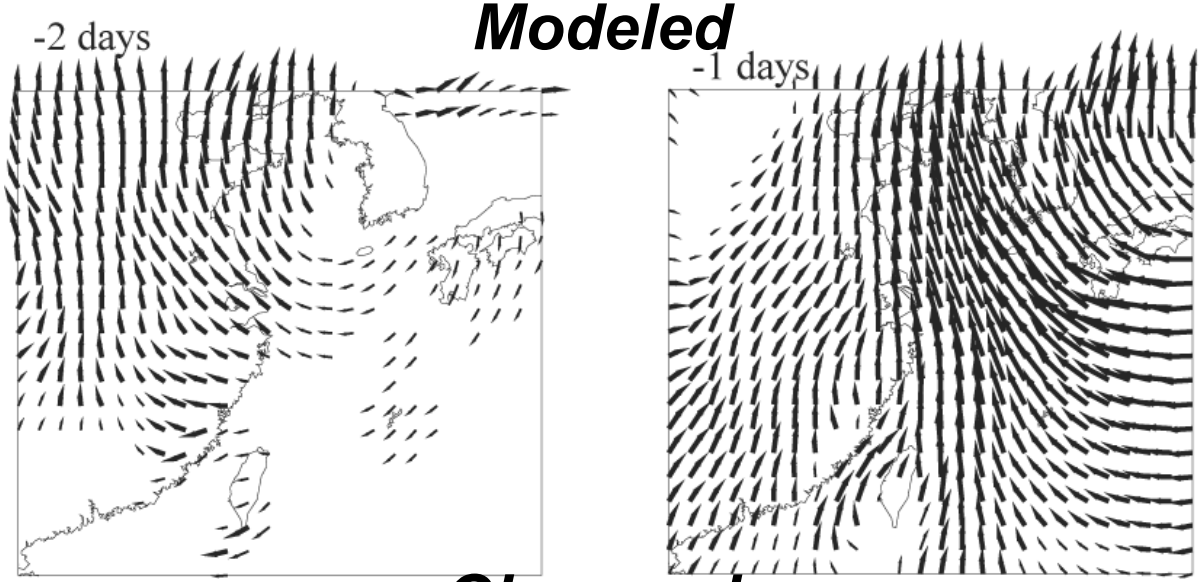
Model Transport

- Tides removed (harmonic analysis)
- 48 low-pass filter to remove inertial oscillations
- 20 low pass filter (synoptic variations)

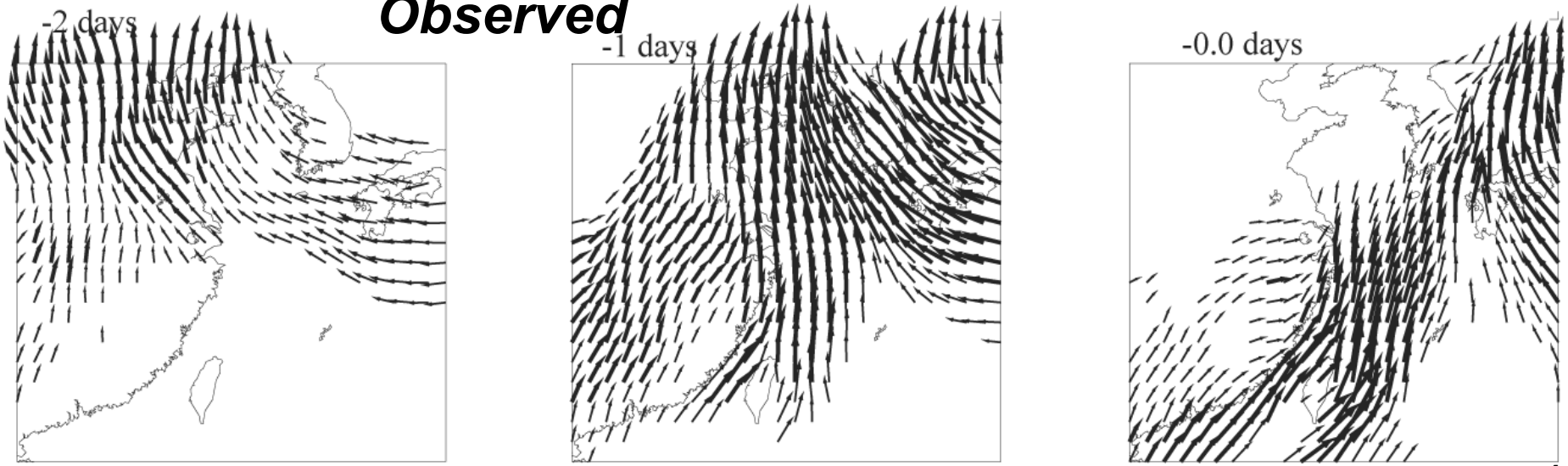


Transport Relation to Wind Stress

Modeled

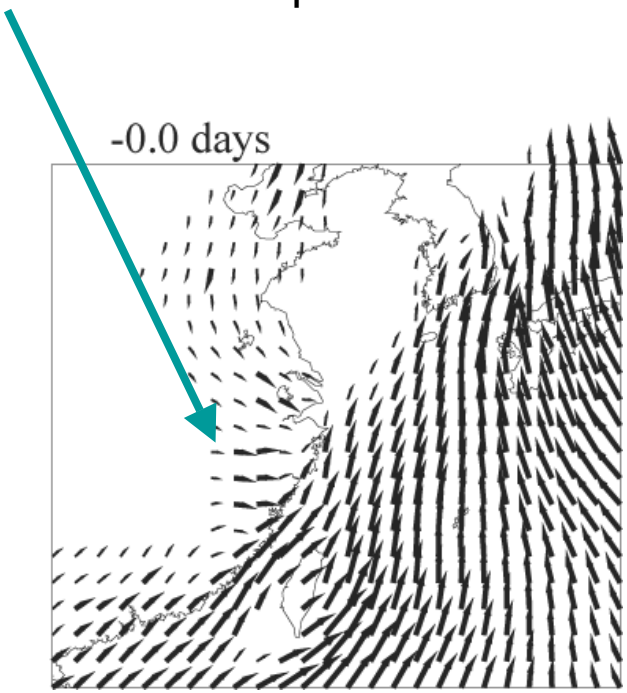


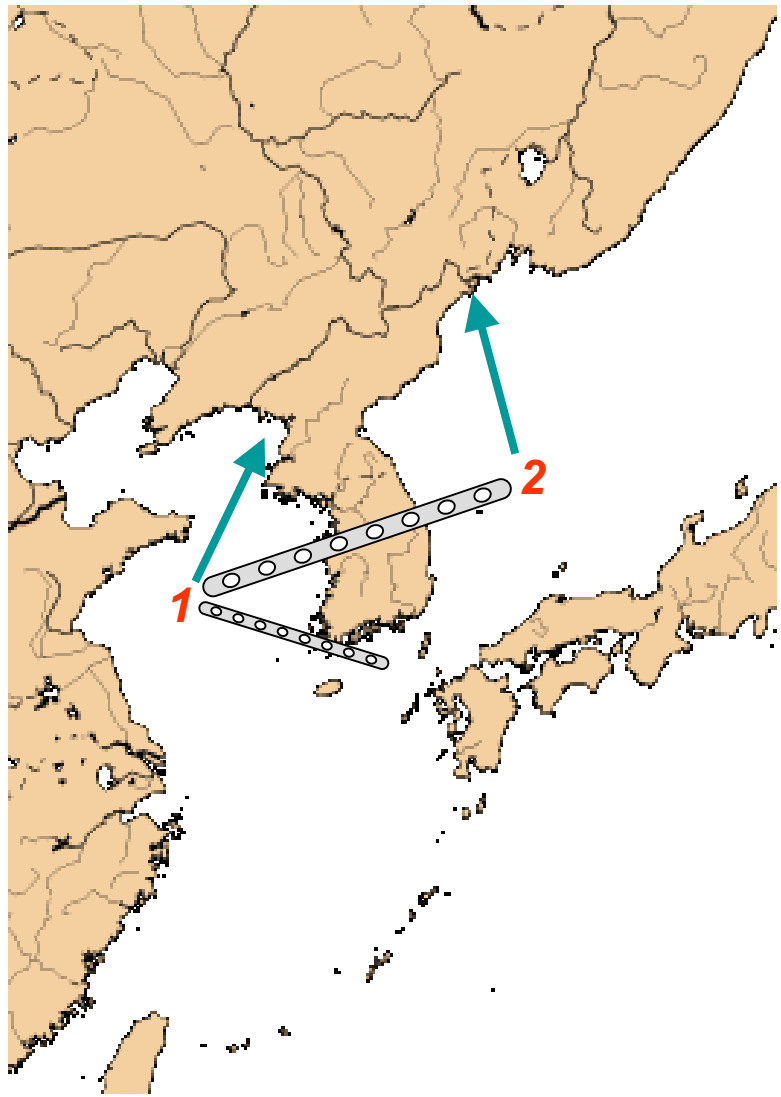
Observed



Troubles with Correlations

- Wind stress at one point may be dynamically connected to the strait transport
- Wind stress at another point may not be
- However, the large scale connections within the wind stress field make it appear as though point 2 were connected to the strait transport
- For example, wind stress over land is correlated to strait transport

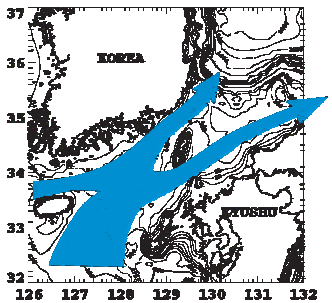




Adjoint Analysis

- What we really want is the derivative of the strait transport with respect to the wind stress (throughout space and time)
- We can specify numerical model dynamics that connect the two
- The adjoint of the numerical model dynamics provide the gradient information

$$\frac{\partial}{\partial}$$



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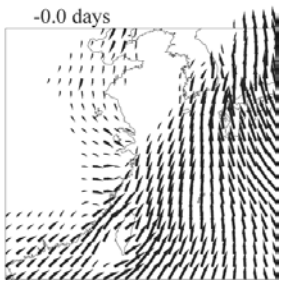
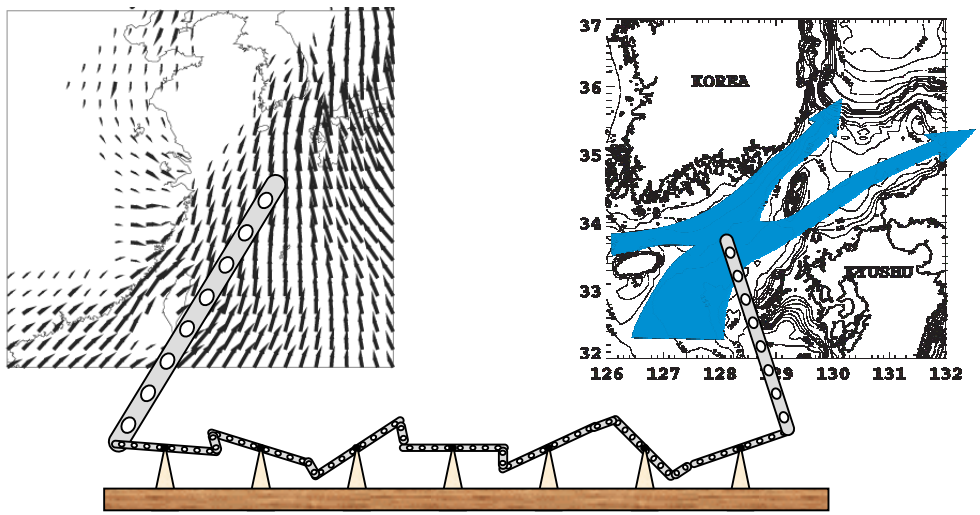
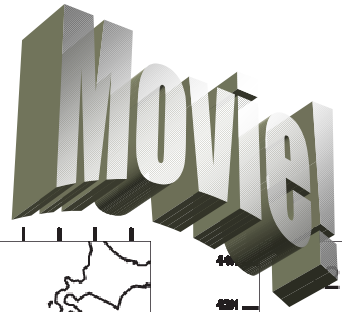
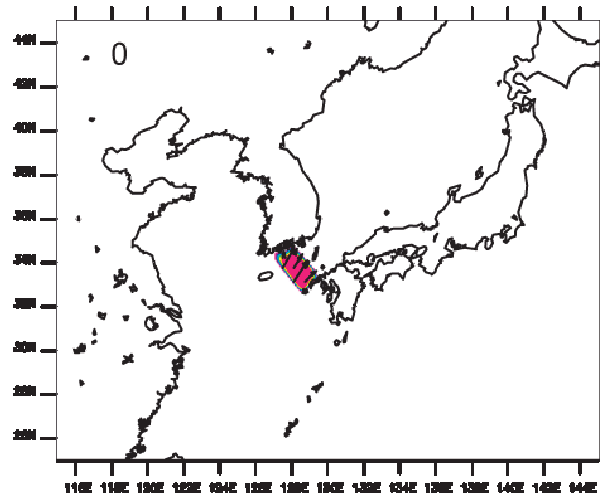


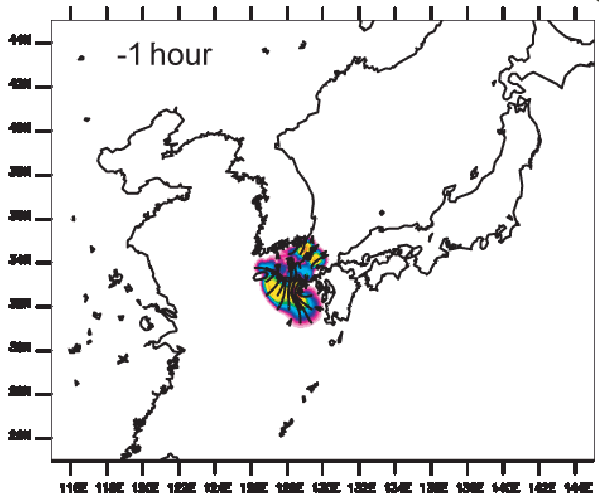


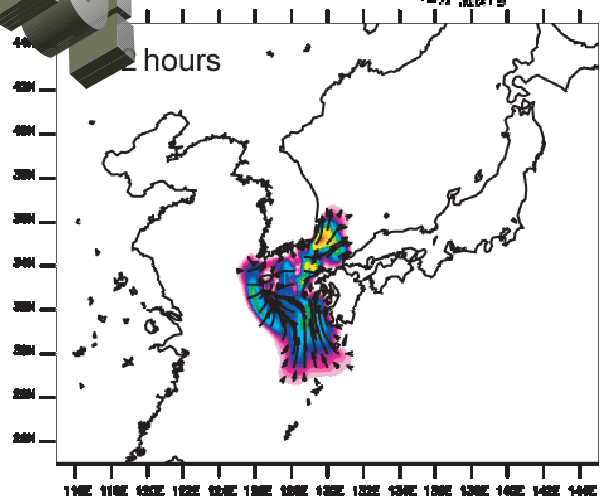
Linear Barotropic Sensitivity

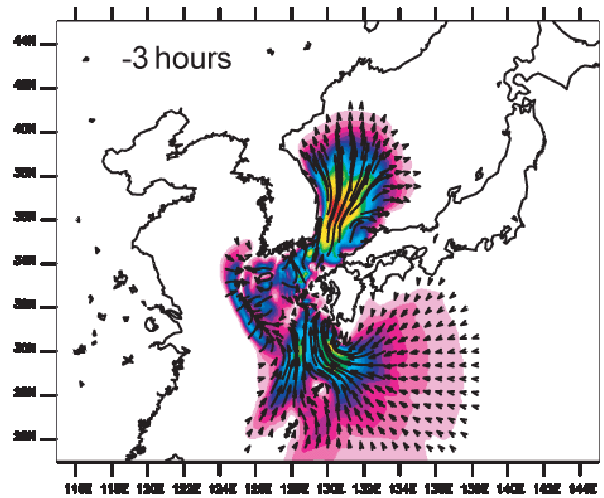
- Assume dynamics are linear barotropic

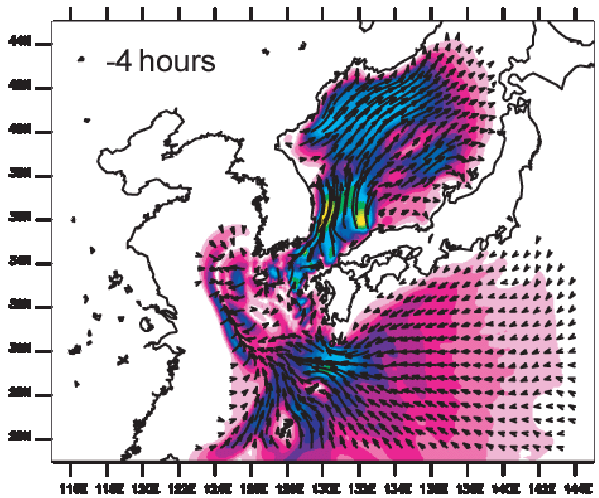


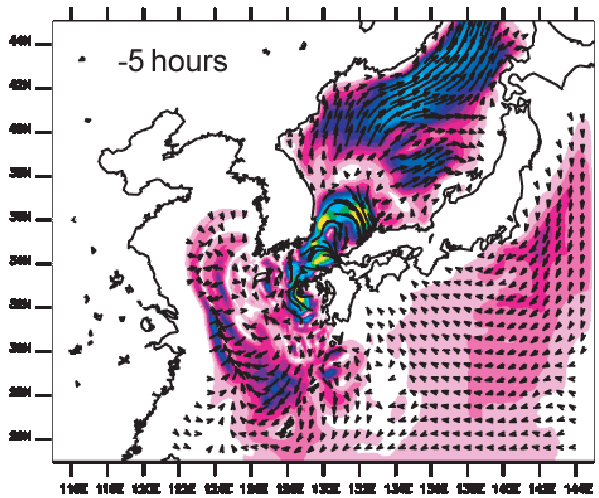






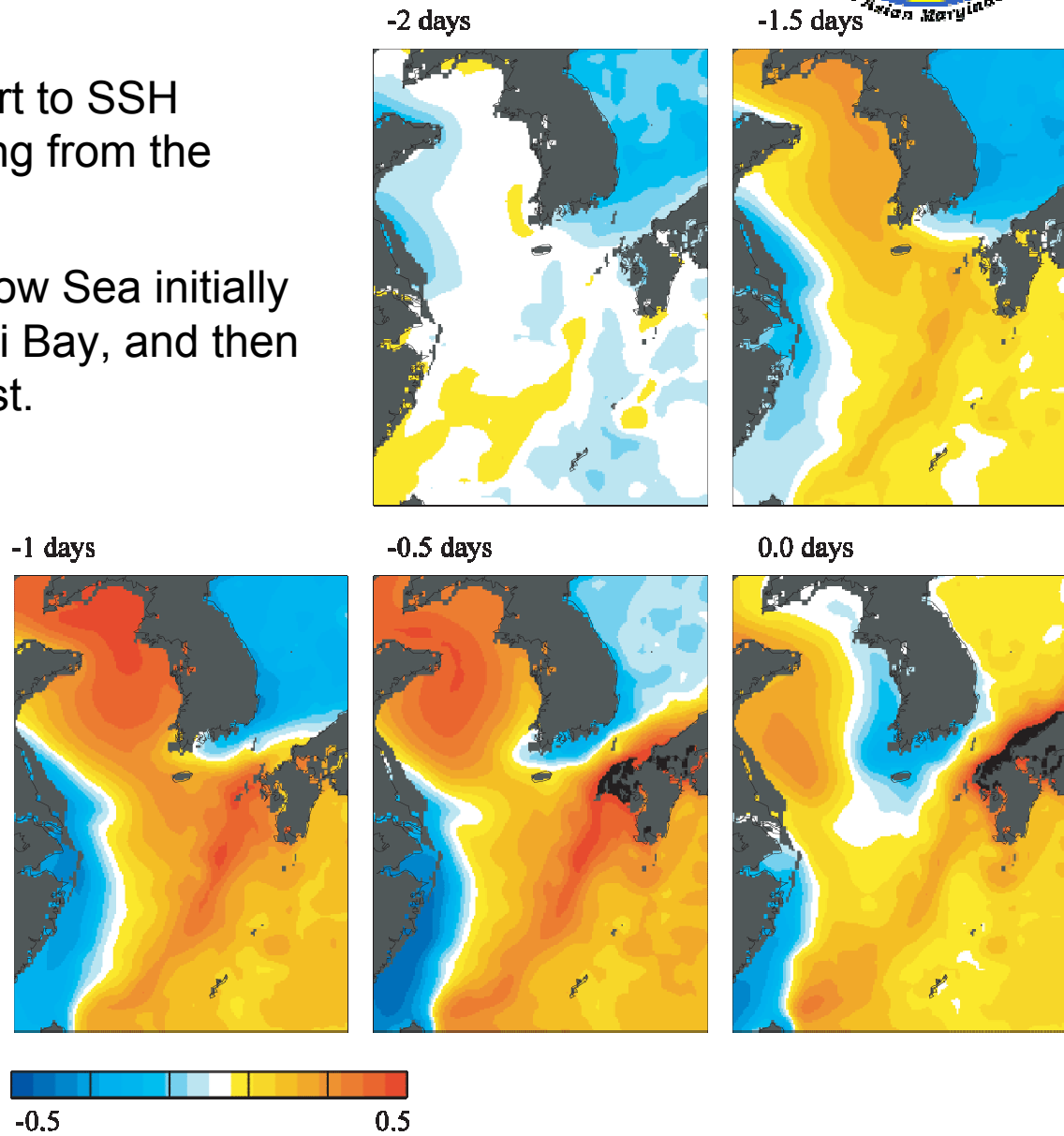






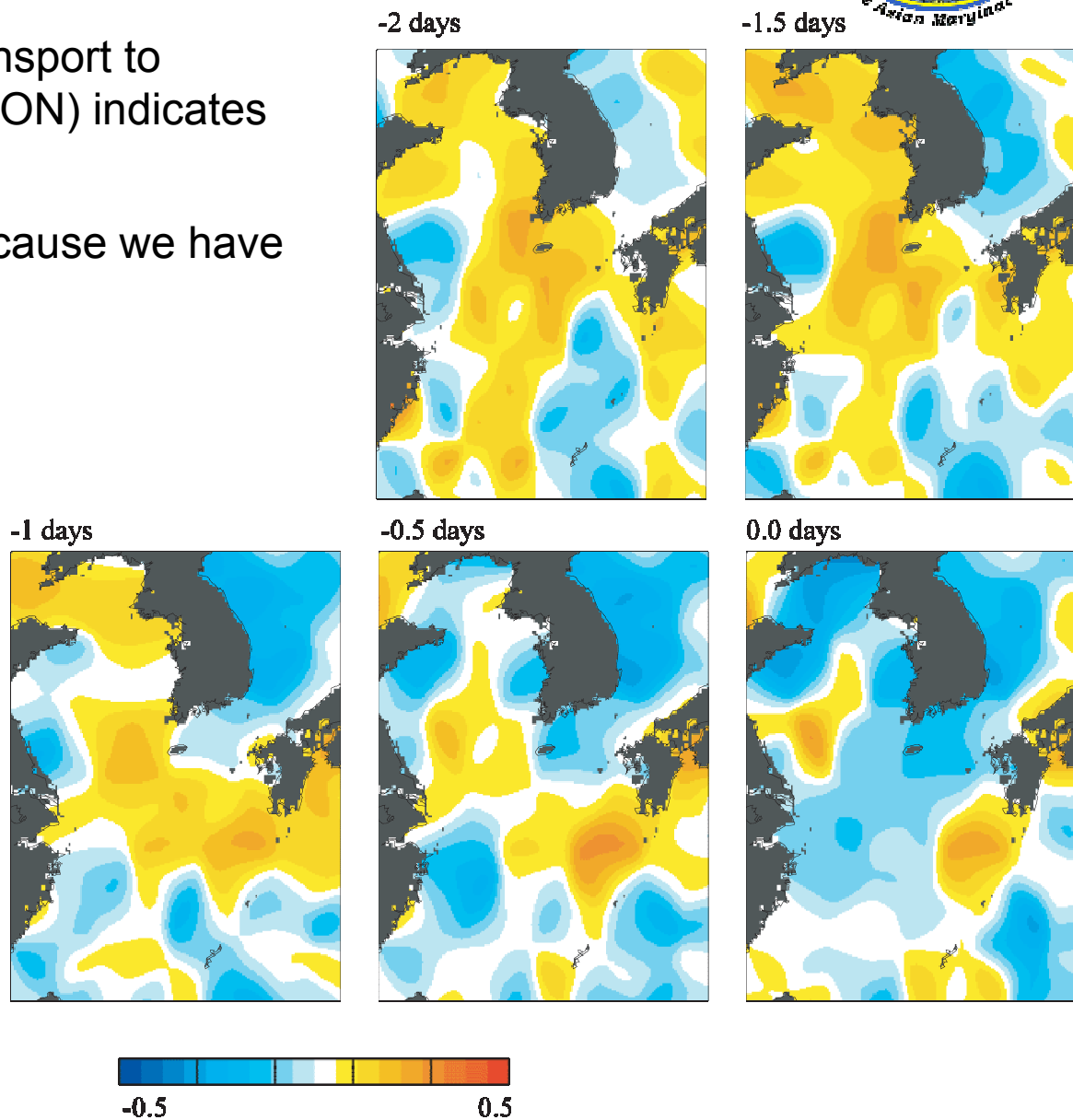
Correlation of Model SSH to Strait Transport

- Correlation of model strait transport to SSH indicates low SSH area propagating from the JES through the strait.
- The high SSH area within the Yellow Sea initially propagates northward to the Bohai Bay, and then southward along the Chinese coast.



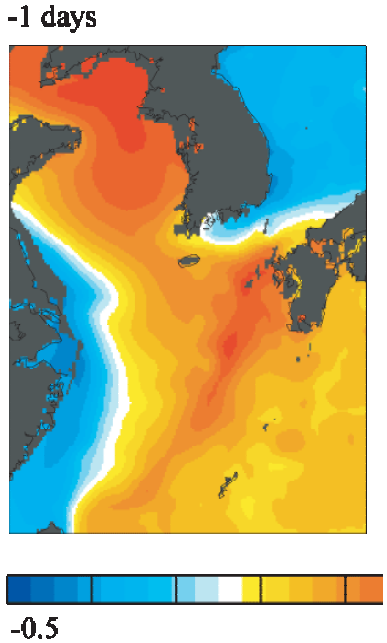
Correlation of Observed SSH to Strait Transport

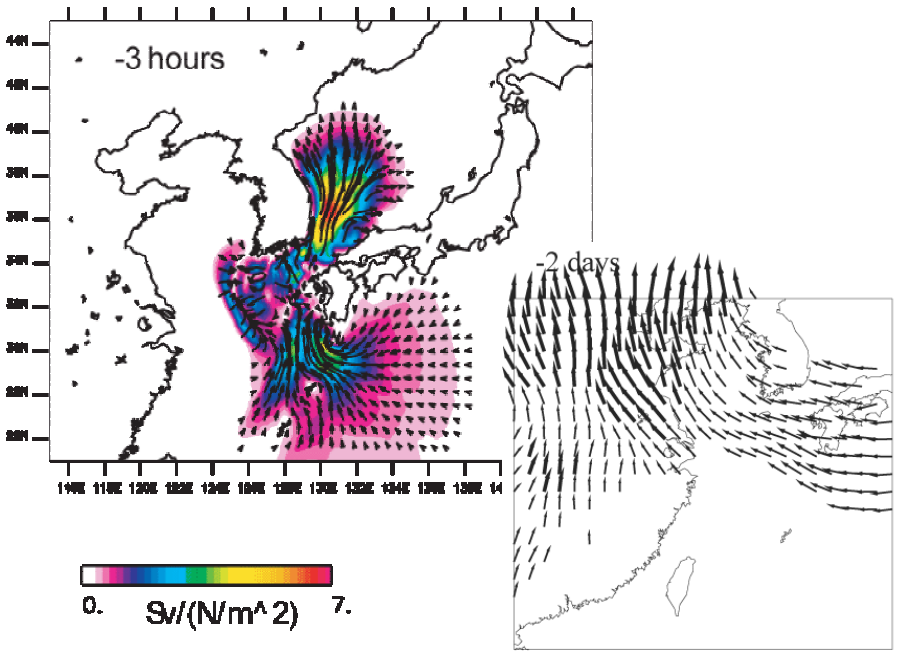
- Correlation of observed strait transport to observed SSH (TOPEX/POSEIDON) indicates similar features.
- Addition noise (a lot of noise) because we have only 30 samples.

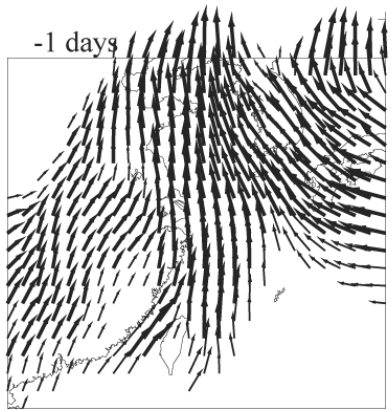


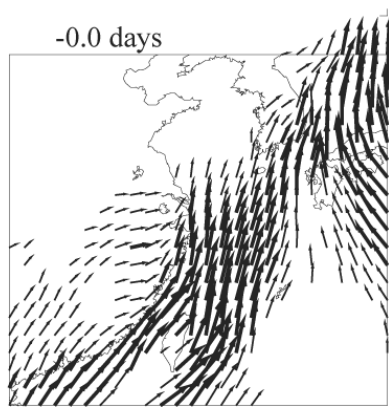
Time Lags

- Barotropic dynamics indicate rapid response to wind stress (order of a few hours)
- Correlations of model and observations indicate much longer time period of response (order of 1 day)
- The slower development of the wind field (southeastward movement of fronts over 1 to 2 days)









Transport Connections to Wind Stress

- The strait transport is dynamically connected to wind stress across the JES off the east Korean coast.
- Kelvin waves generated by the wind stress propagate to the strait, changing the gradient across the strait, and thus changing transport
- Wind stress across the Yellow Sea generates Kelvin waves that propagate away from the strait. Thus, the Yellow Sea wind stress is not significantly influential to the strait transport.
- The 1-day lag is due to the slow movement of atmospheric features and the rapid propagation of ocean features.