

# Air-sea Interactions in a High-Resolution Ocean-atmosphere Simulation

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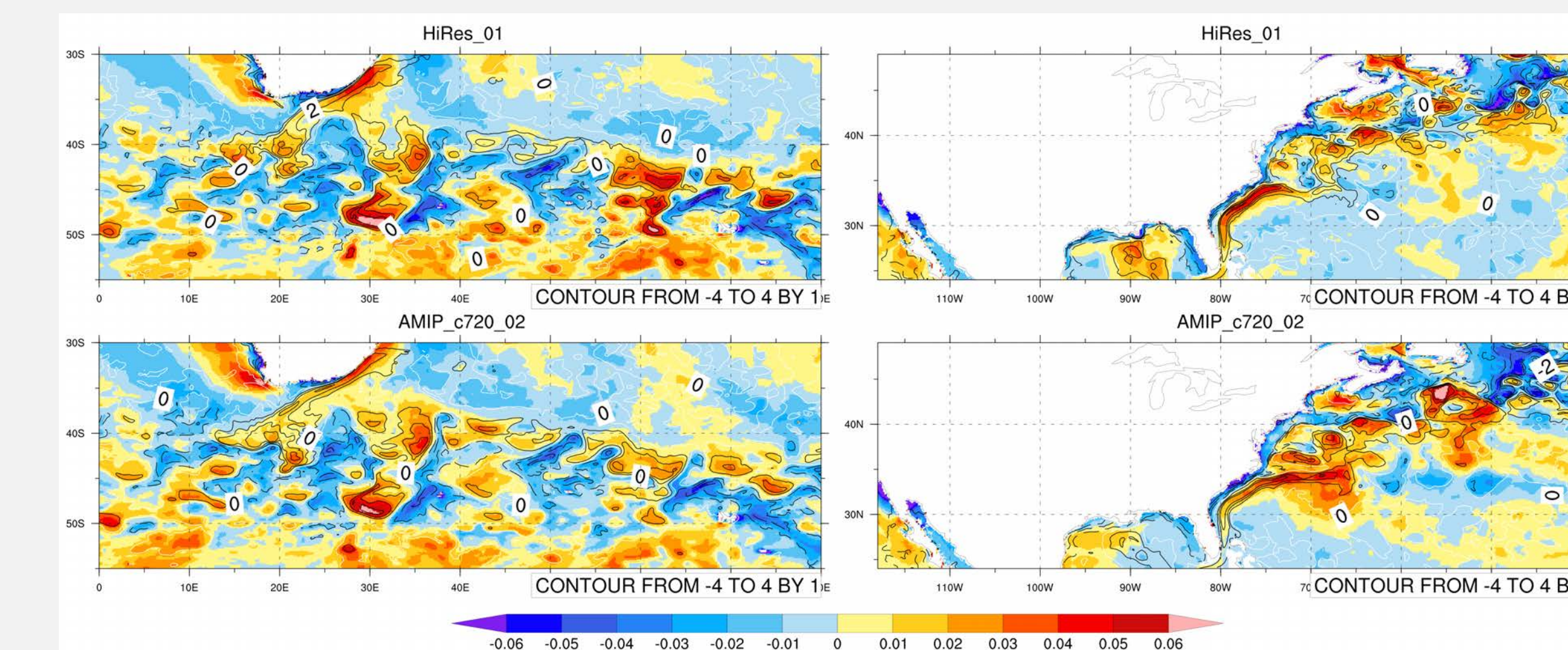
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**1. Background:** Analysis of coarse resolution observation-based products generally finds negative correlation between SST and surface wind speed. This interaction between the ocean and the atmosphere is interpreted as the ocean passively responding to wind induced latent and sensible heat fluxes. However, on oceanic mesoscales, observations showed that wind speed is stronger over warmer ocean and weaker over cooler ocean. The explanation for the positive correlation in this case is that positive Sea Surface Temperature (SST) anomalies increase Planetary Boundary Layer (PBL) instability and the resulting turbulence acts to transfer momentum from the upper levels into the surface.

**Is there a governing feedback mechanism between the atmosphere and the ocean?**



Two-month averages (Feb-Mar, 2012) of spatially high-pass-filtered sea surface temperature (SST) overlaid as contours on spatially high-pass-filtered wind stress

## 2. The Coupled Model

Atmosphere – GEOS:

- Horizontal grid type – Cubed sphere, 1/8° X1/8°
- Vertical grid type – hybrid sigma-pressure, 72 levels

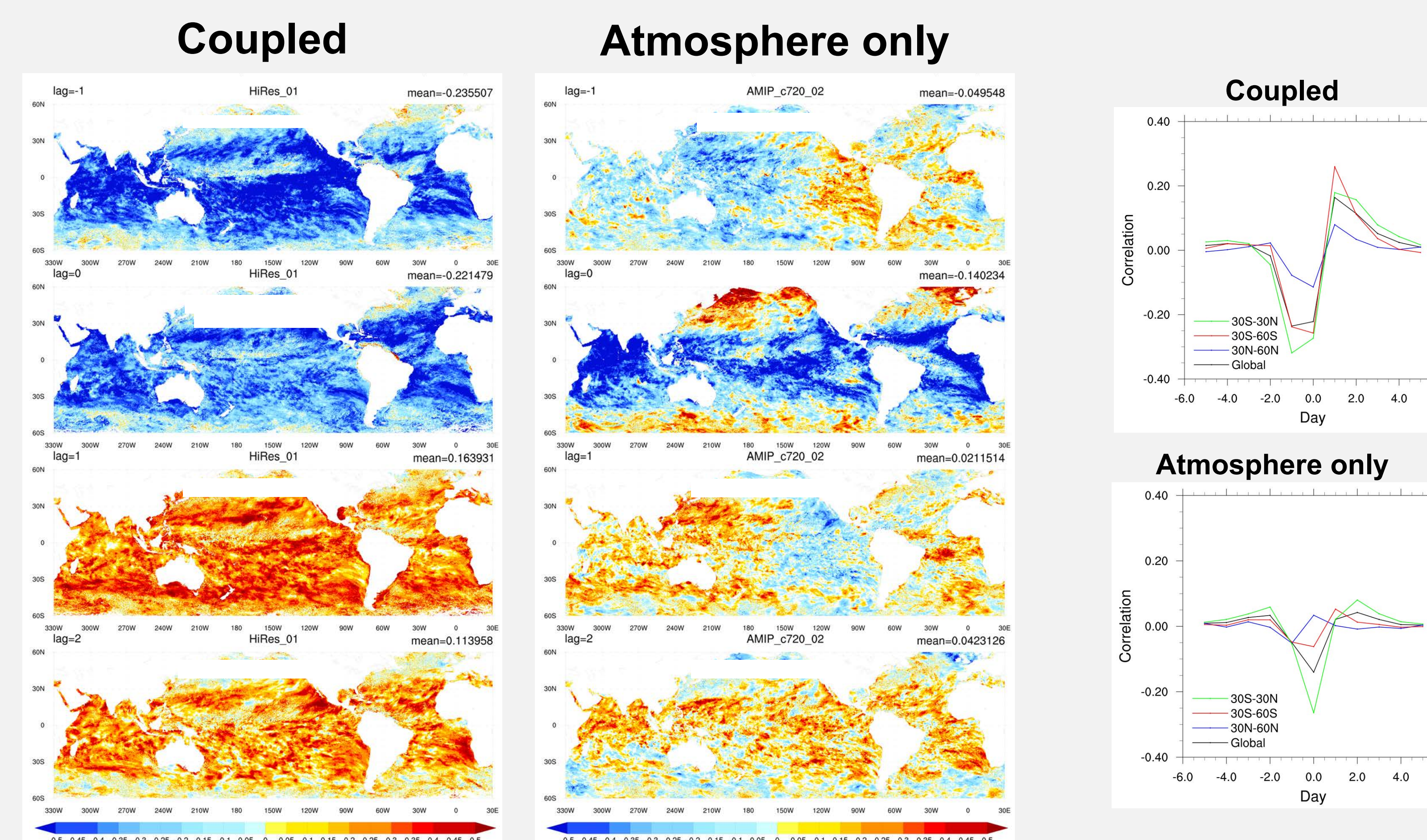
Ocean – MITgcm

- Horizontal grid type – Lat-Lon-Cap, 1/12° X1/12°
- Vertical grid type – z\* rescaled height vertical coordinate, 90 levels

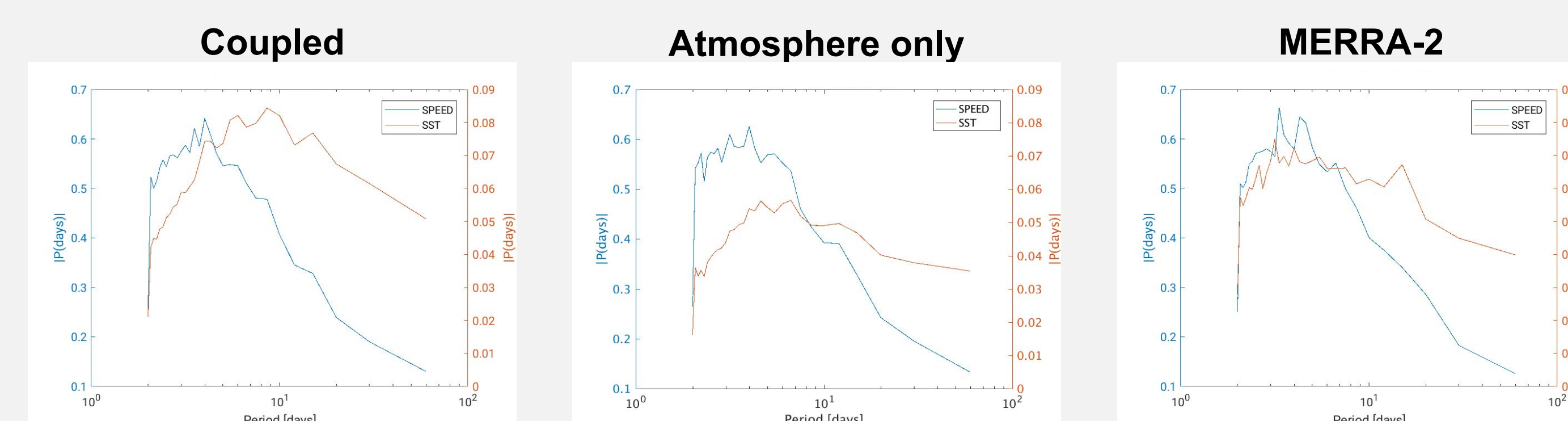
## 3. Experiments

1. Atmosphere Only – GEOS (AGCM)
  - Feb, 9 – Apr 9, 2012
  - Forcing: SST and ice fraction from ocean only equivalent experiment.
  - Initial conditions: MERRA-2
2. Coupled – GEOS-MITgcm (AOGCM)
  - Feb, 9 – Apr 9, 2012
  - Ocean initial conditions: from run 1
  - Atmospheric initial conditions: MERRA-2 (same as the run 2)

## 4. Correlation between daily SST and wind speed tendencies



Lagged correlations between SST and wind speed for -1,0,1 and 2 days for the AOGCM (left) and AGCM (right). Positive correlations corresponds to SST lagging the wind speed

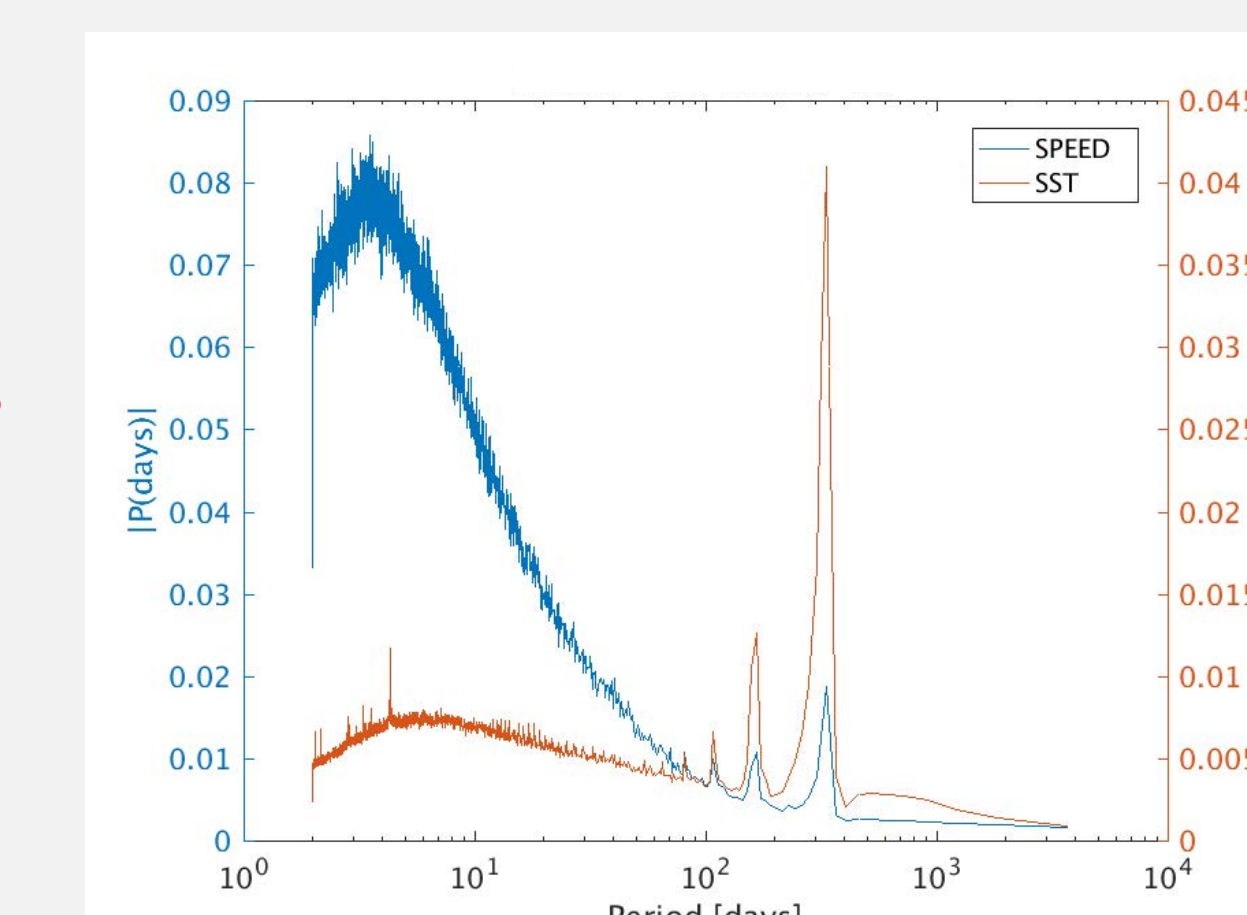


Power spectrum of the SST and wind speed as a function of the period averaged between 60°S to 60°N for the same two months).

**SST-wind correlation indicates a three-four day cycle**

## 5. MERRA-2

Several days cycle is also found in an observation-based product



## 6. Suggested Mechanism

