Global Observation of Wind Jets Using TMI and RapidScat

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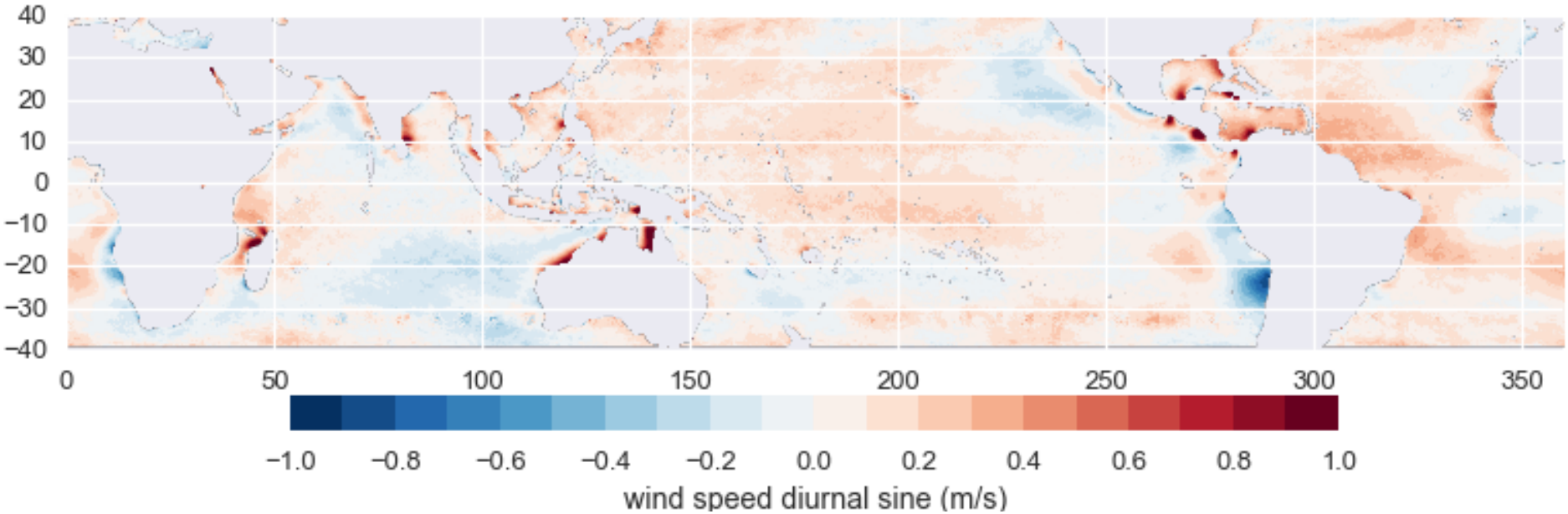
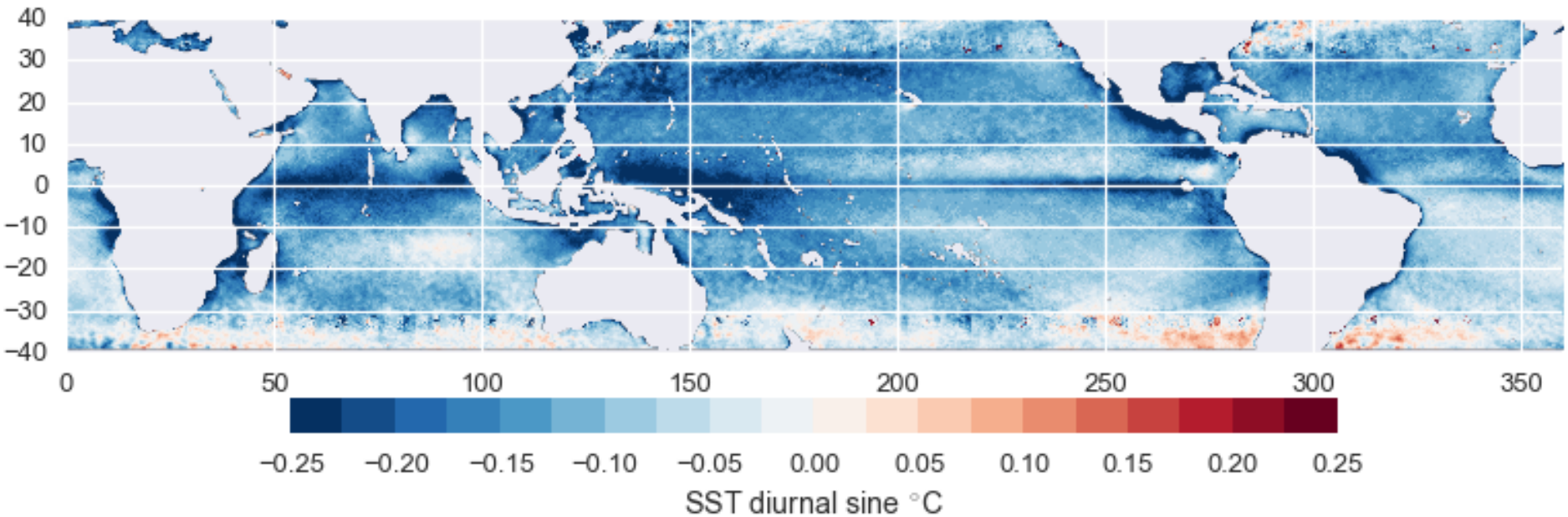
Overview

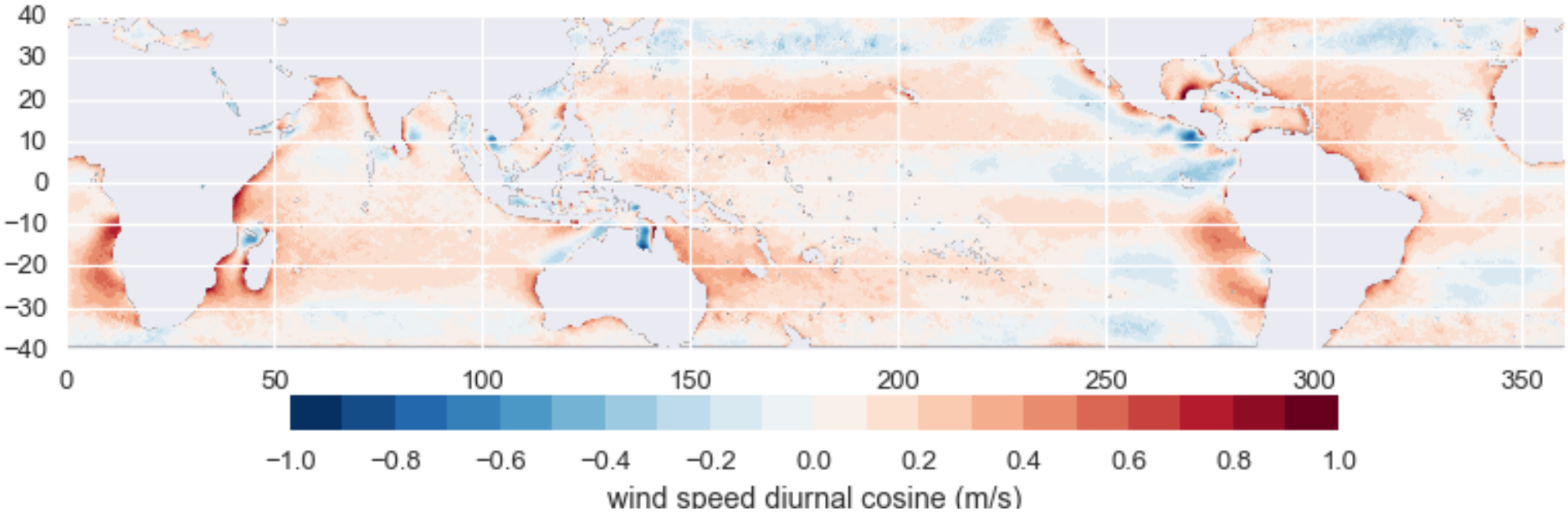
- What can non-sun-synchronous observations tell us about the daily variability of winds and SST?
  - Global look
  - Concentrate on wind jet regions where variability is daily maximized
- TMI
  - 17 year data record!
  - Coincident wind speed, SST, and atmospheric water content
- RapidScat
  - 2 year data record
  - Vector winds, stress, and derivatives
  - Catches a major El Niño event!

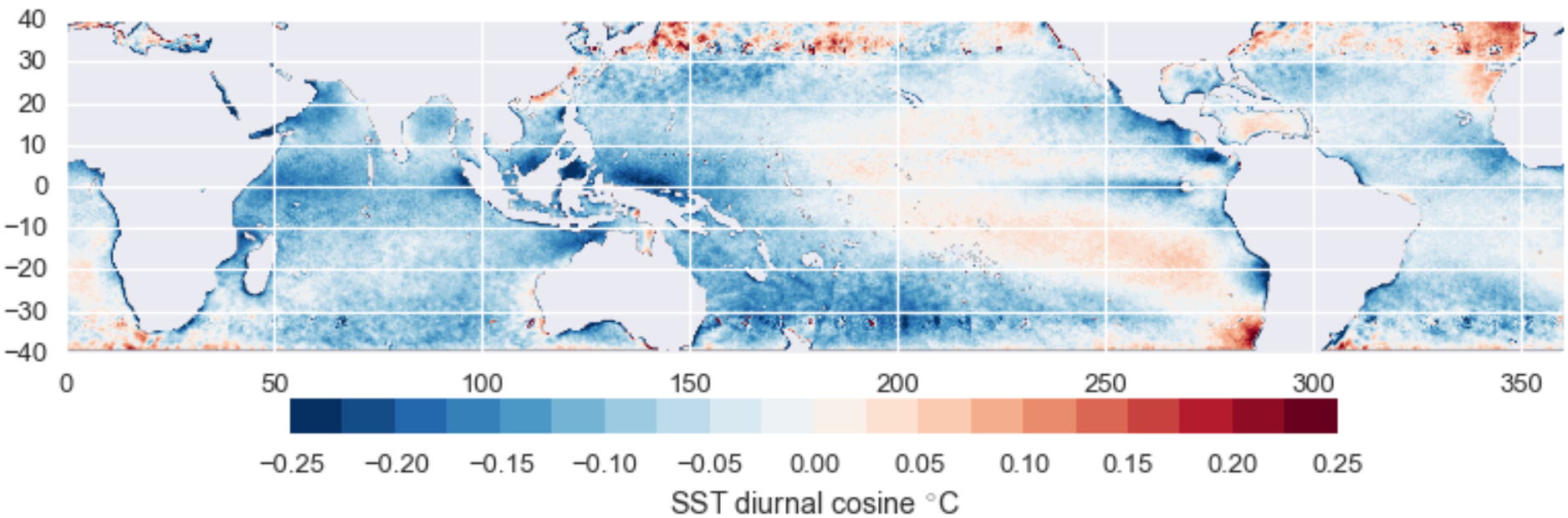
TMI Diurnal Cycle: 6am/6pm



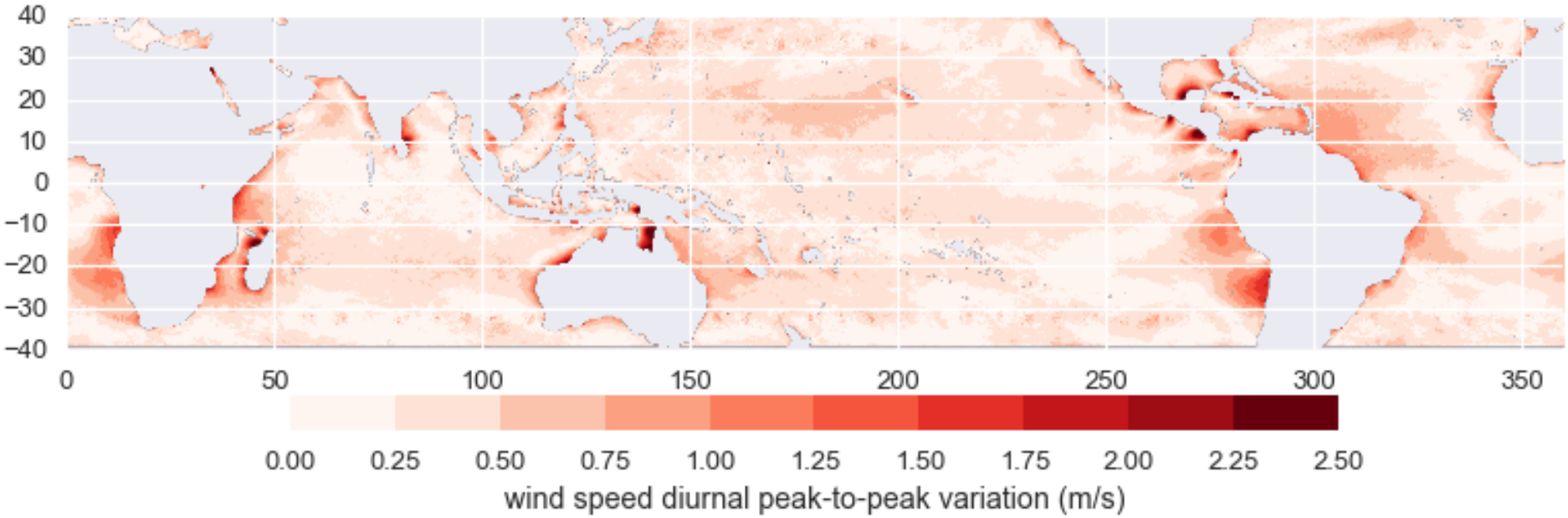


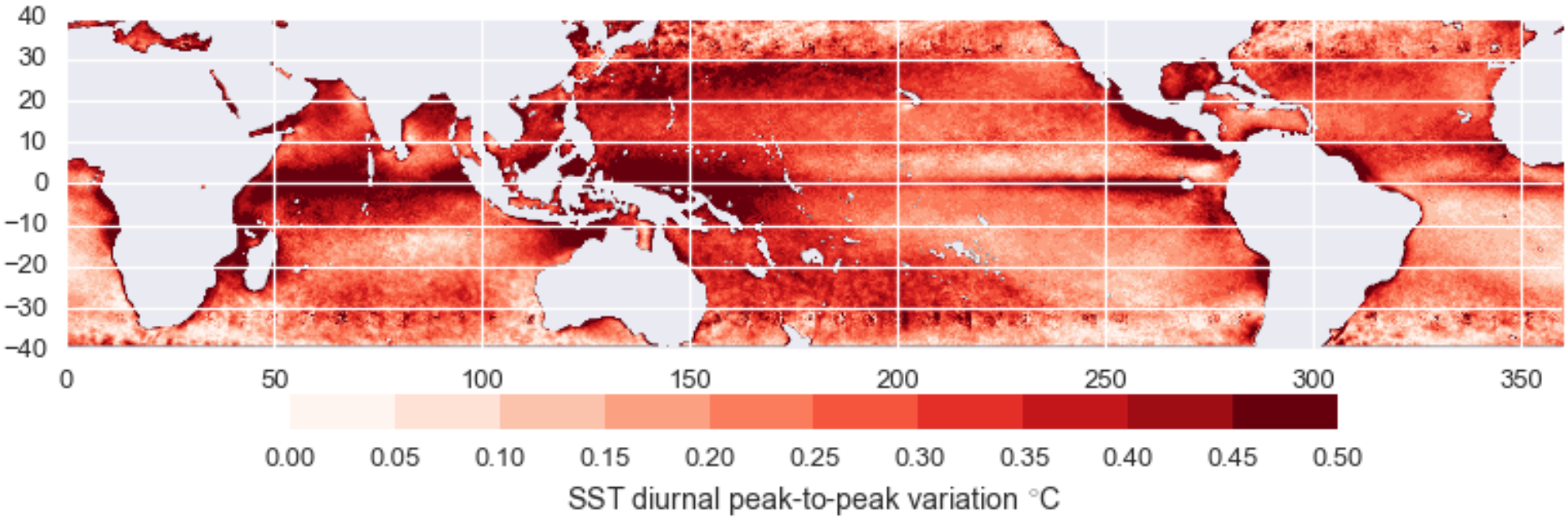
TMI Diurnal Cycle: 12am/12pm



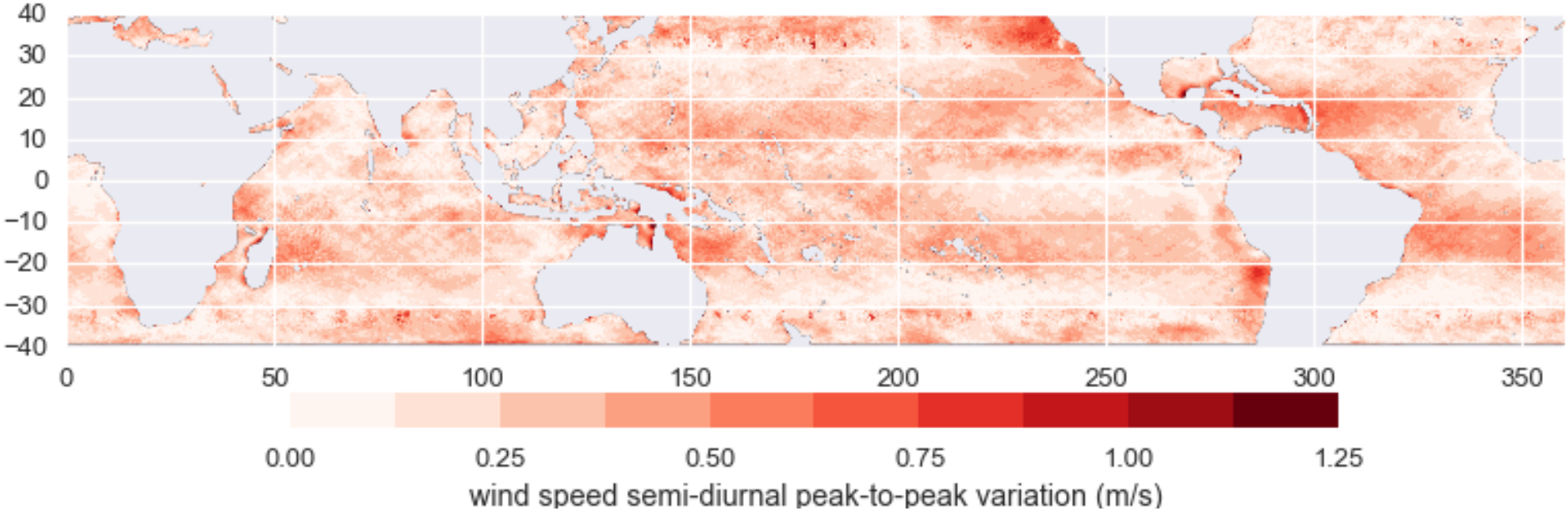


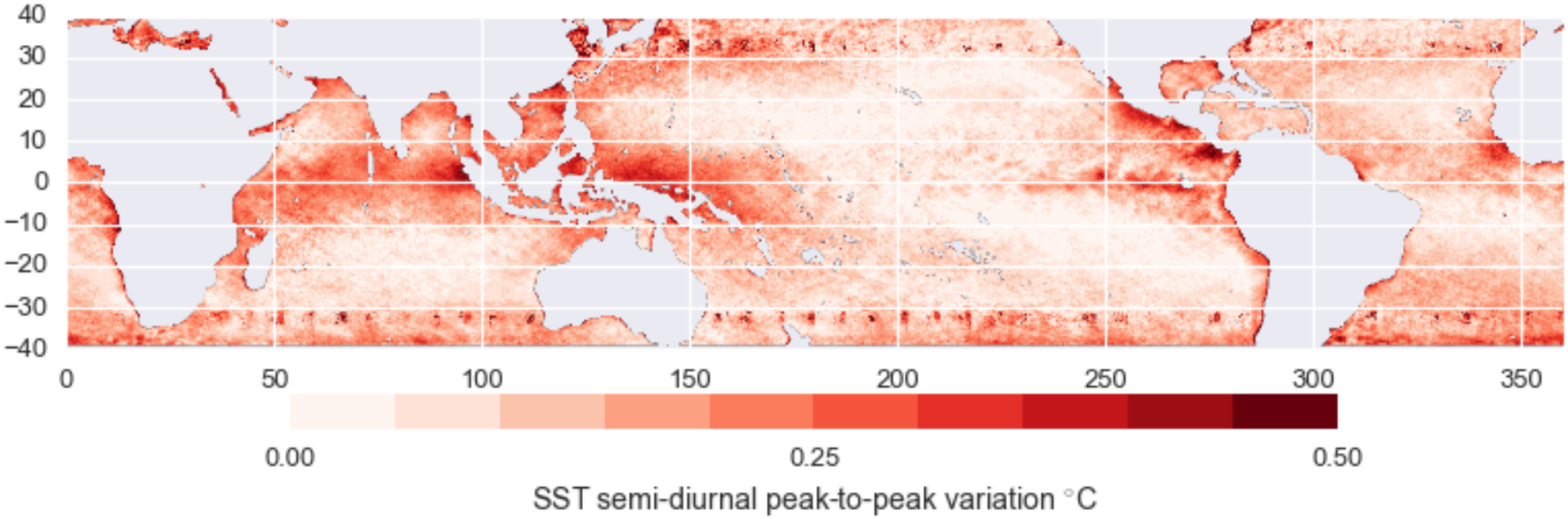
TMI Diurnal Cycle Magnitude



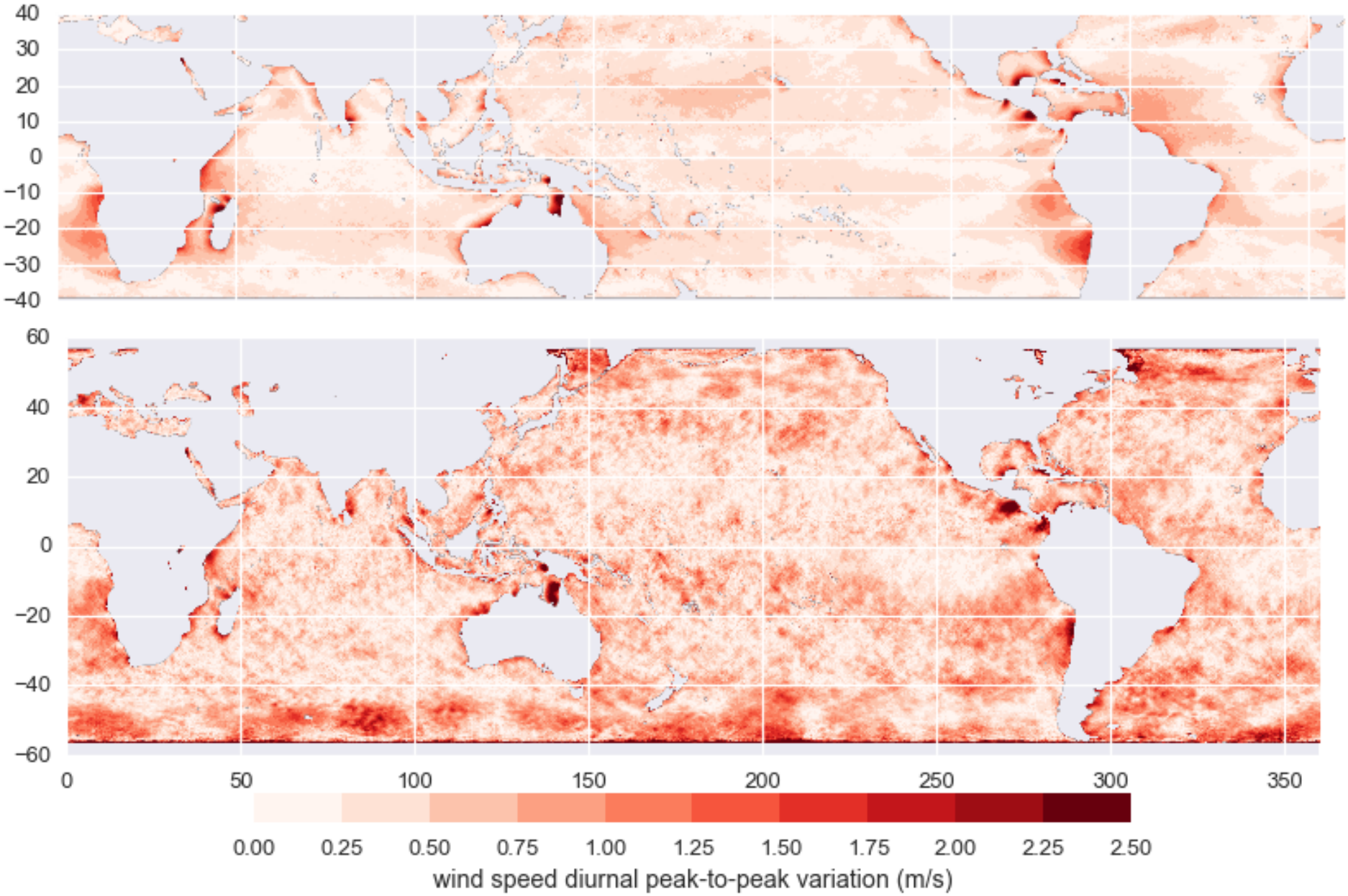


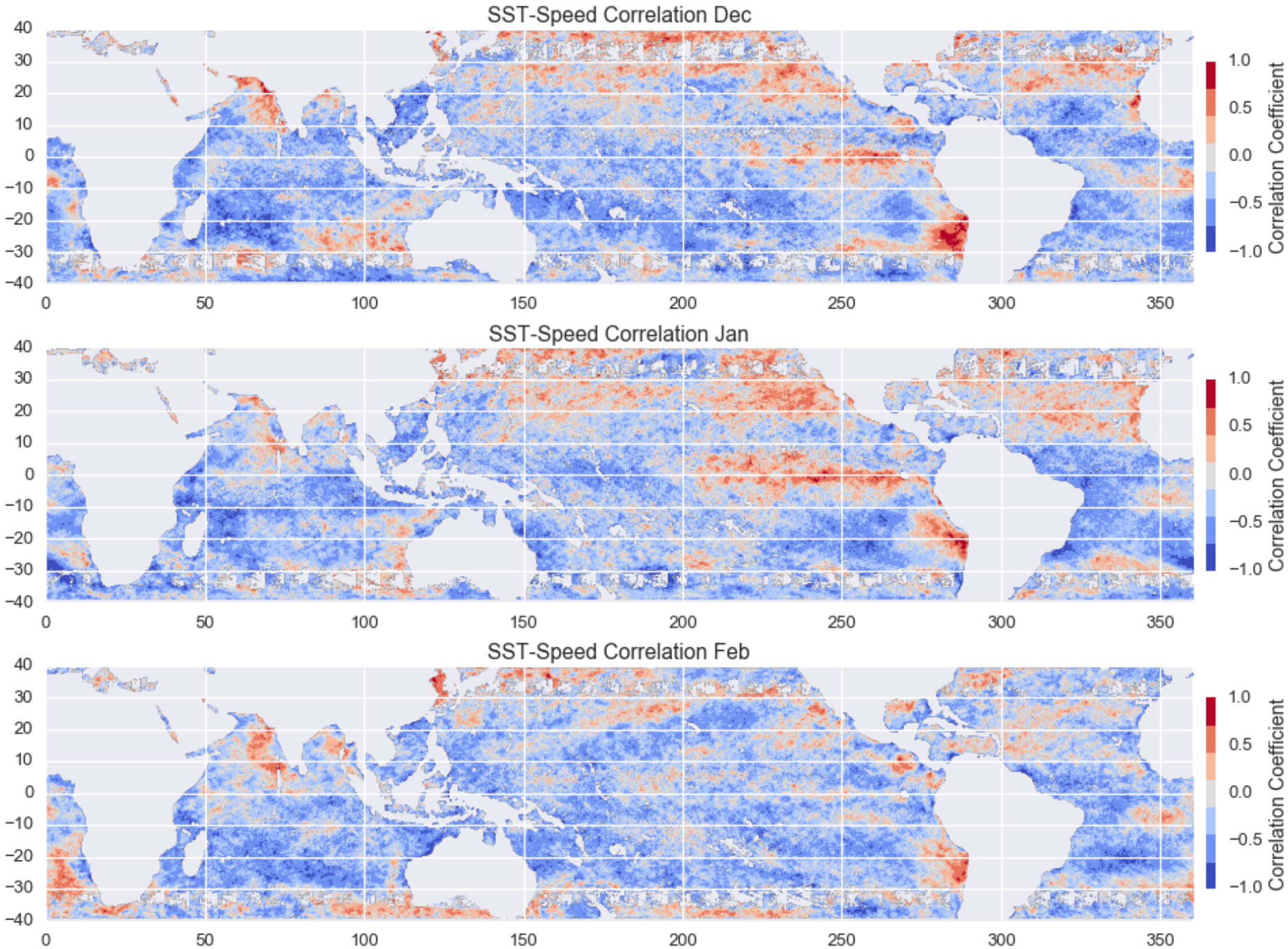
TMI Semi-Diurnal Cycle Magnitude

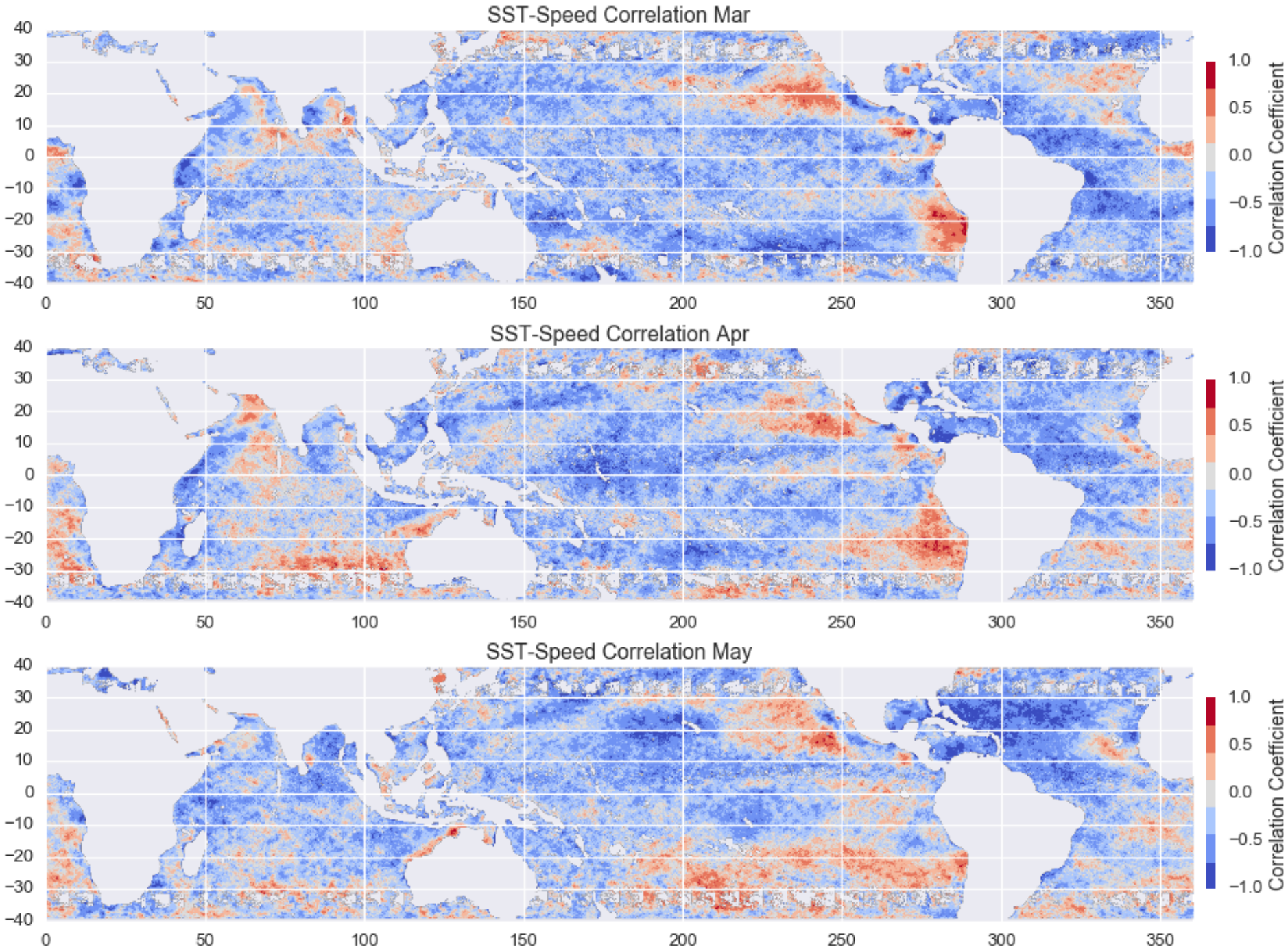


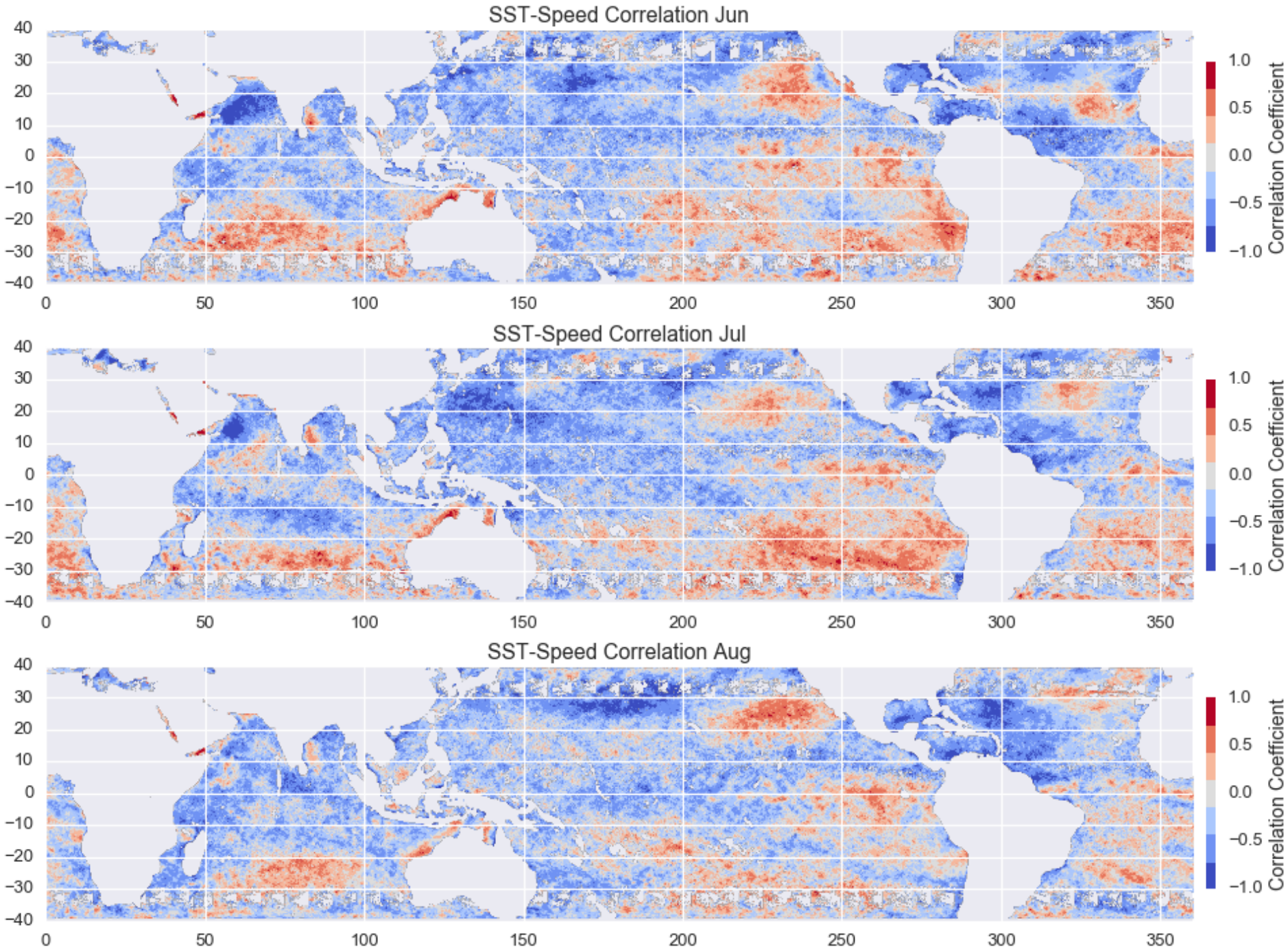


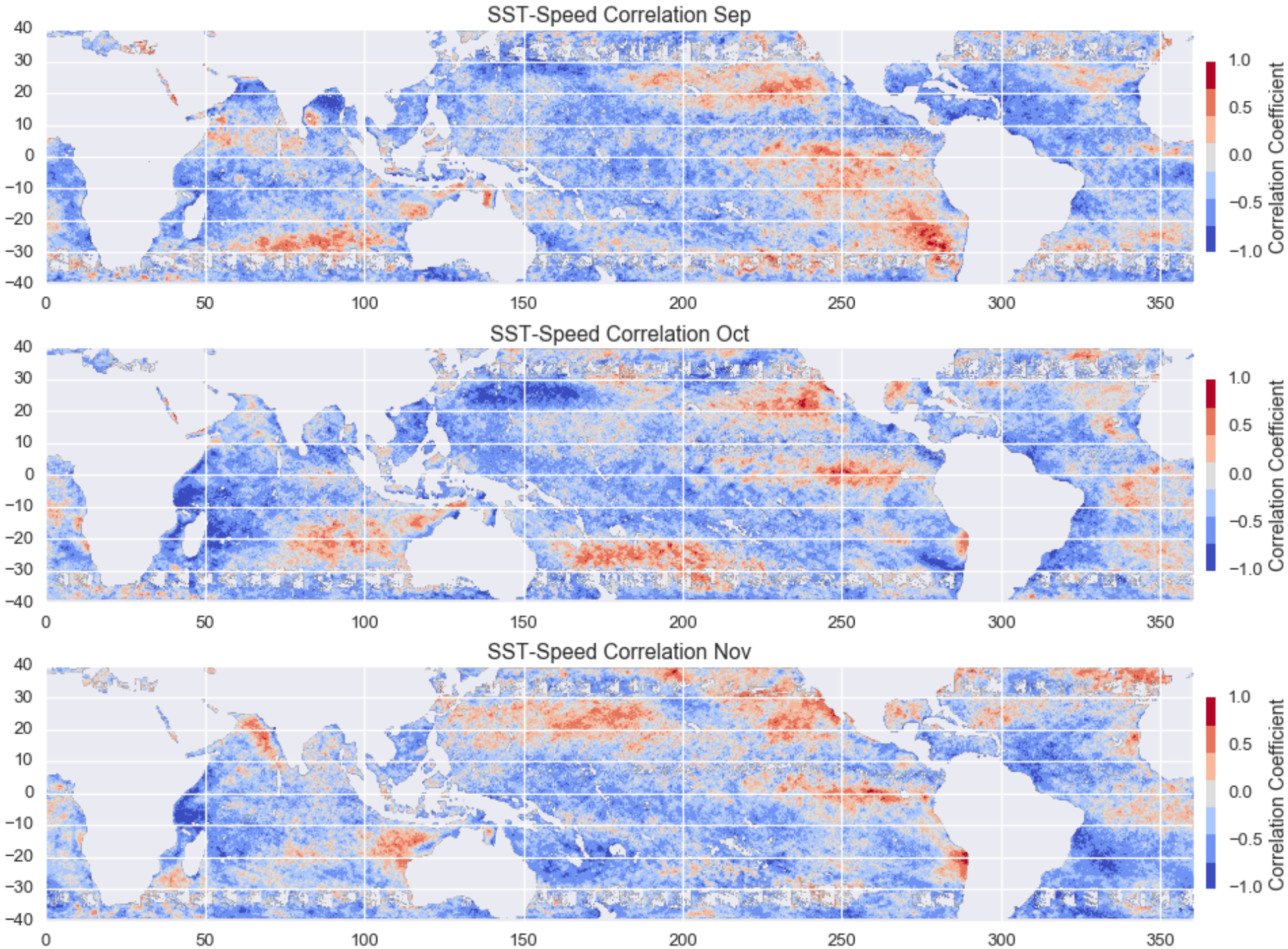
TMI & RapidScat Speed Diurnal



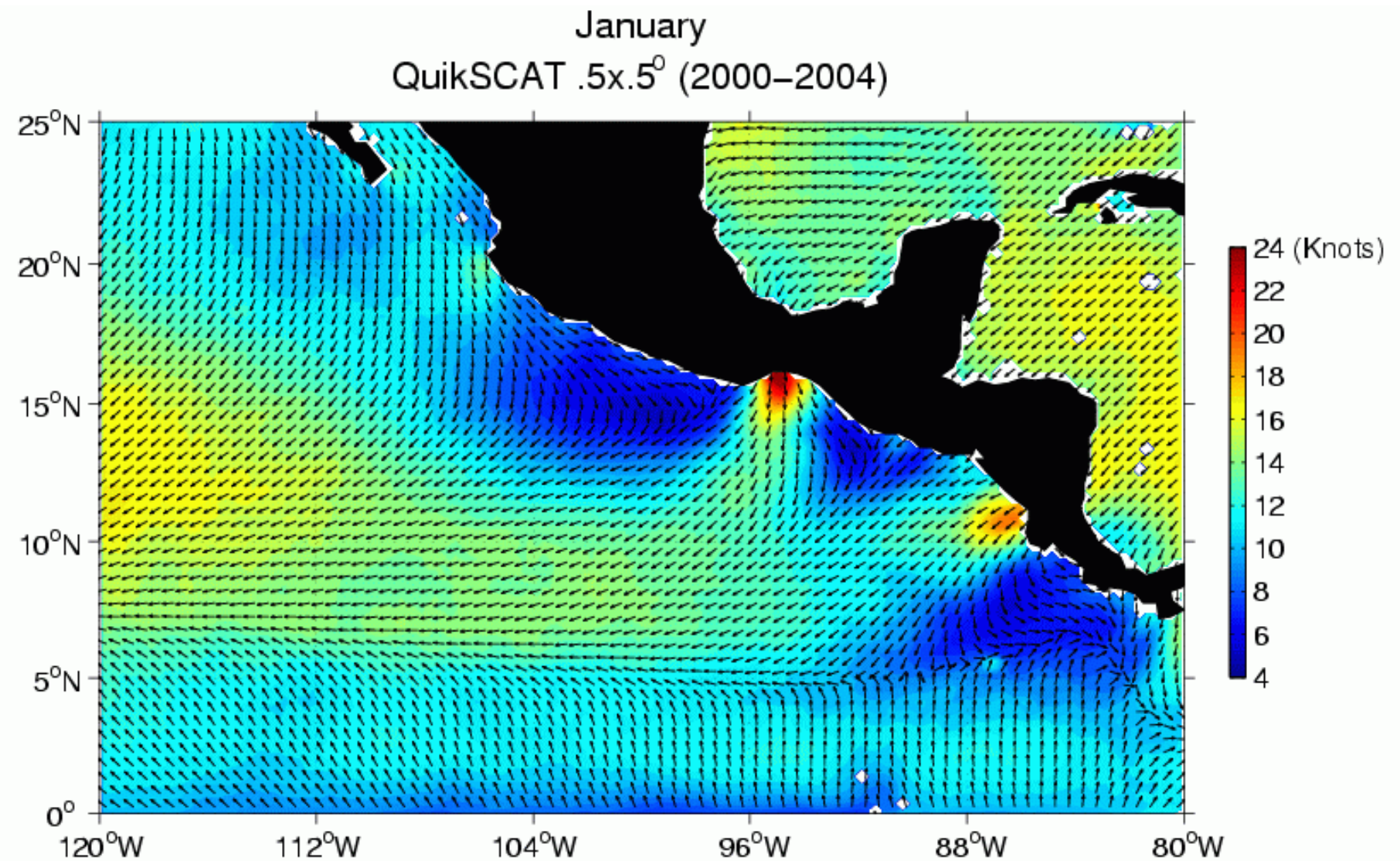

SST-Speed Correlation Dec
SST-Speed Correlation Jan
SST-Speed Correlation Feb
40
30
20
10
0
−10
−20
−30
−40
0
50
100
150
200
250
300
350
1.0
0.5
0.0
−0.5
−1.0
Correlation Coefficient


SST-Speed Correlation Mar
SST-Speed Correlation Apr
SST-Speed Correlation May
40
30
20
10
0
−10
−20
−30
−40
0
50
100
150
200
250
300
350
1.0
0.5
0.0
−0.5
−1.0
Correlation Coefficient


SST-Speed Correlation Jun
SST-Speed Correlation Jul
SST-Speed Correlation Aug
40
30
20
10
0
−10
−20
−30
−40
0
50
100
150
200
250
300
350
1.0
0.5
0.0
−0.5
−1.0
Correlation Coefficient

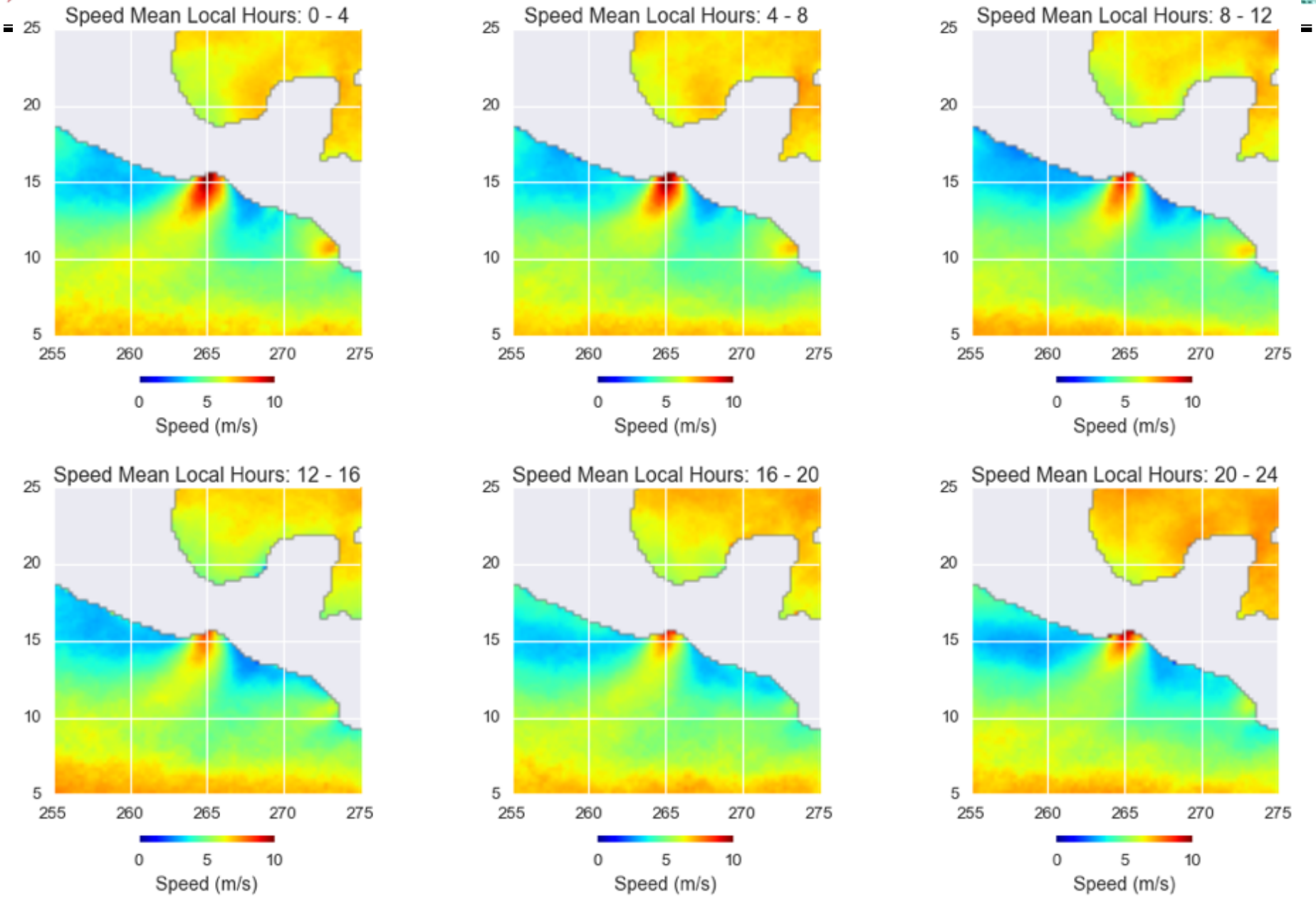

SST-Speed Correlation Sep
SST-Speed Correlation Oct
SST-Speed Correlation Nov
40
30
20
10
0
−10
−20
−30
−40
0
50
100
150
200
250
300
350
1.0
0.5
0.0
−0.5
−1.0
Correlation Coefficient

Tehuantepec-Papagayo COAPS Climatology

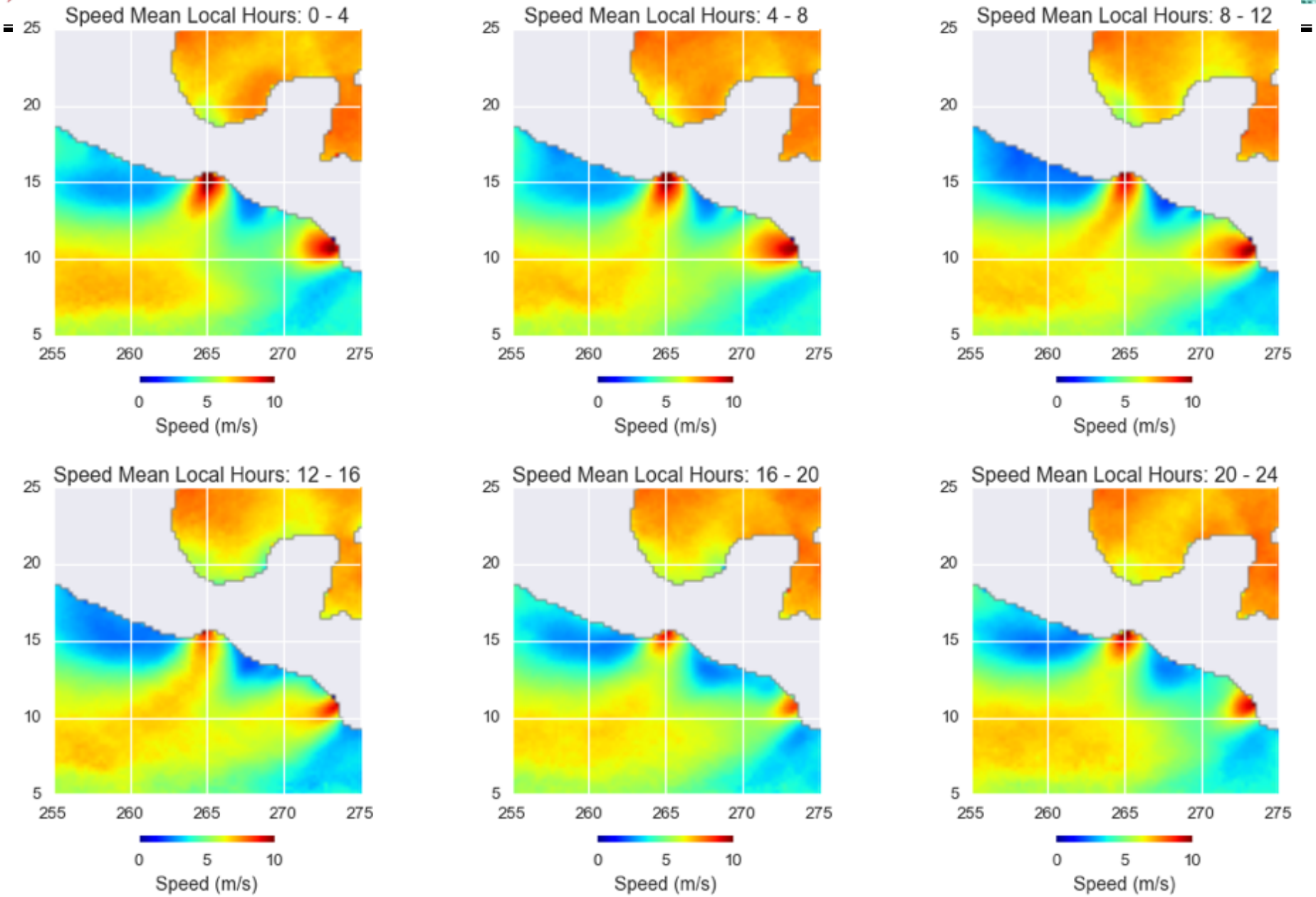


C. M. Risien and D. Chelton, "A global climatology of surface wind and wind stress fields from 8 years of quikscat scatterometer data," Journal of Physical Oceanography, 2008.

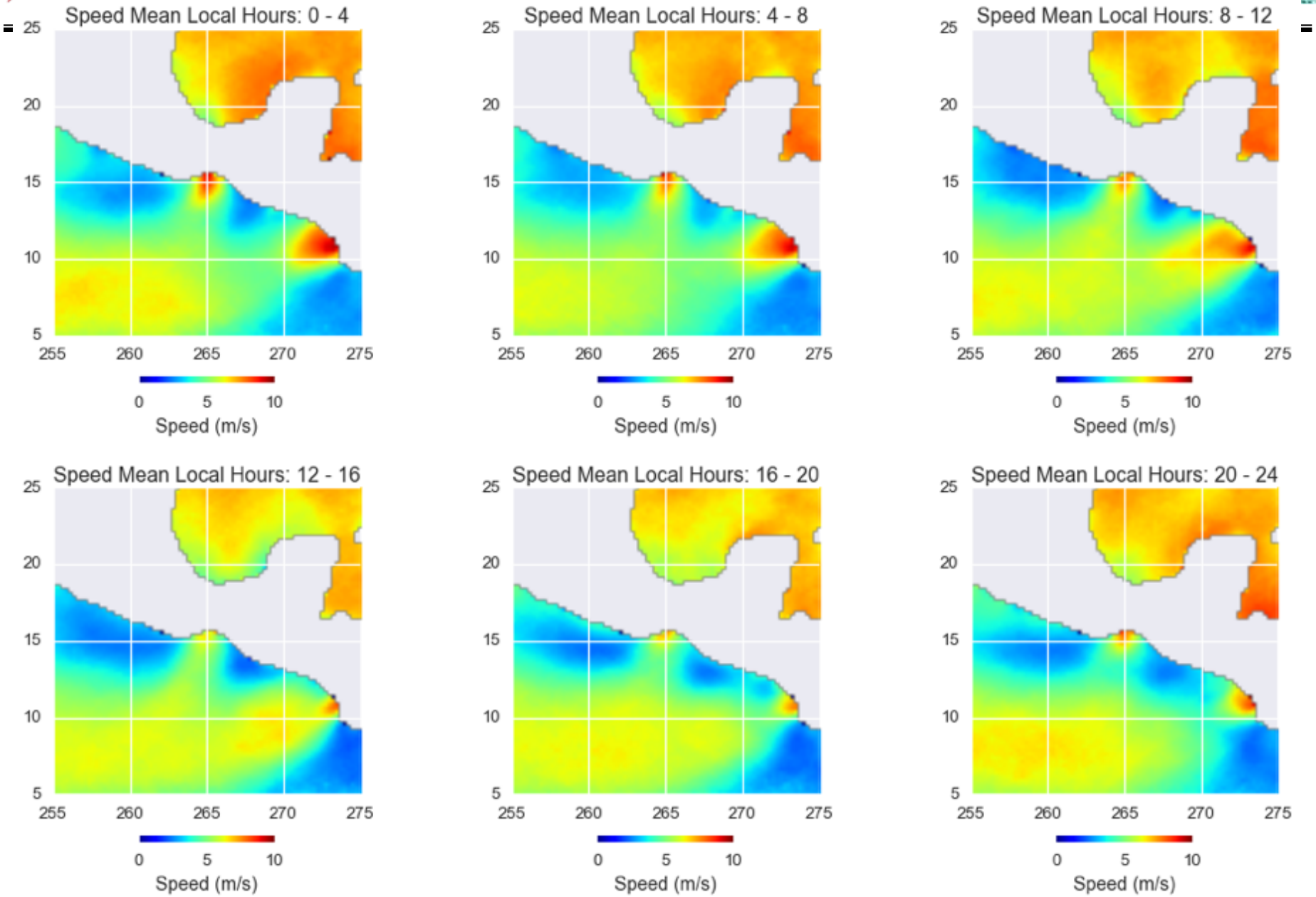
October-November



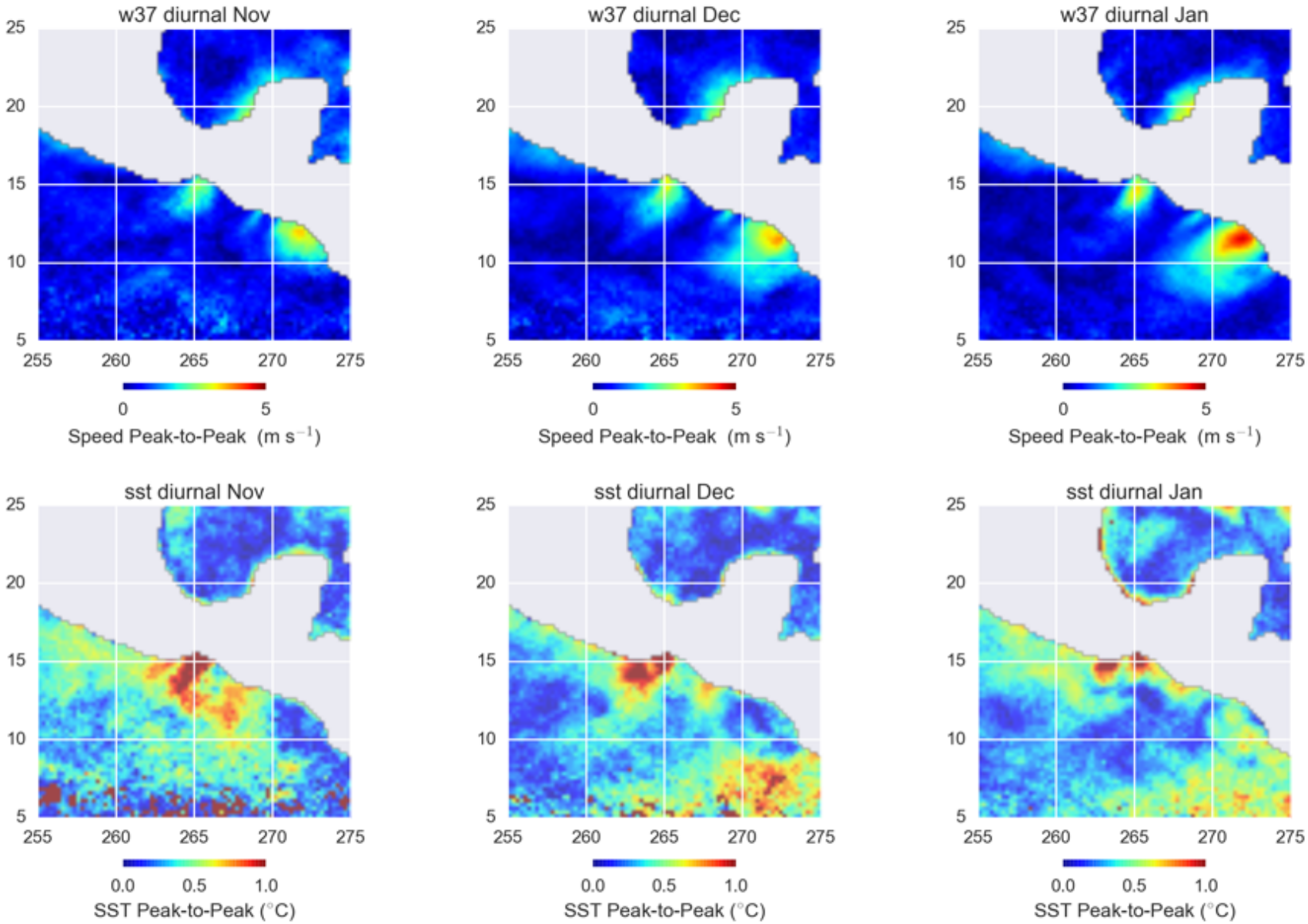
December-January



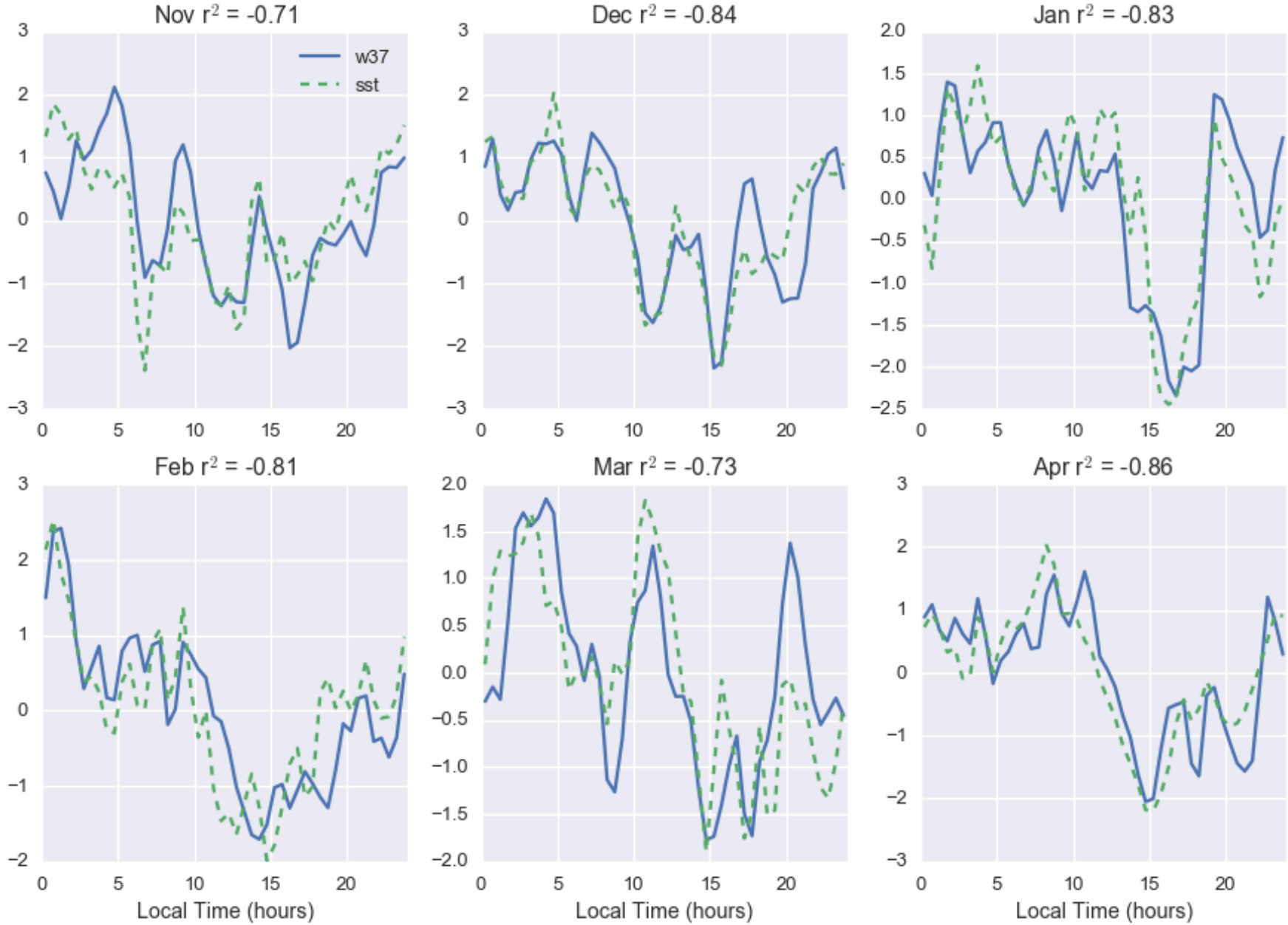
February-March



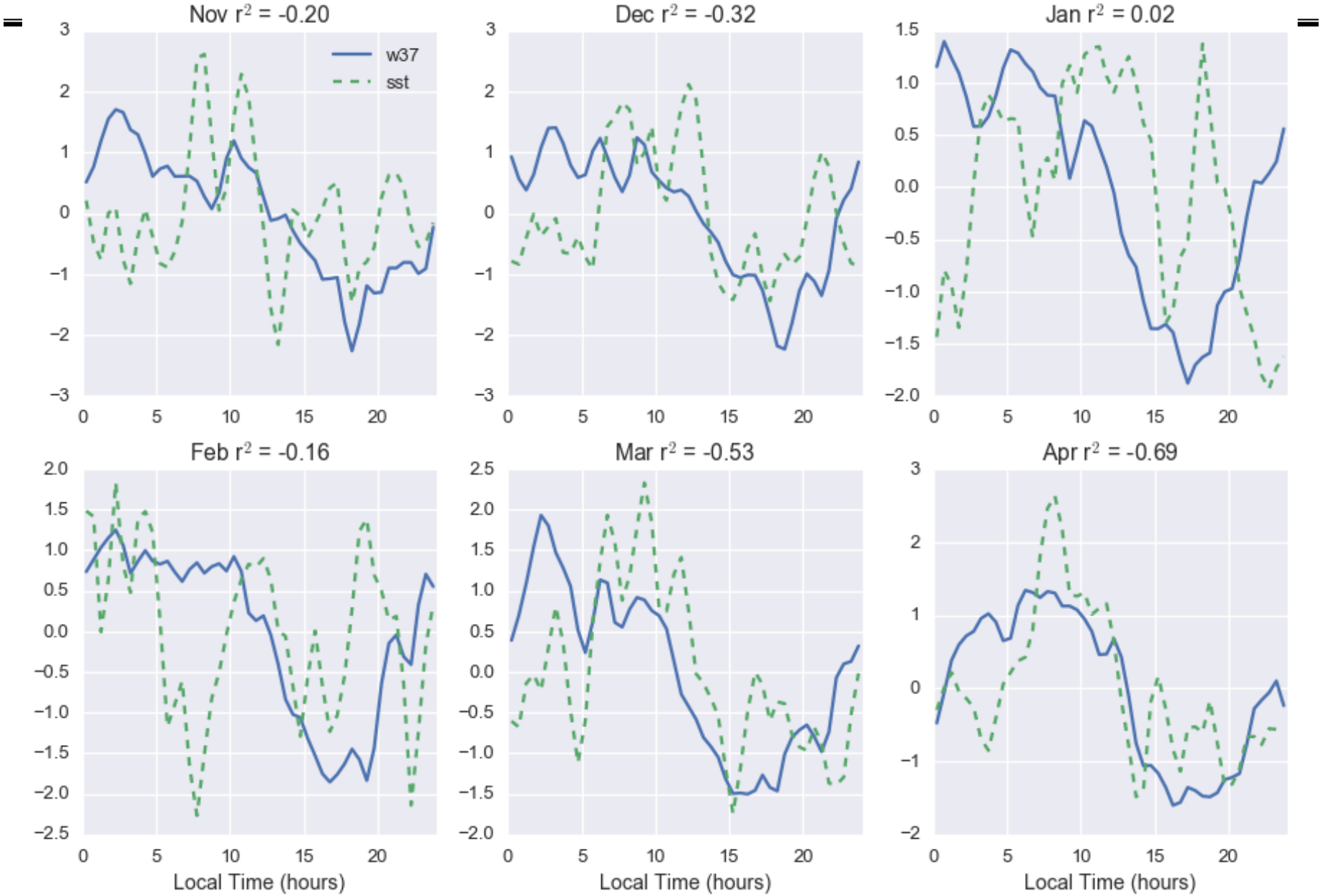
Nov-Jan Diurnal Component



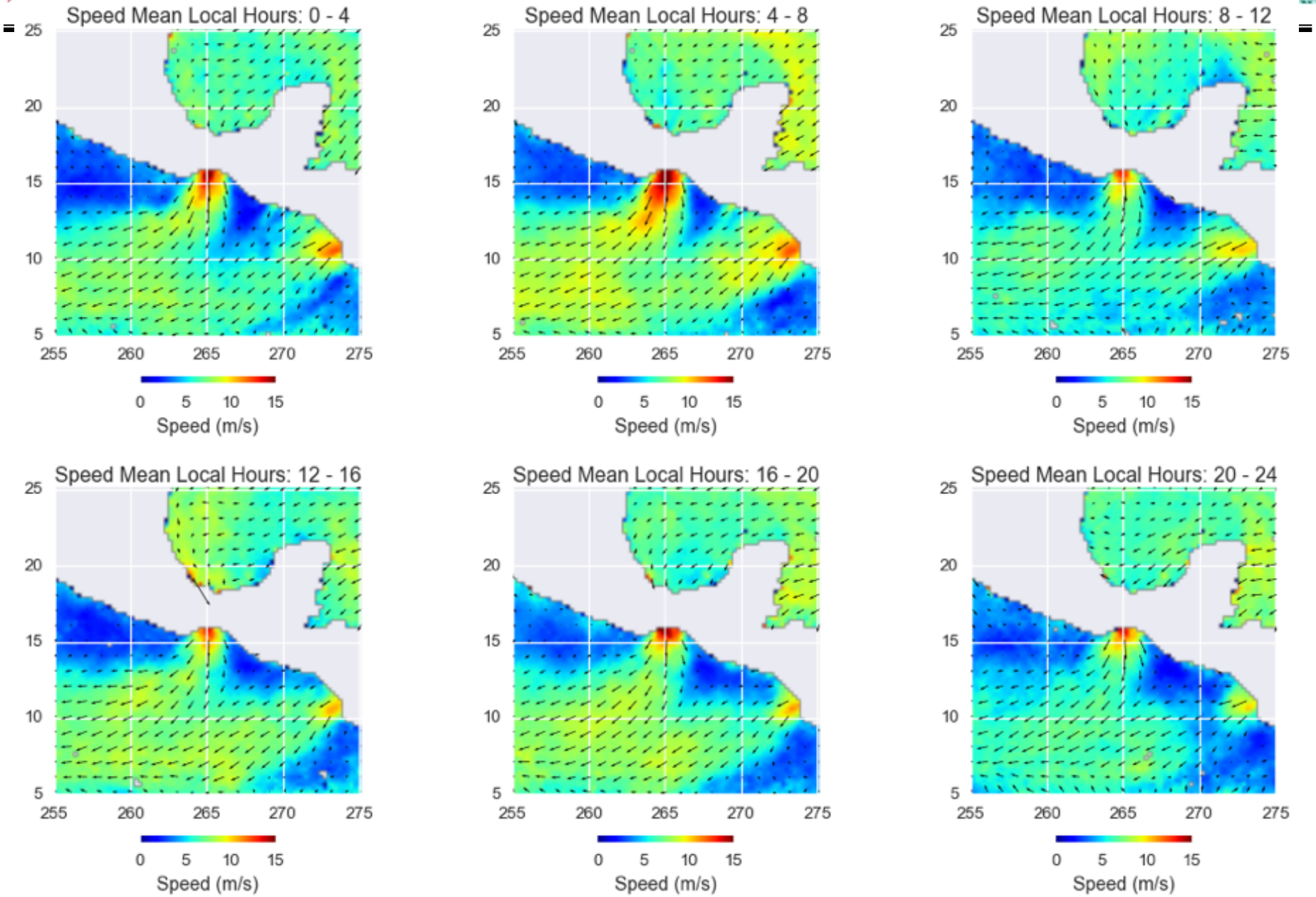
Tehuantepec: Wind-SST Time Series



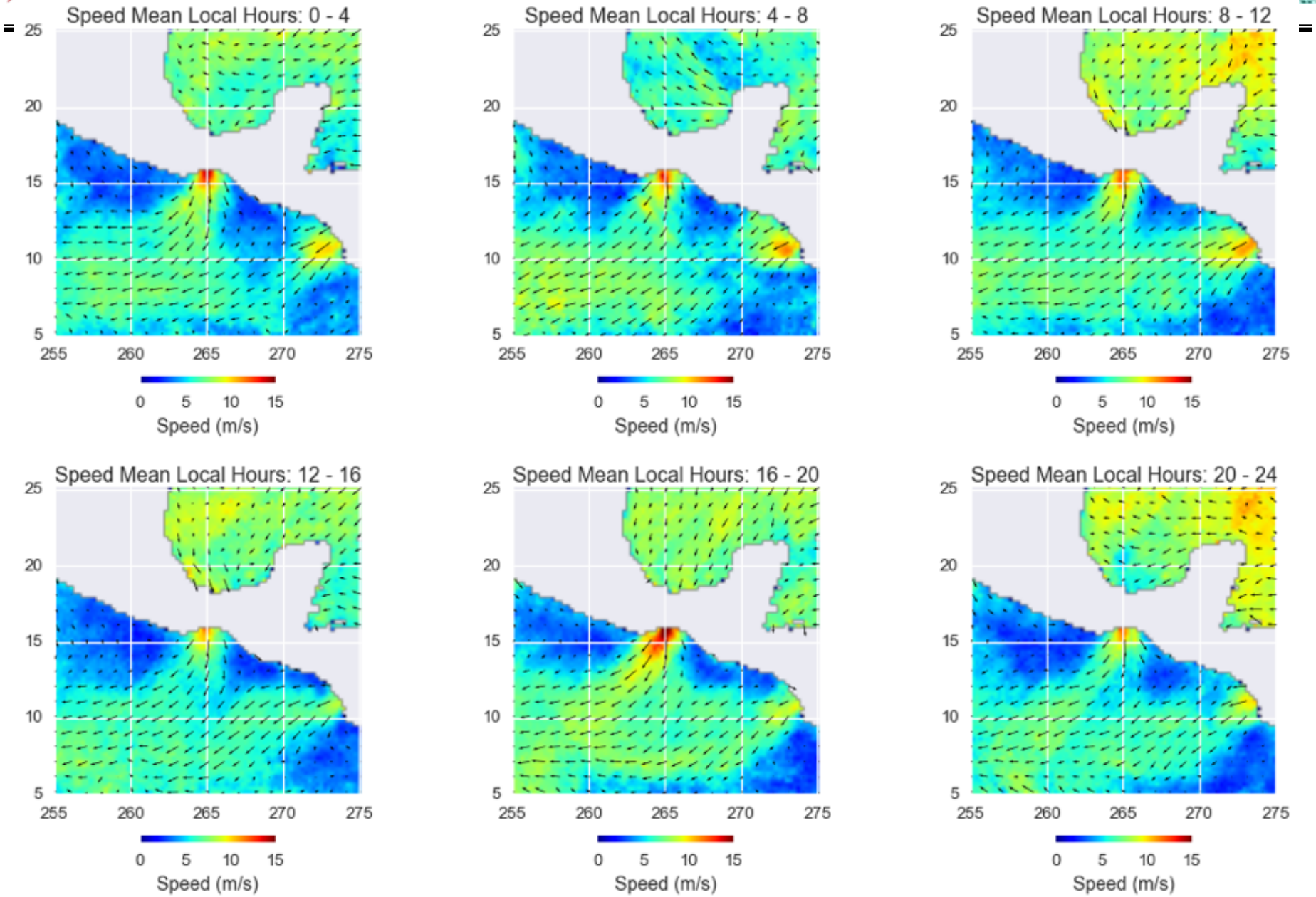
Papagayo: Wind-SST Time Series



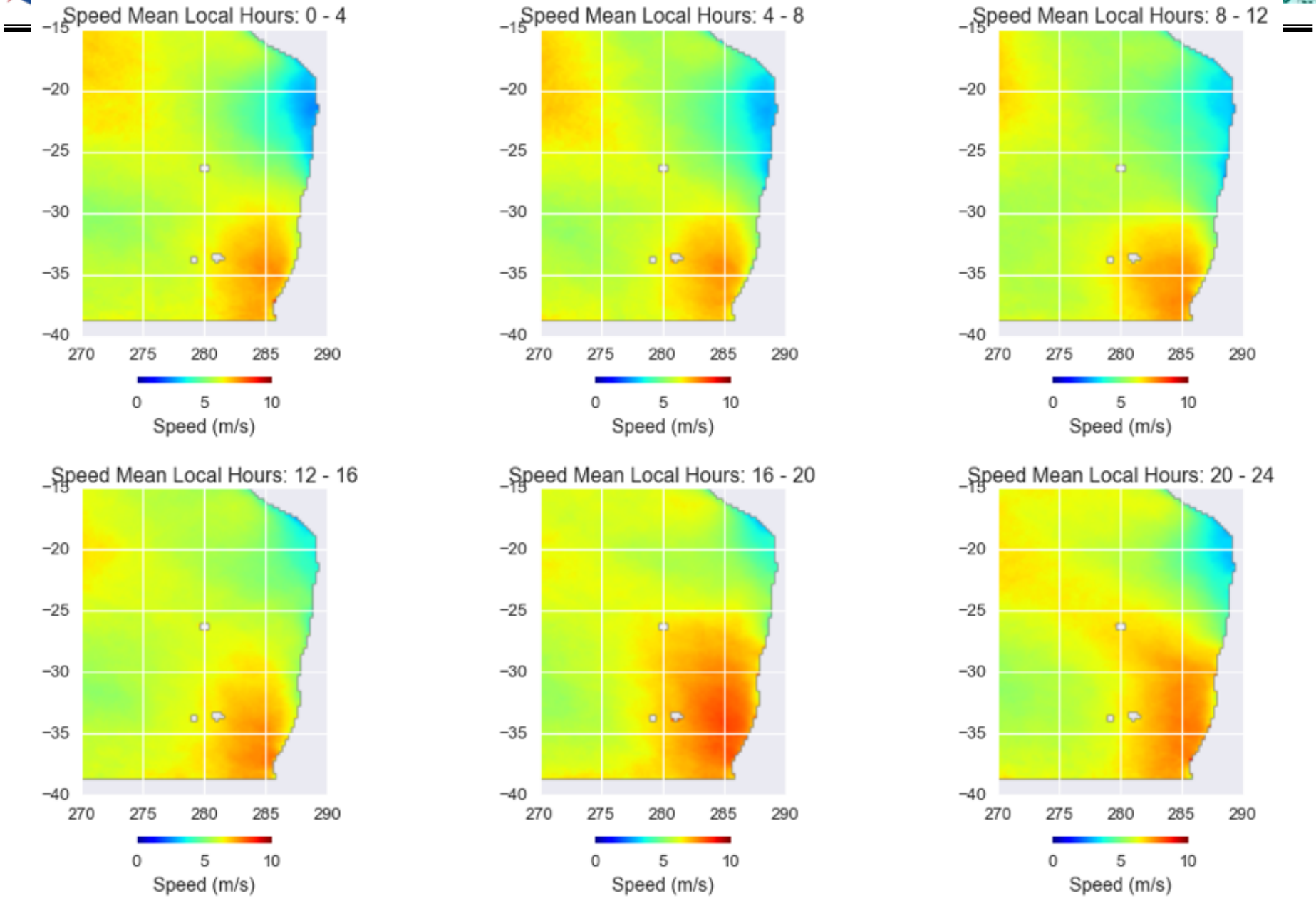
Tehuantepec, Dec’14-Jan’15



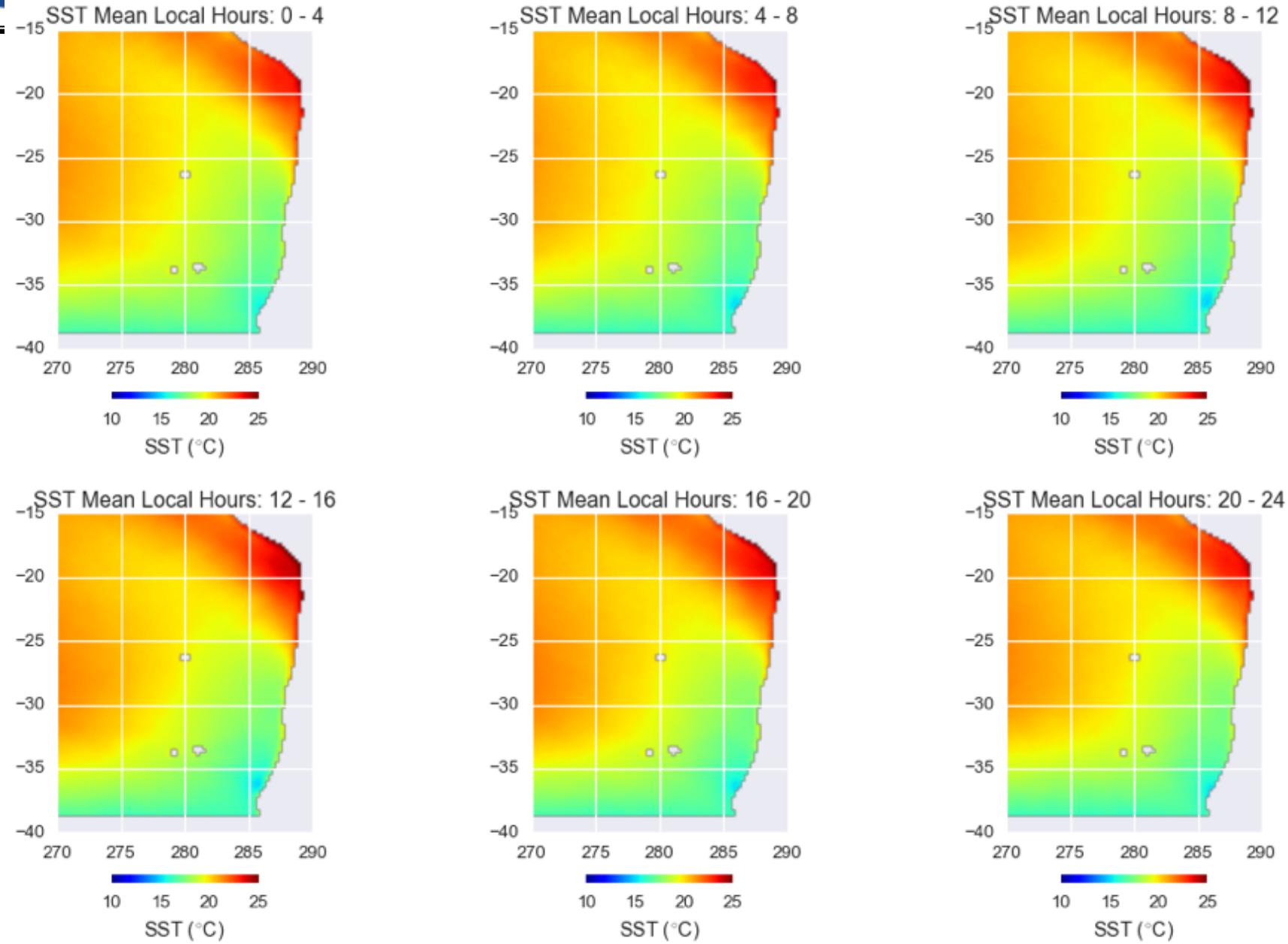
Tehuantepec, Dec’15-Jan’16



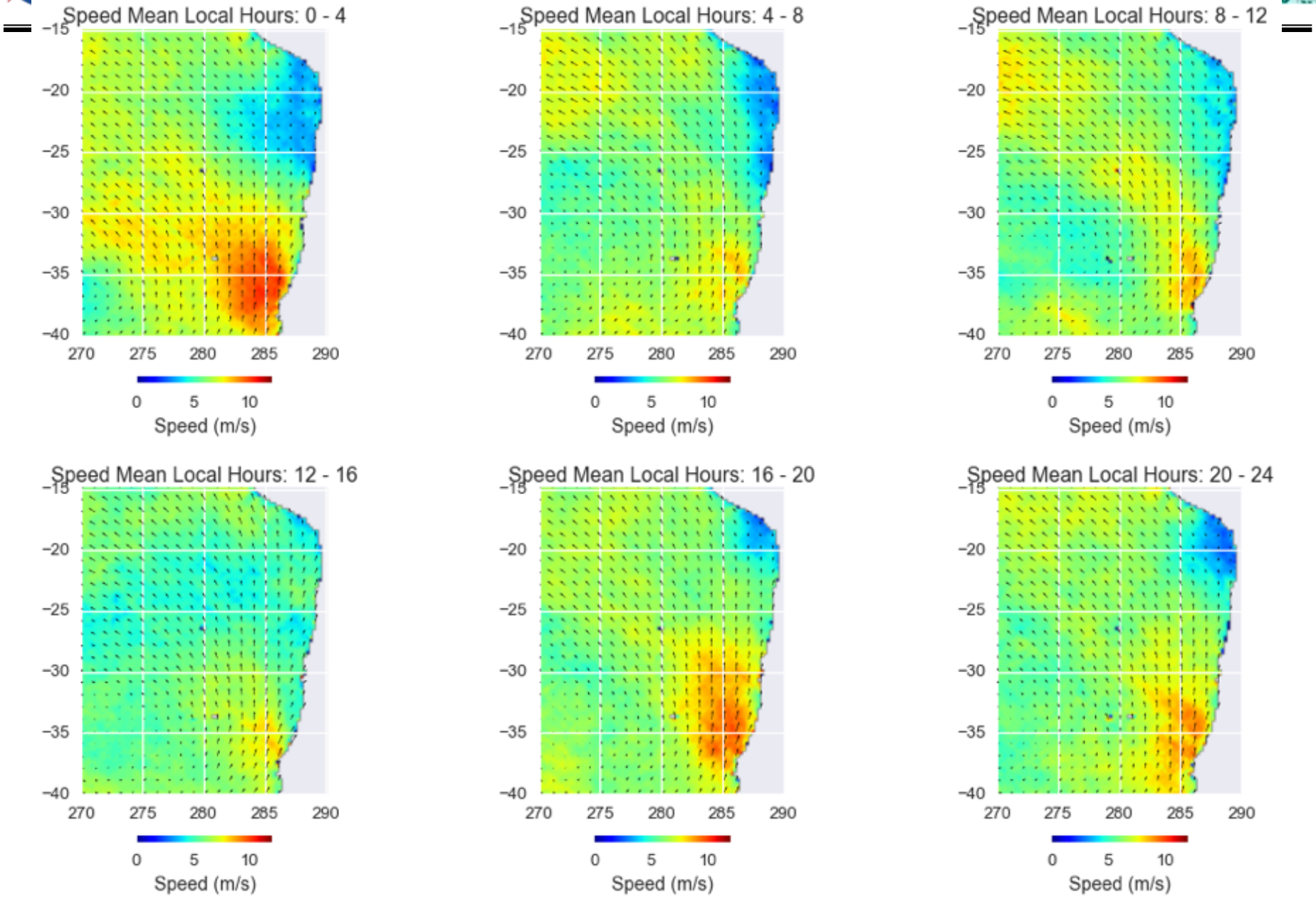
TMI Wind Speed Chile Coast Dec-Jan



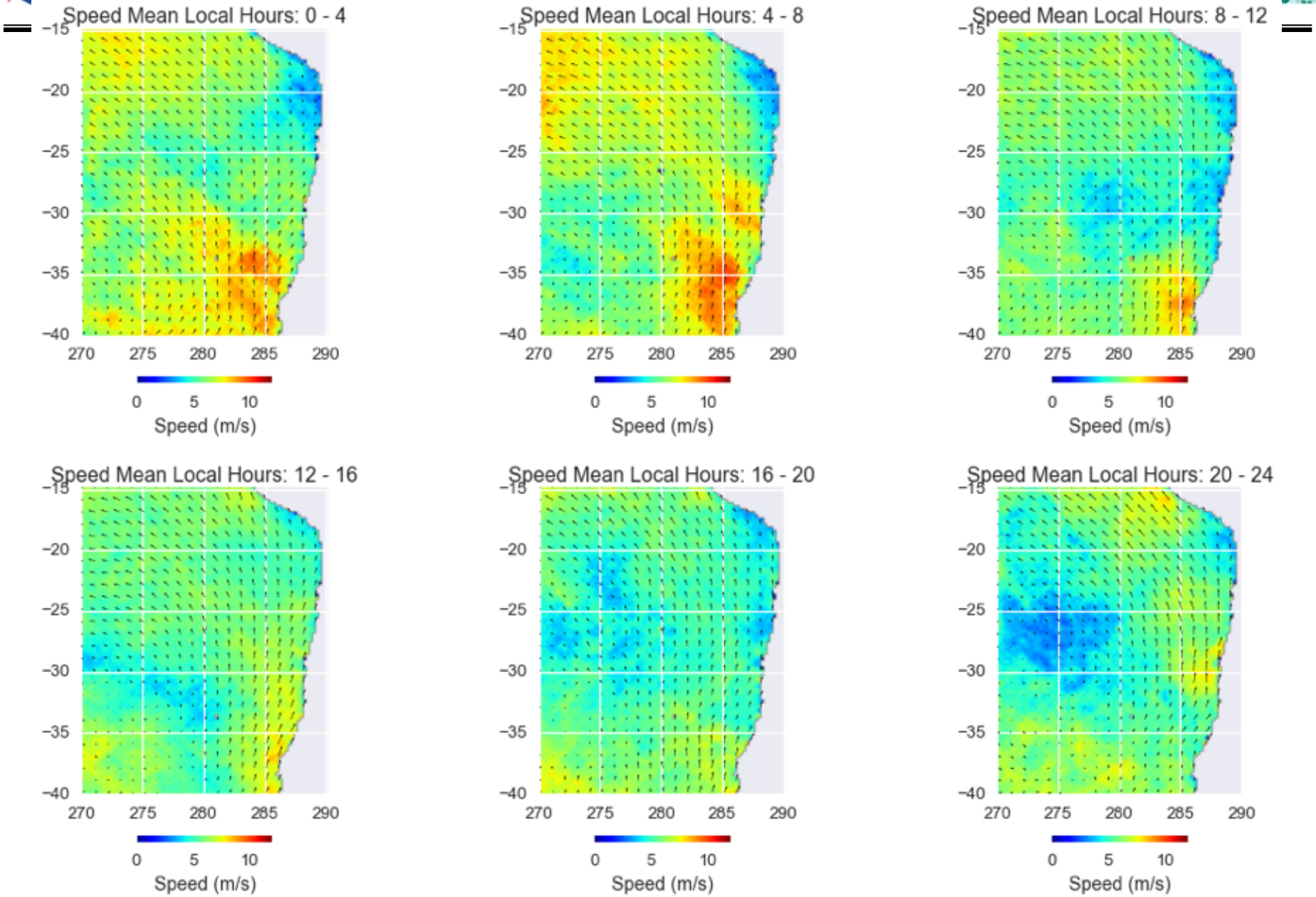
TMI SST Chile Coast Dec-Jan



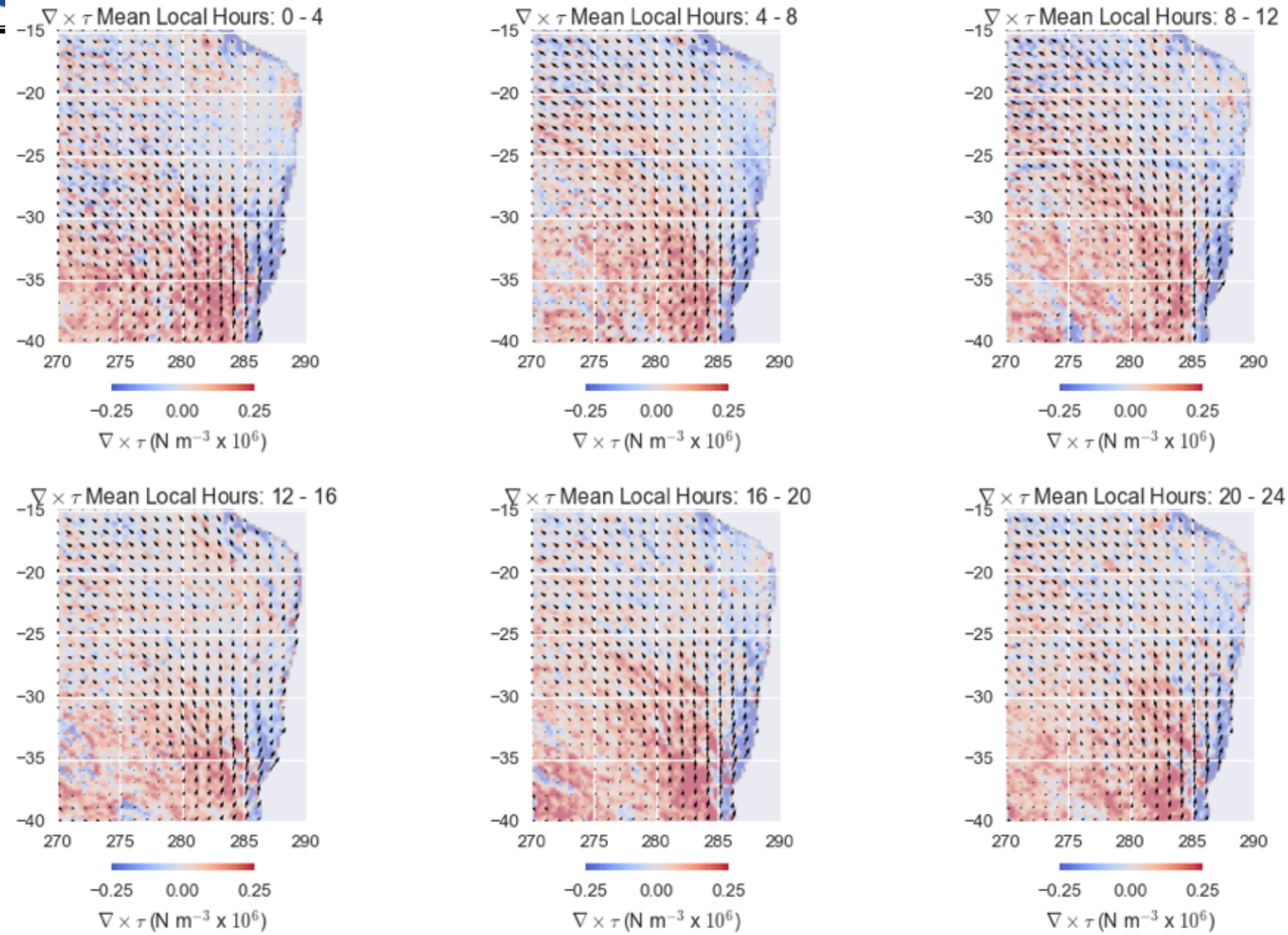
Chile Coast: Dec’14-Jan’15



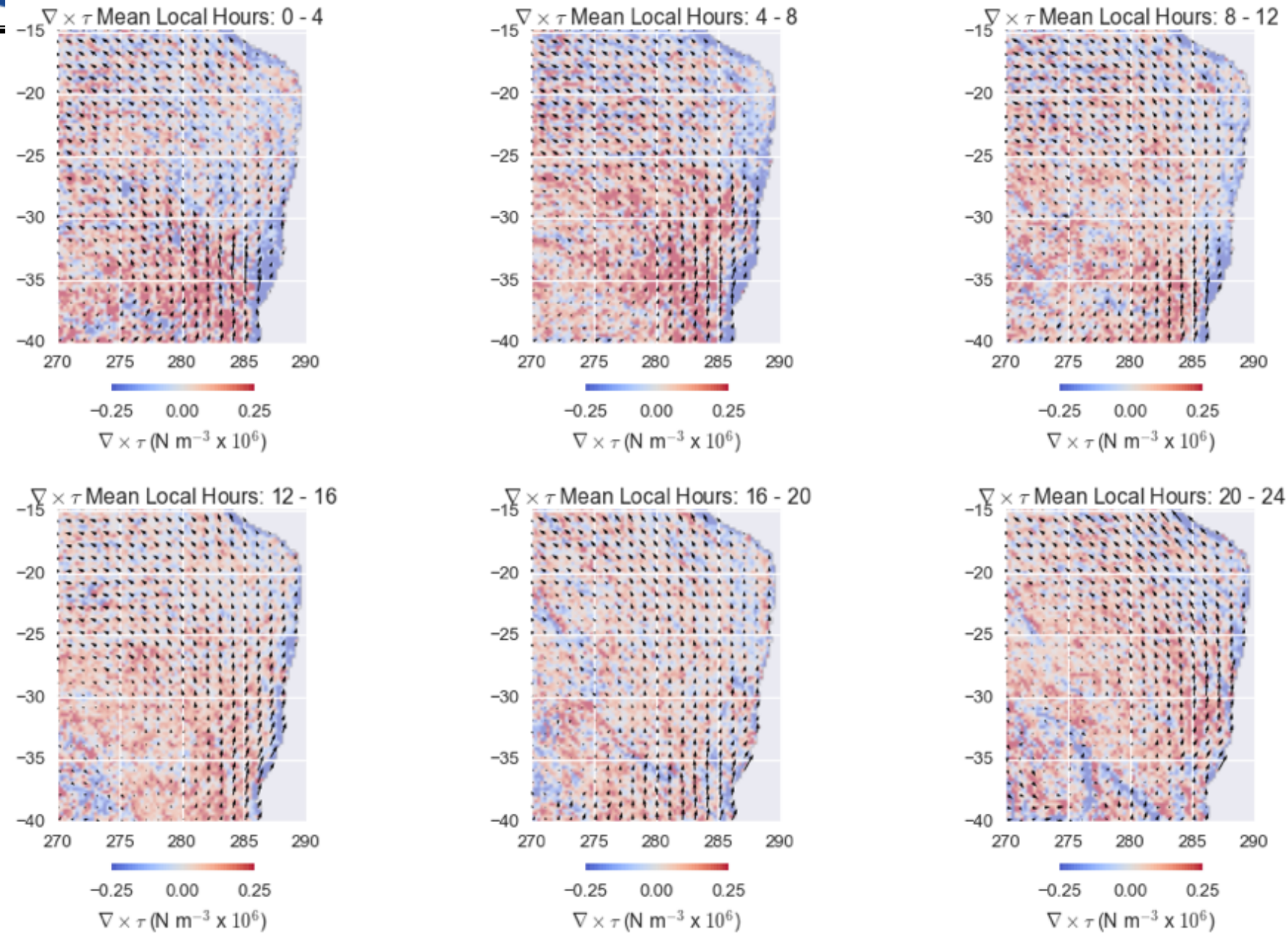
Chile Coast: Dec’15-Jan’16



Chile Coast: Dec'14-Jan'15

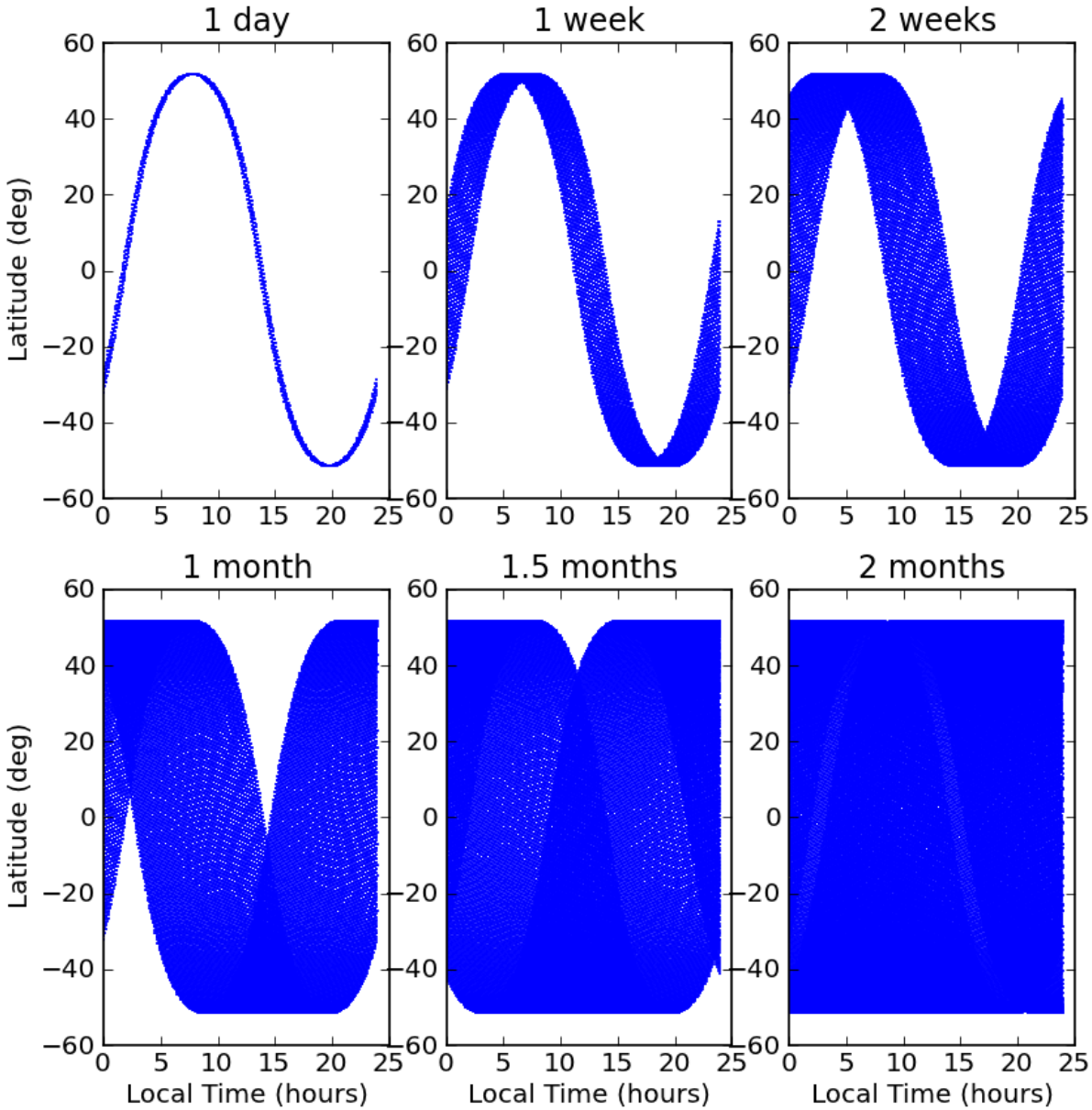


Chile Coast: Dec'15-Jan'16



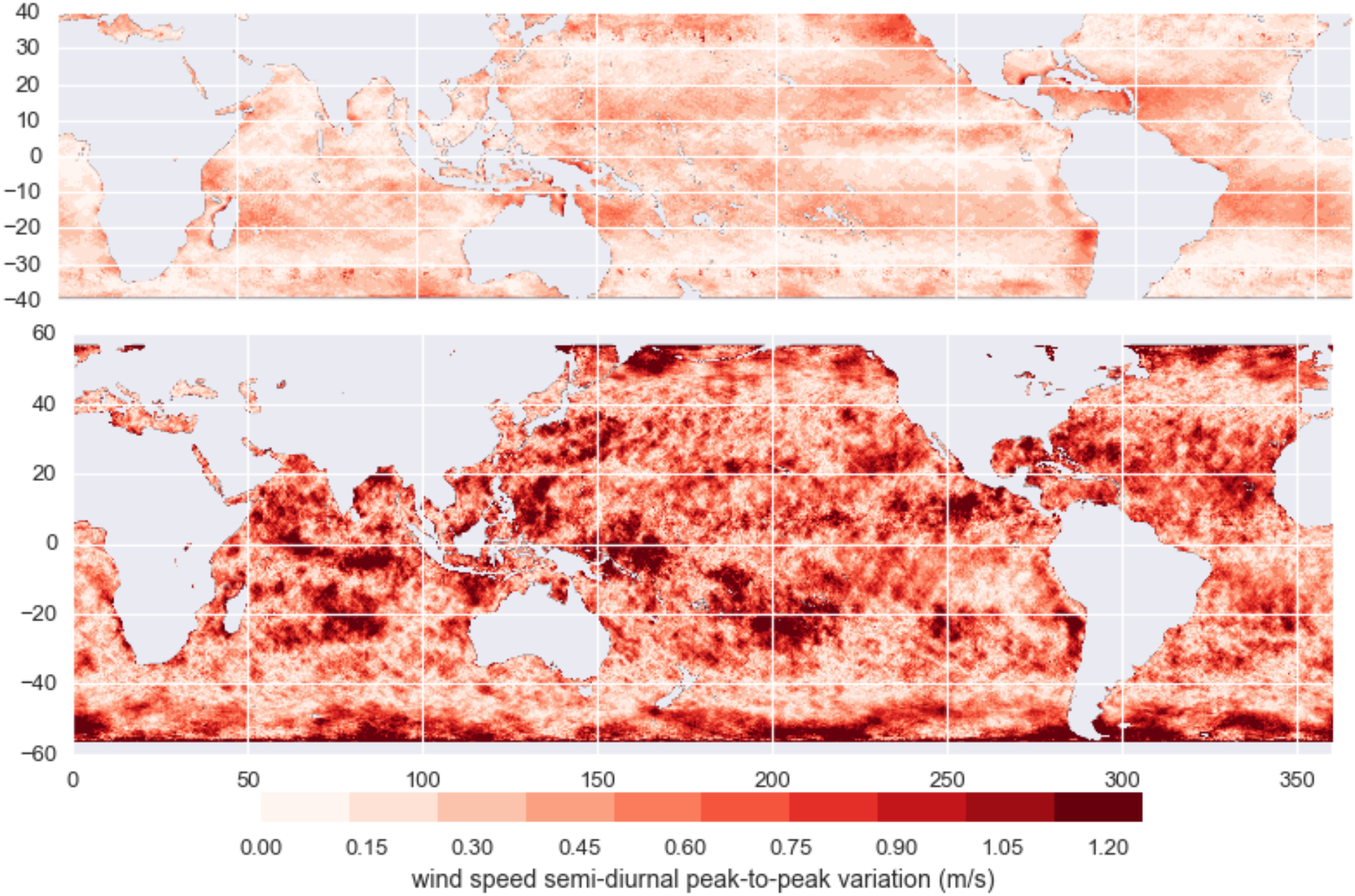
BACKUPS

Mapping of the Diurnal Cycle



- Mapping the diurnal and semi-diurnal cycles requires, at a minimum, sampling every 6 hours in local time.
- The local time sampling characteristics of the ISS are to revisit the same latitude at slightly different local times each orbit.
- To fully sample the diurnal and semi-diurnal cycles once globally requires at least 2 months of data.
- To estimate diurnal and semi-diurnal cycles accurately, on the order of 10 sets of observations (~2 years) will be required.

TMI & RapidScat Semi-Diurnal Variation



Eastern Pacific Wind Jets

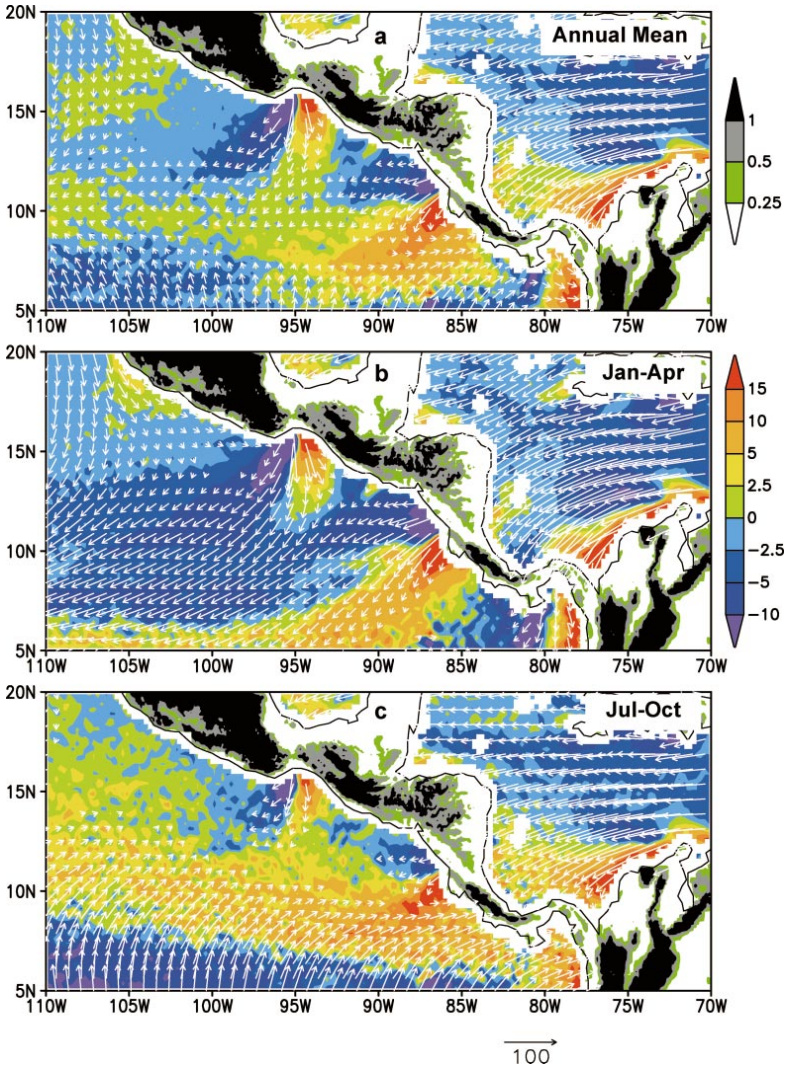
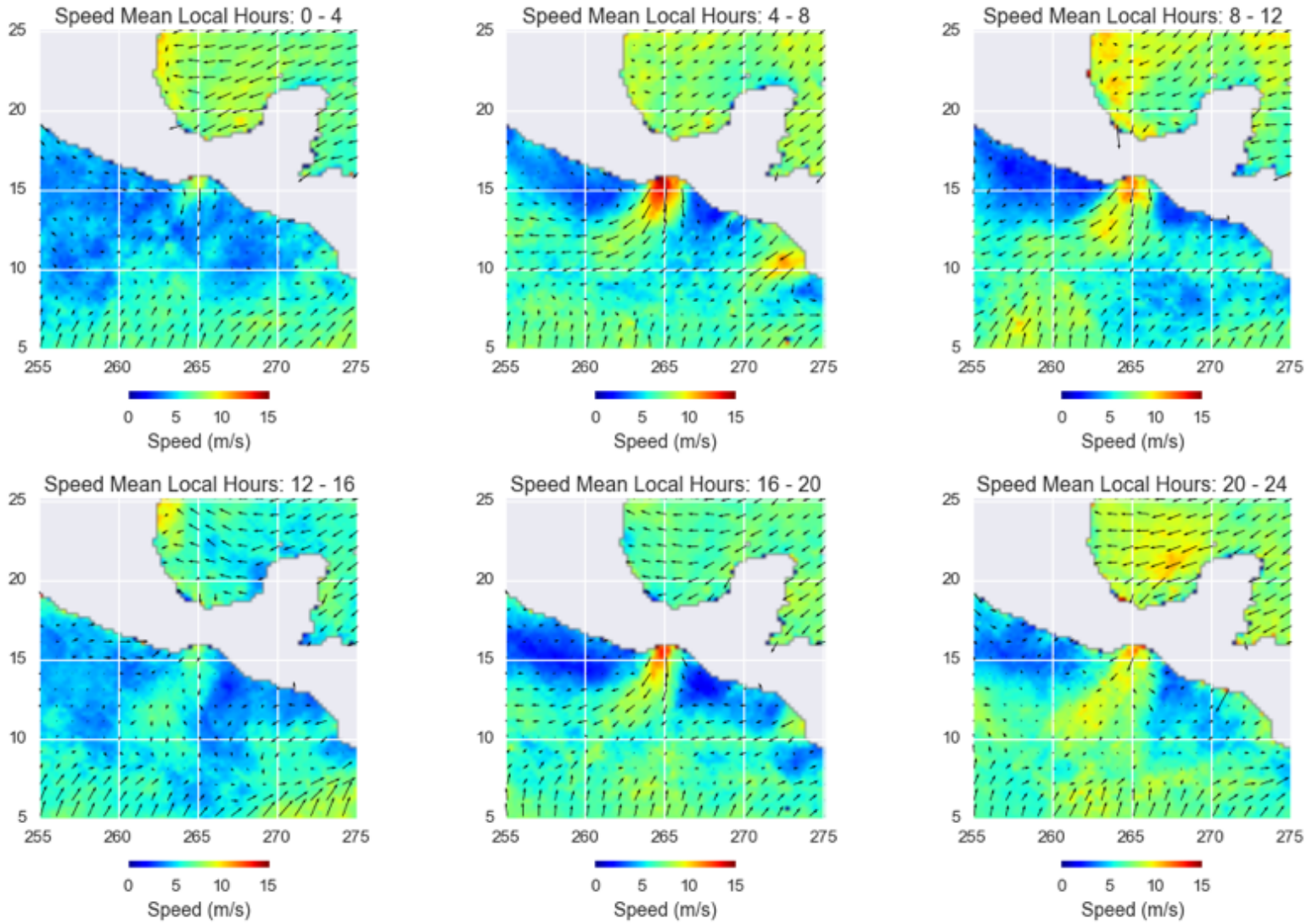


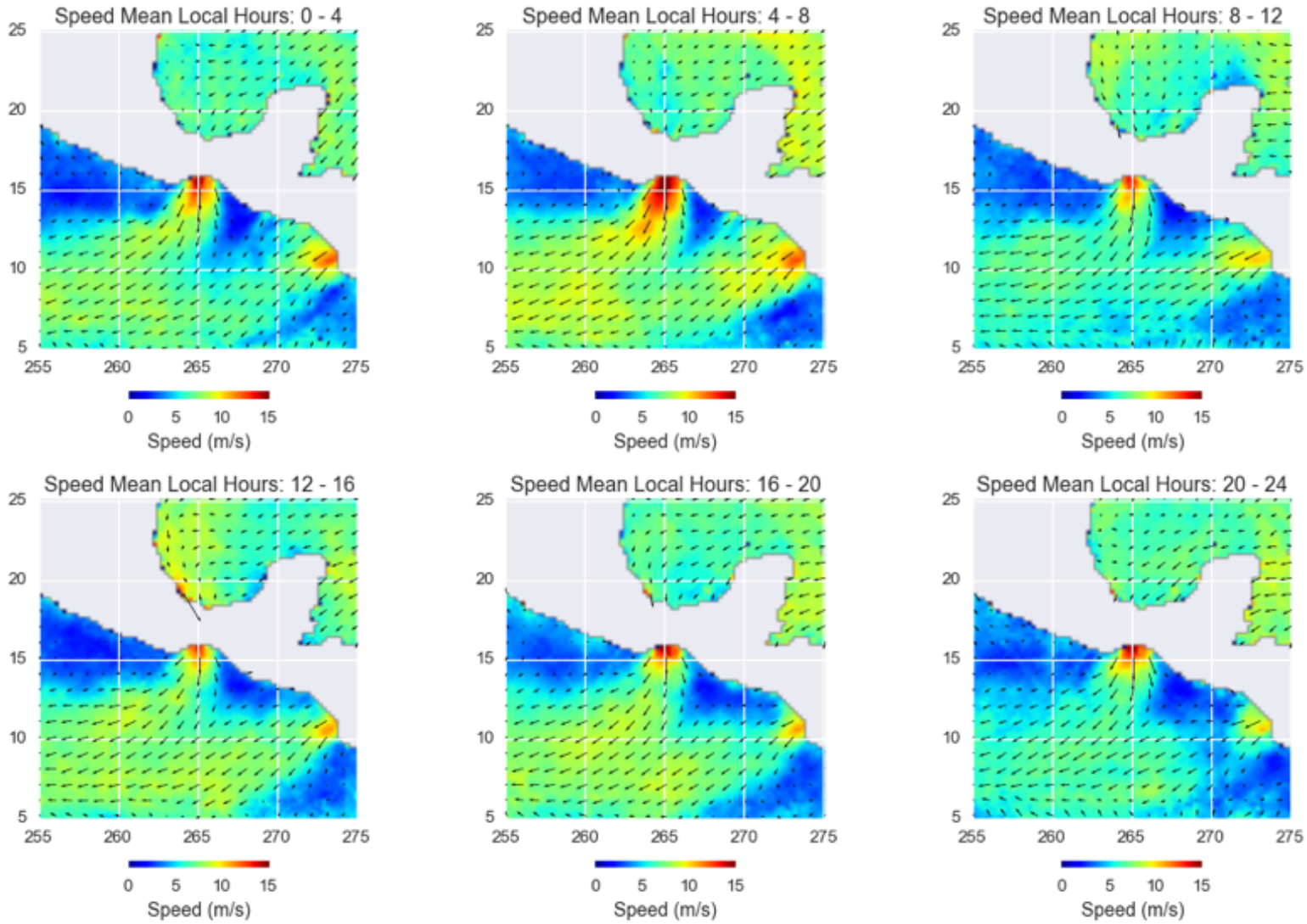
FIG. 3. QuikSCAT pseudo–wind stress (vectors in $m^2 s^{-2}$) and Ekman pumping velocity (shade in 10^{-6} m s^{-1}) climatology: (a) annual mean, (b) Jan–Apr, and (c) Jul–Oct. Land orography (km) is plotted in color shading.

S. Xie, H. Xu, W. Kessler, and M. Nonaka, "Air–sea interaction over the eastern pacific warm pool: Gap winds, thermocline dome, and atmospheric convection," Journal of Climate, vol. 18, no. 1, pp. 5–20, 2005.

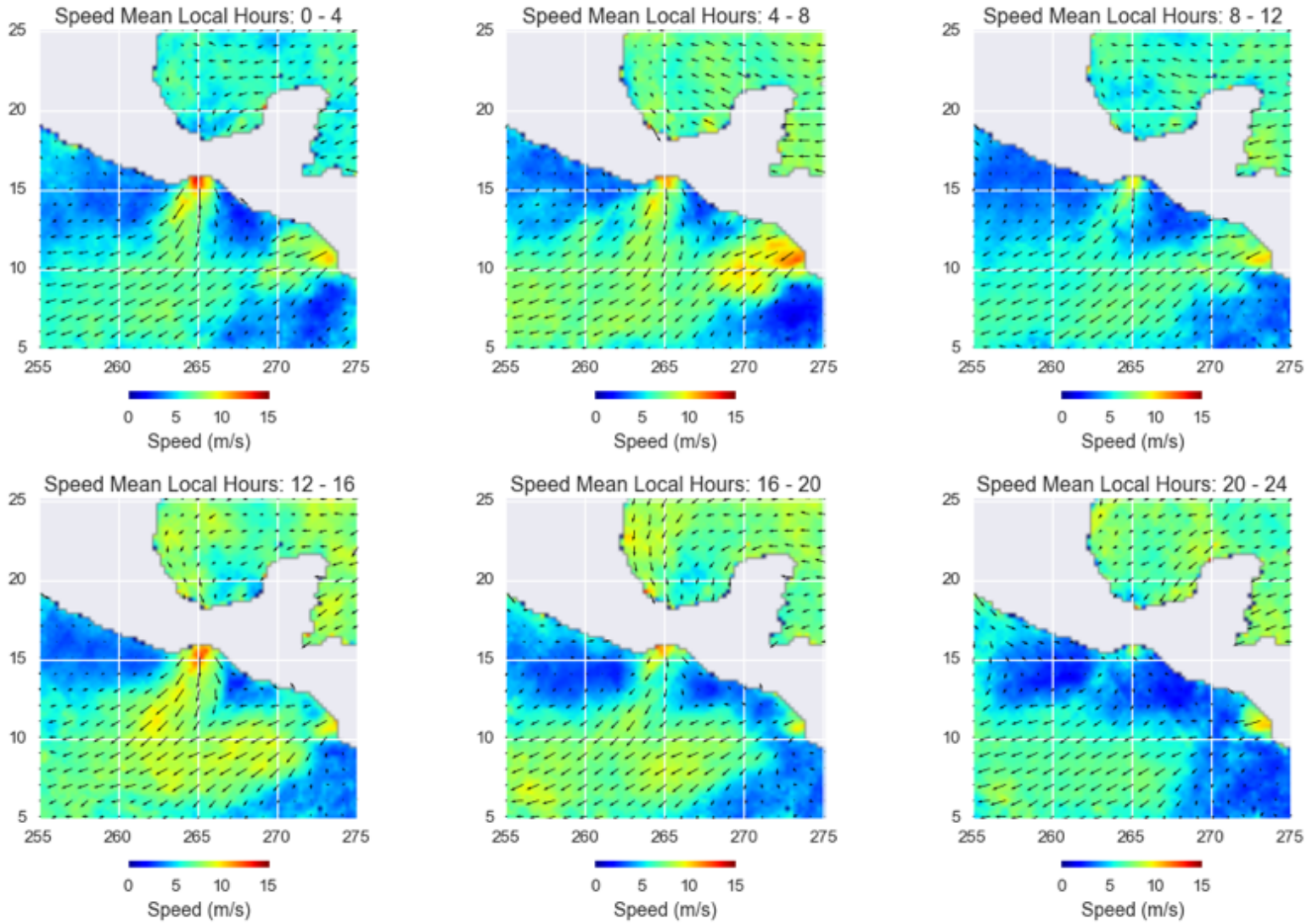
Tehuantepec: October-November



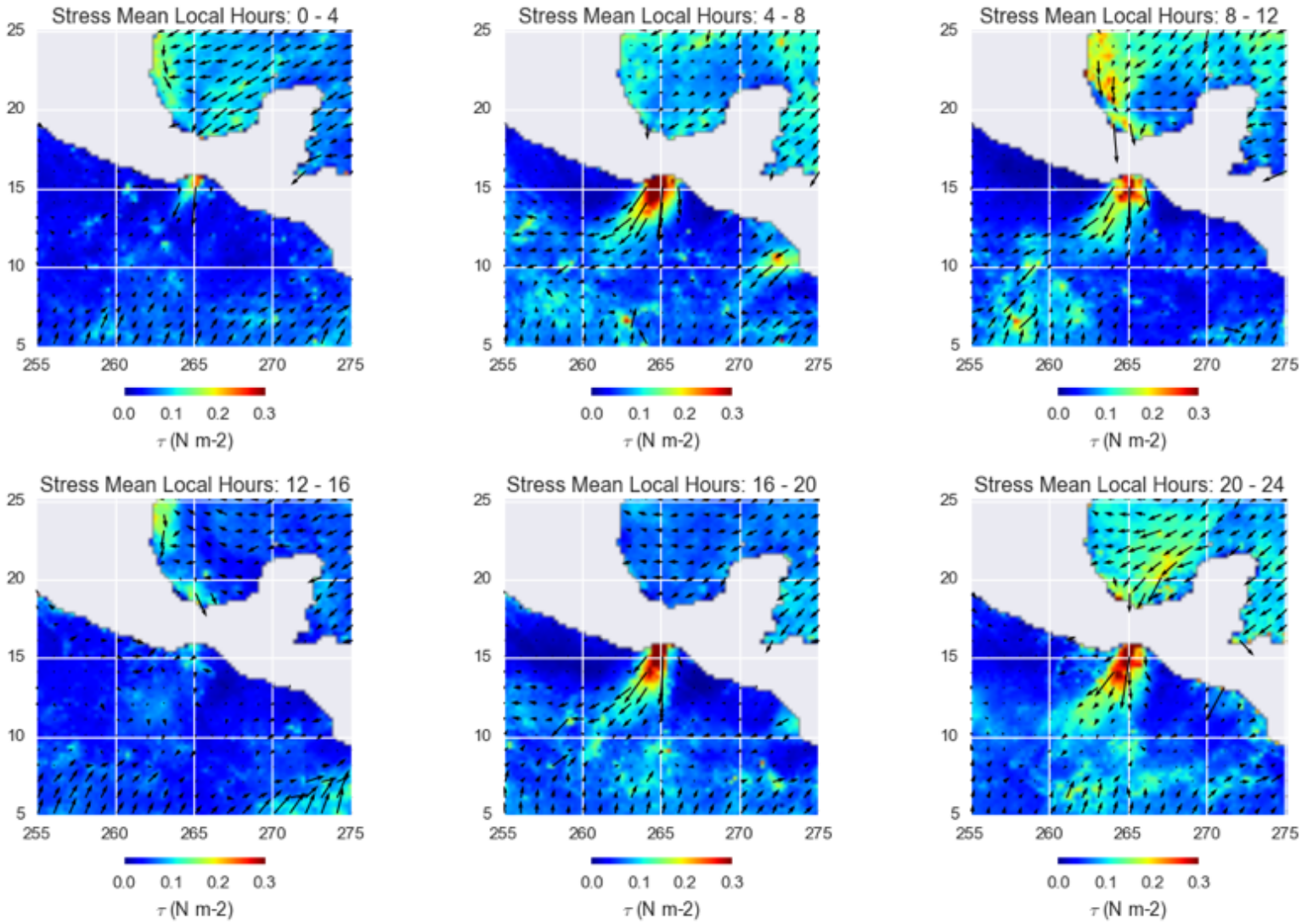
Tehuantepec: December-January



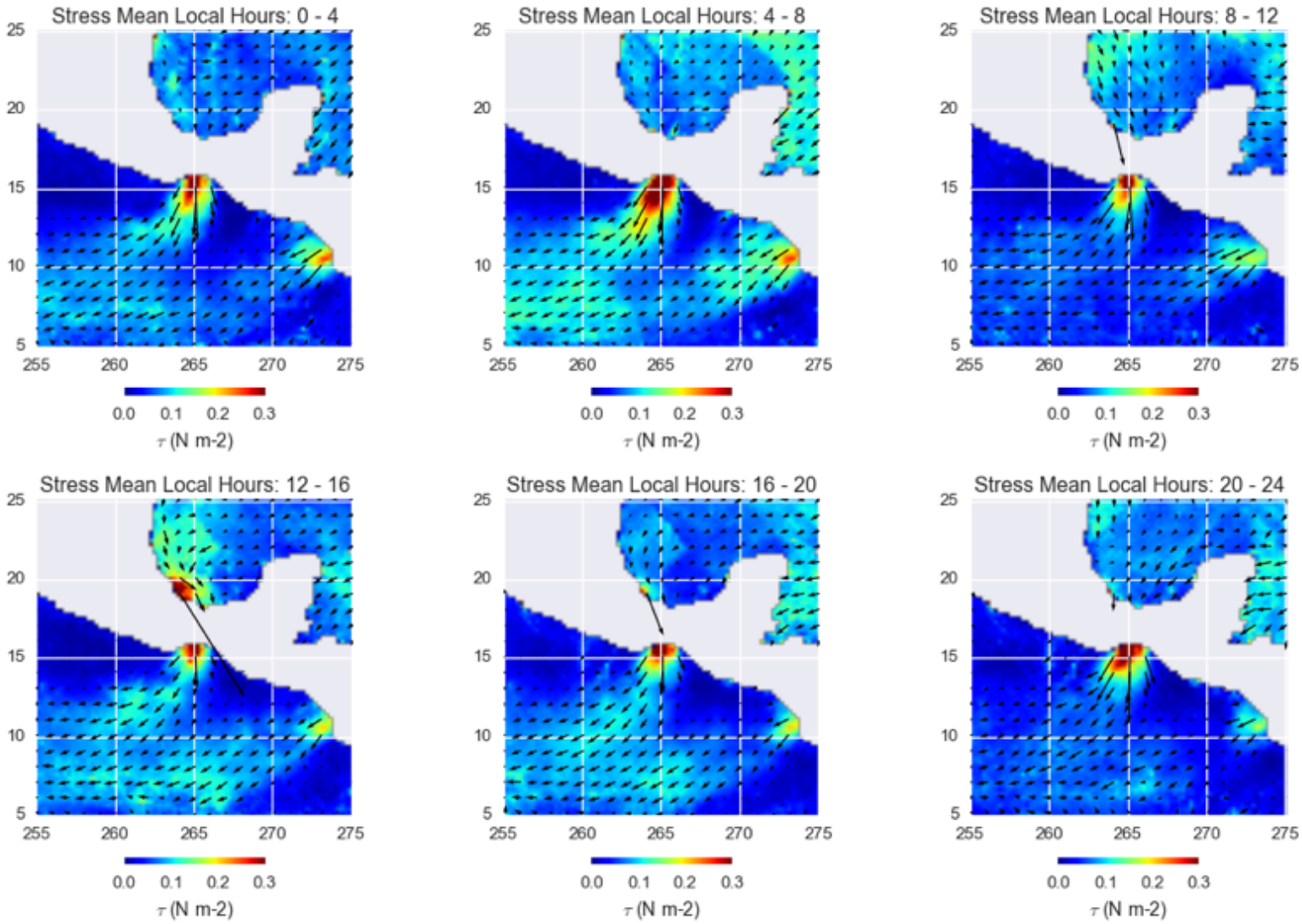
Tehuantepec: February-March



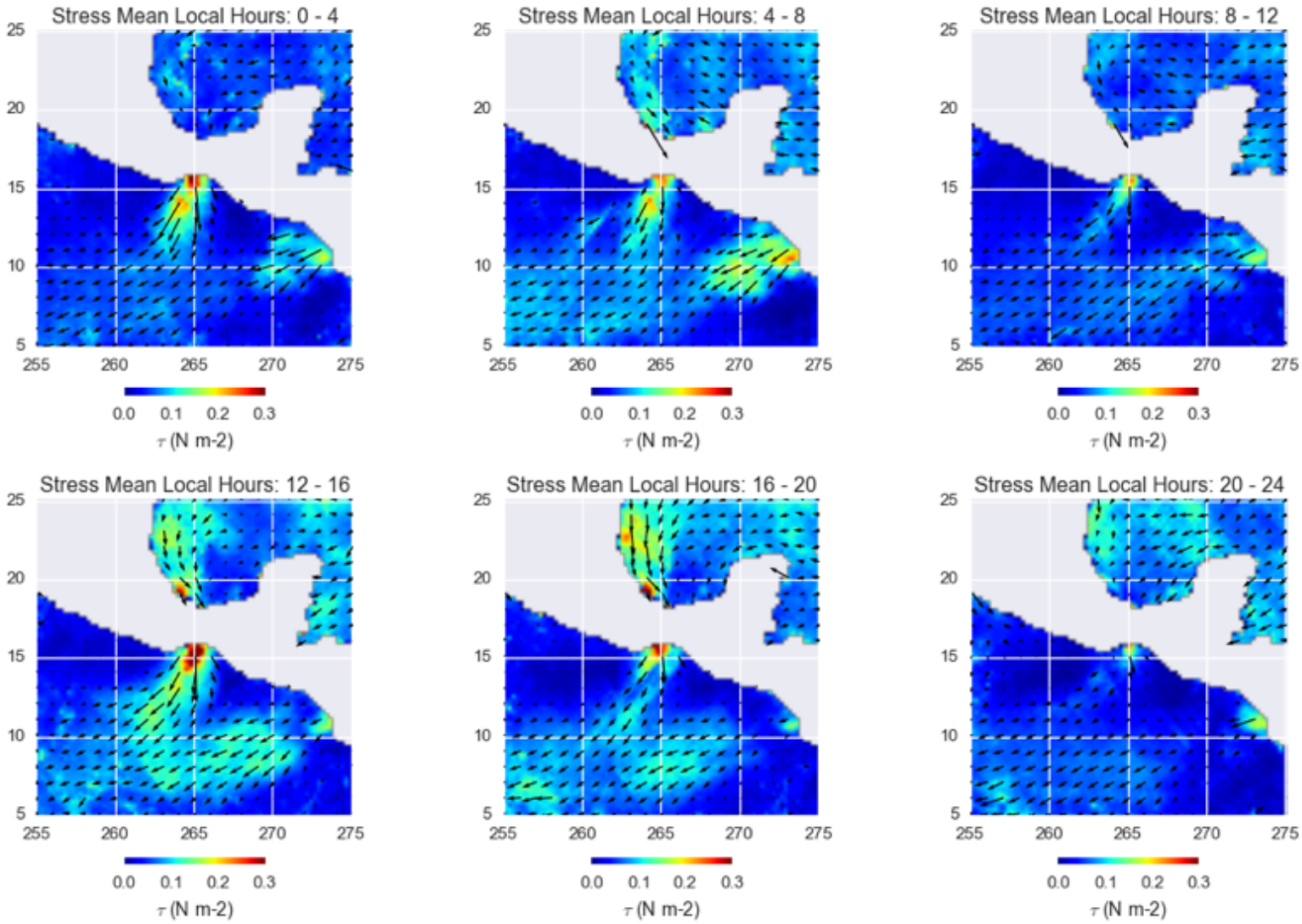
Tehuantepec: October-November



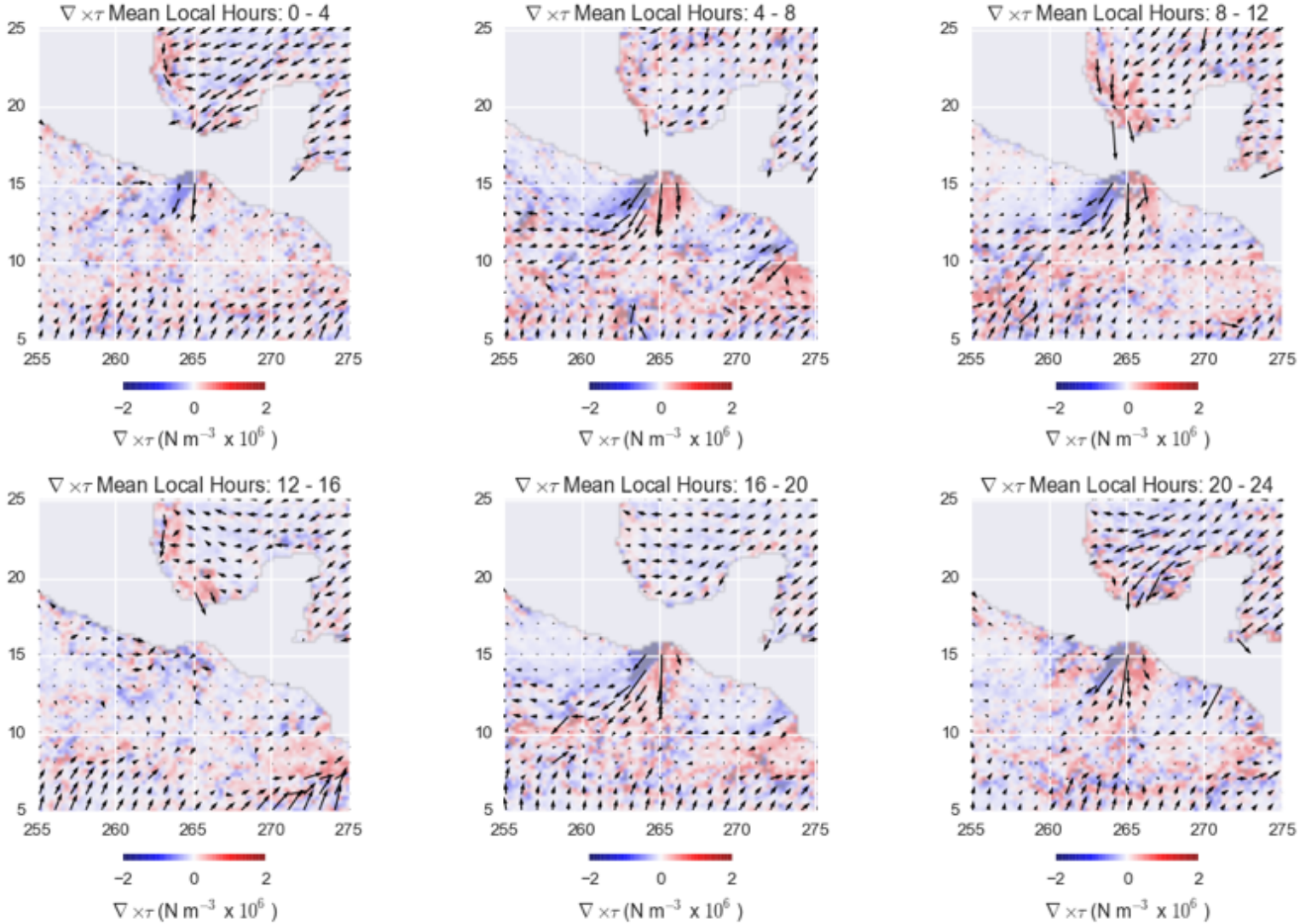
Tehuantepec: December-January



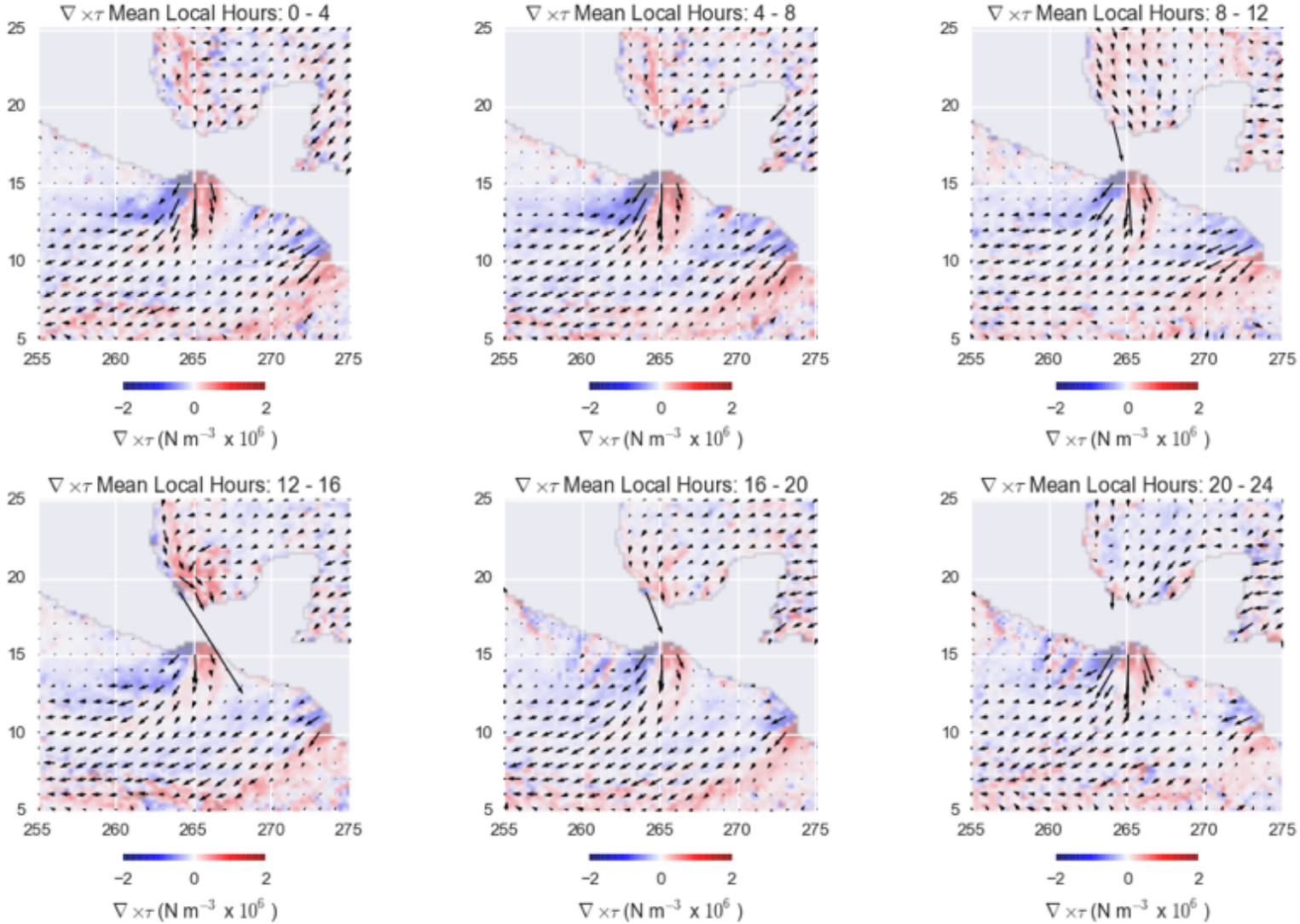
Tehuantepec: February-March



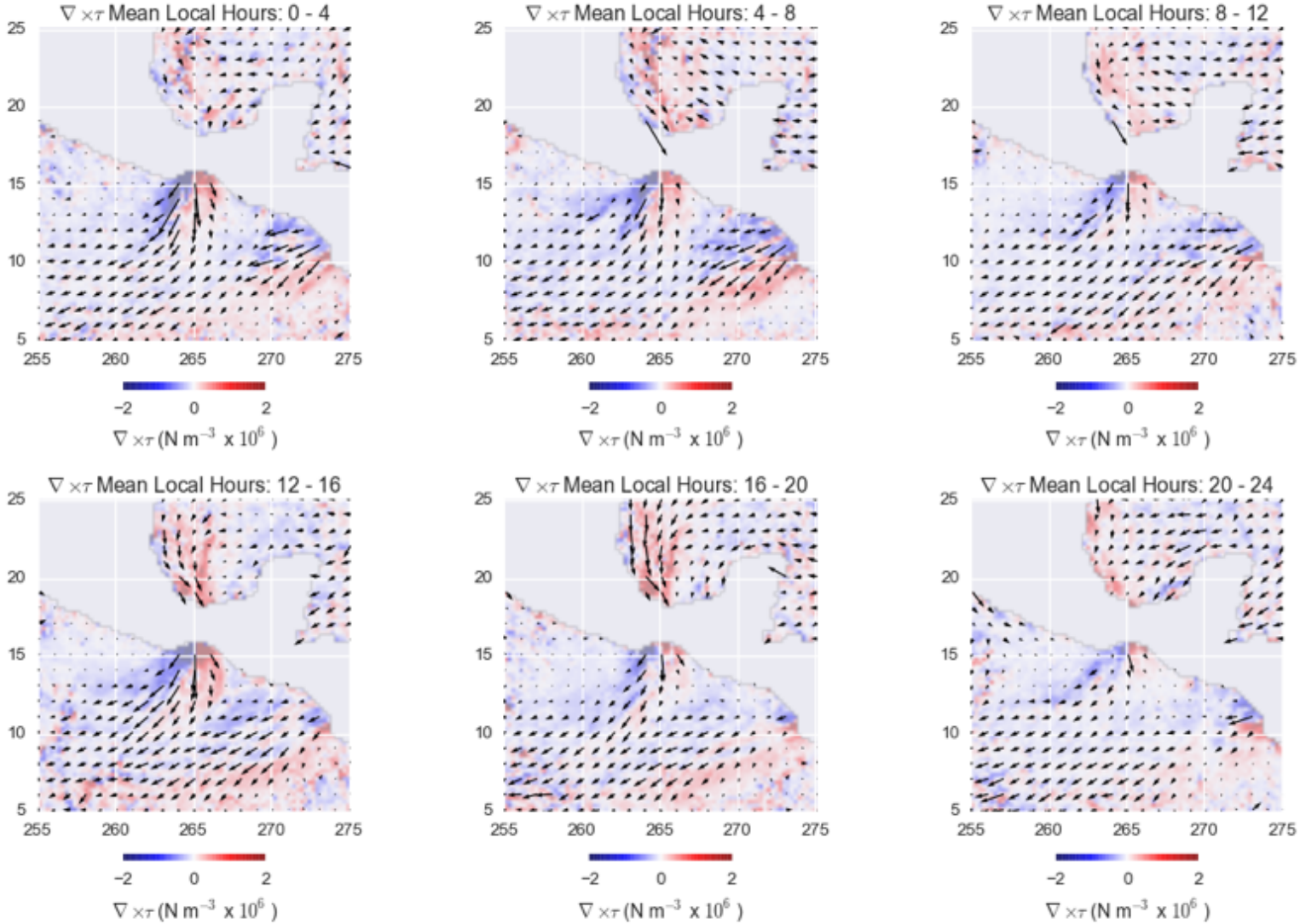
Tehuantepec: October-November



Tehuantepec: December-January



Tehuantepec: February-March



Guajira Upwelling System

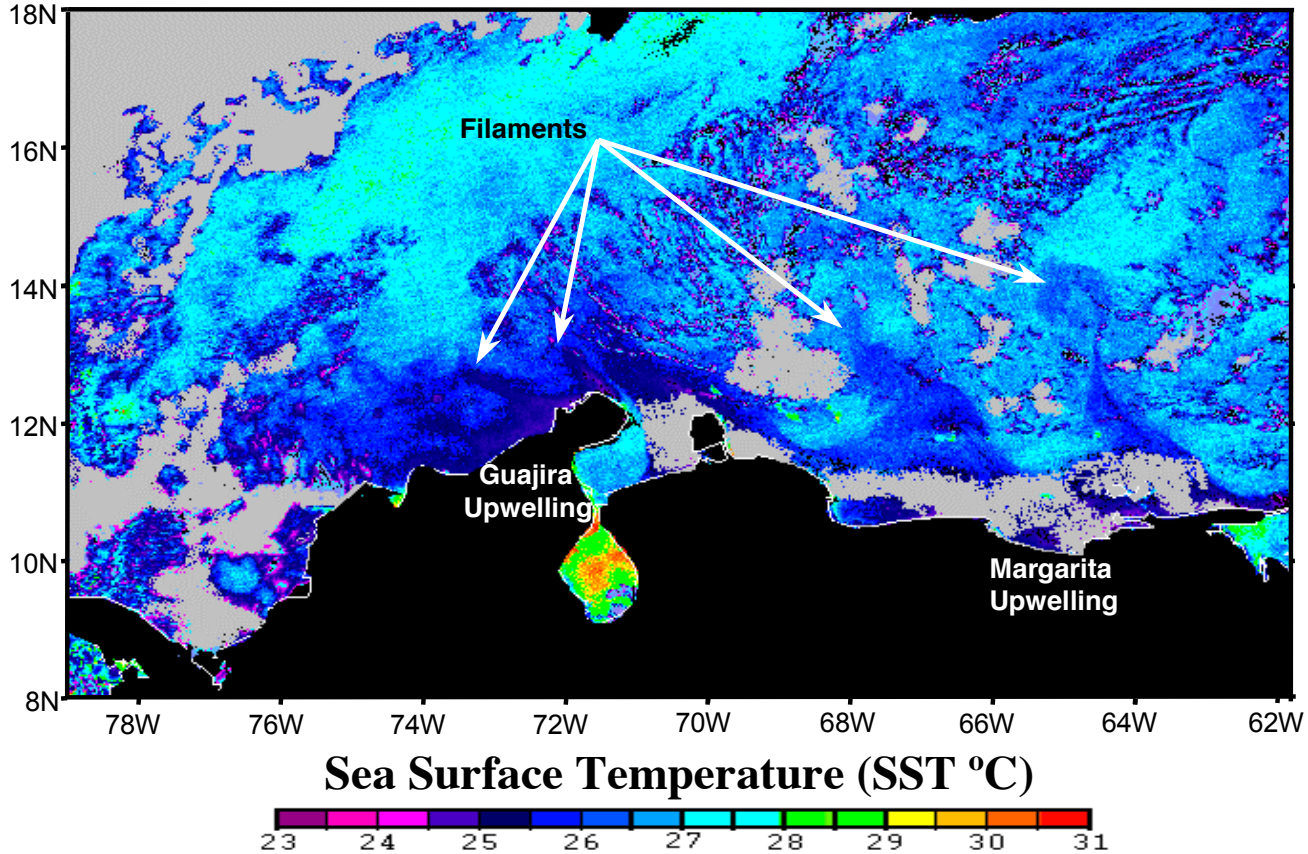
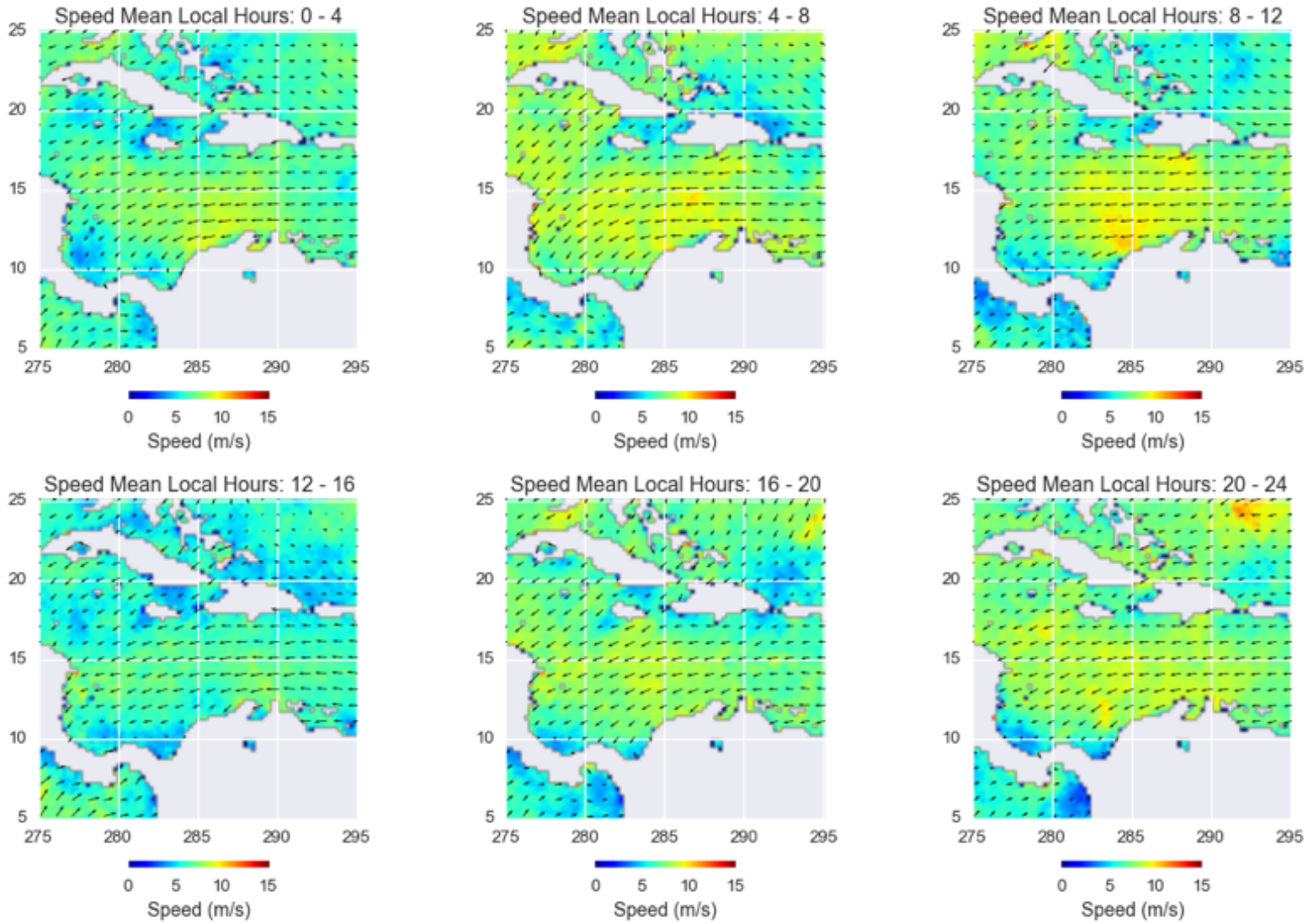


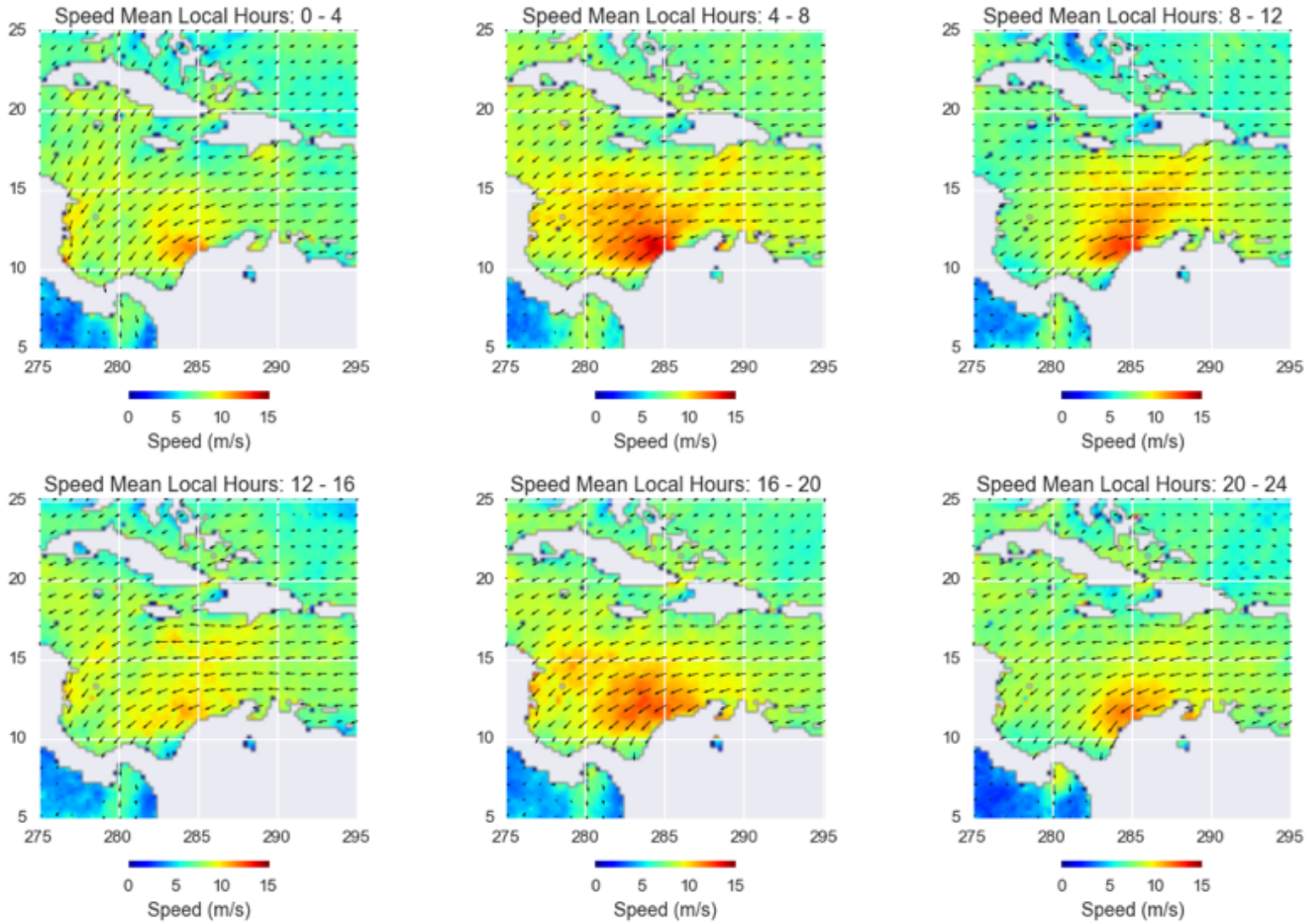
Figure 2. SST from AVHRR image of 12 March 1998. At least 4 filaments are seen in the upwelling zones along the South American coast, including those off Guajira and Margarita Island. Grey areas indicate cloud.

Andrade, C and Barton. E.D., "The Guajira Upwelling System ", Continental Shelf Research, 2004

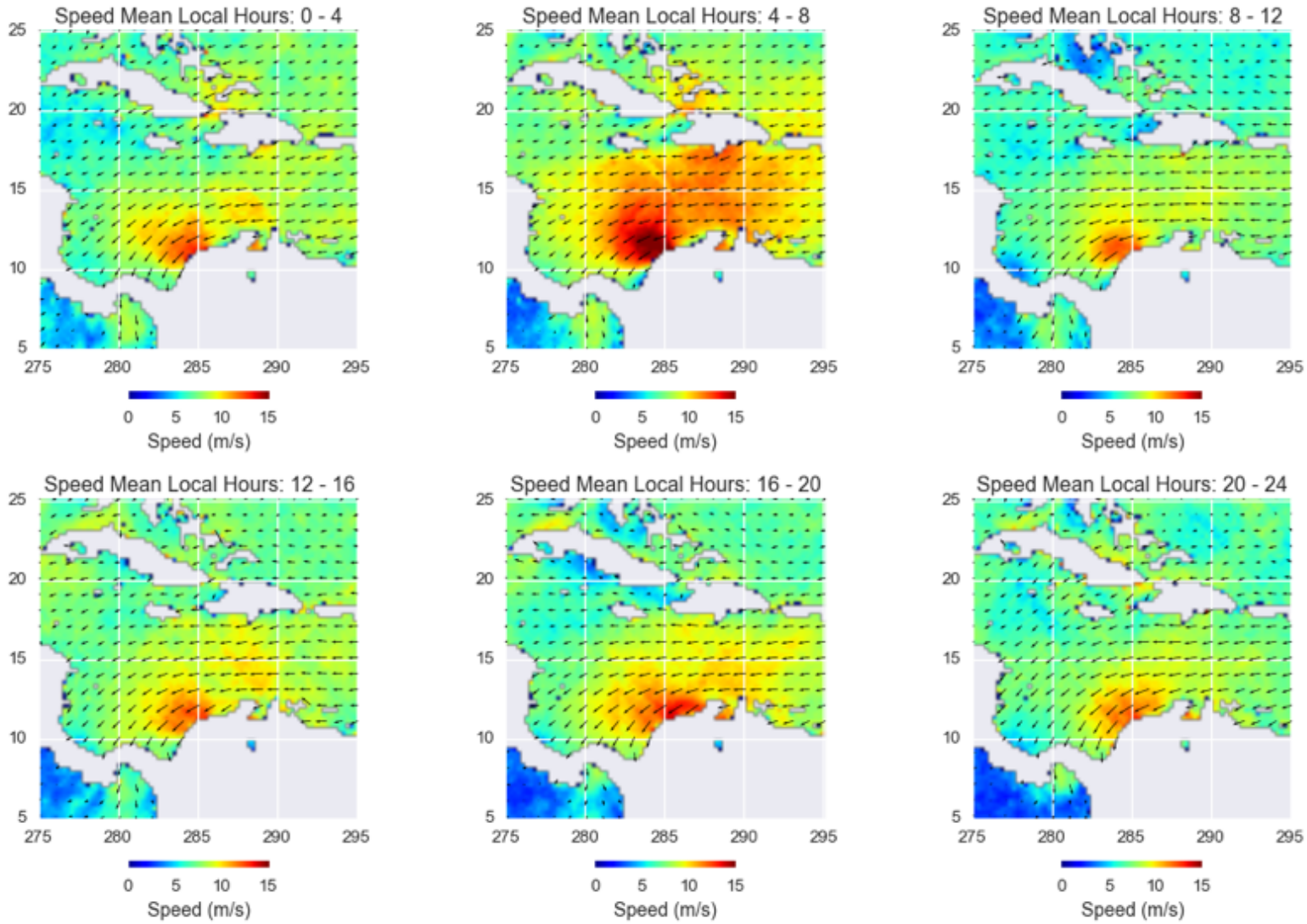
Guajira: October-November



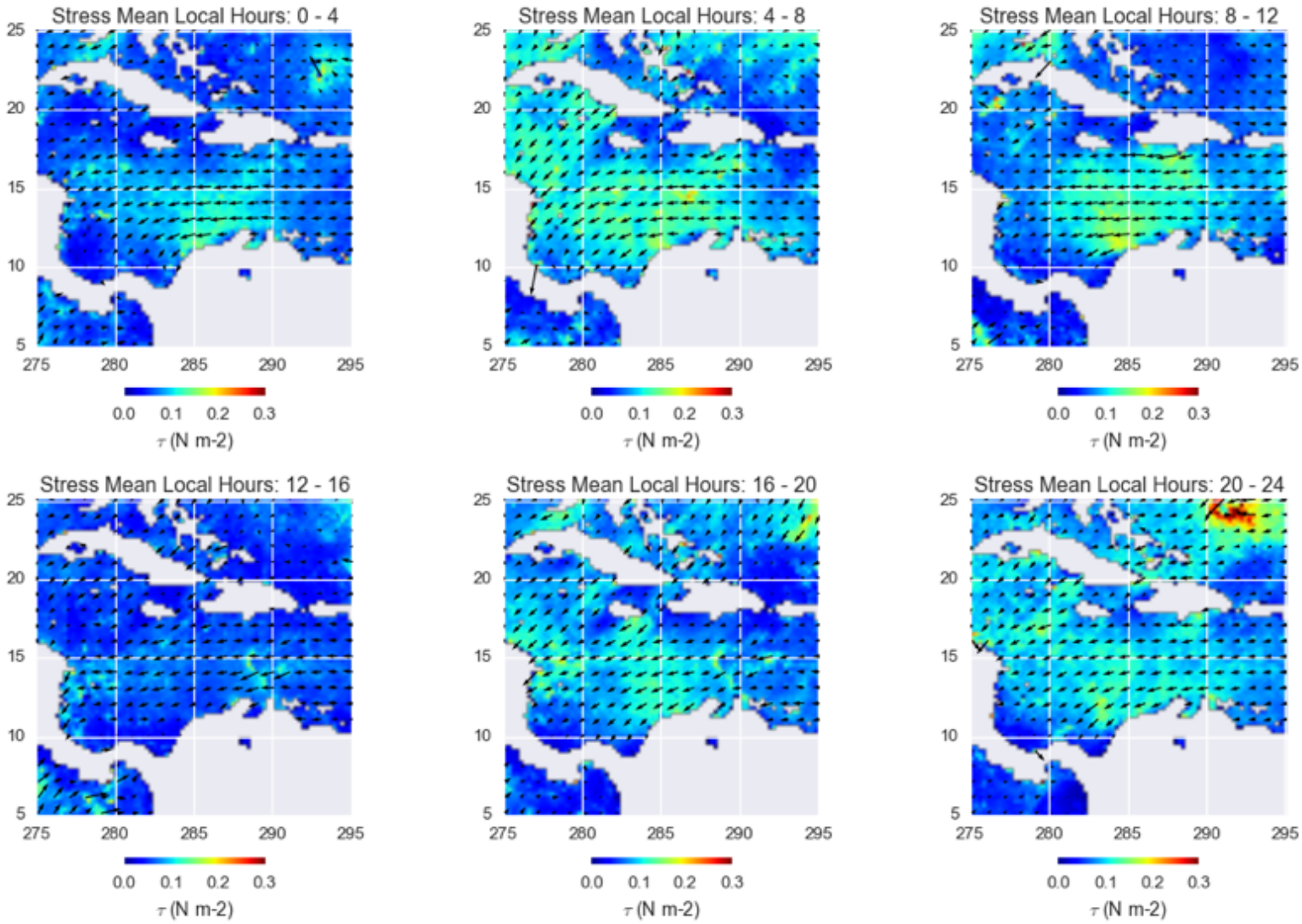
Guajira: December-January



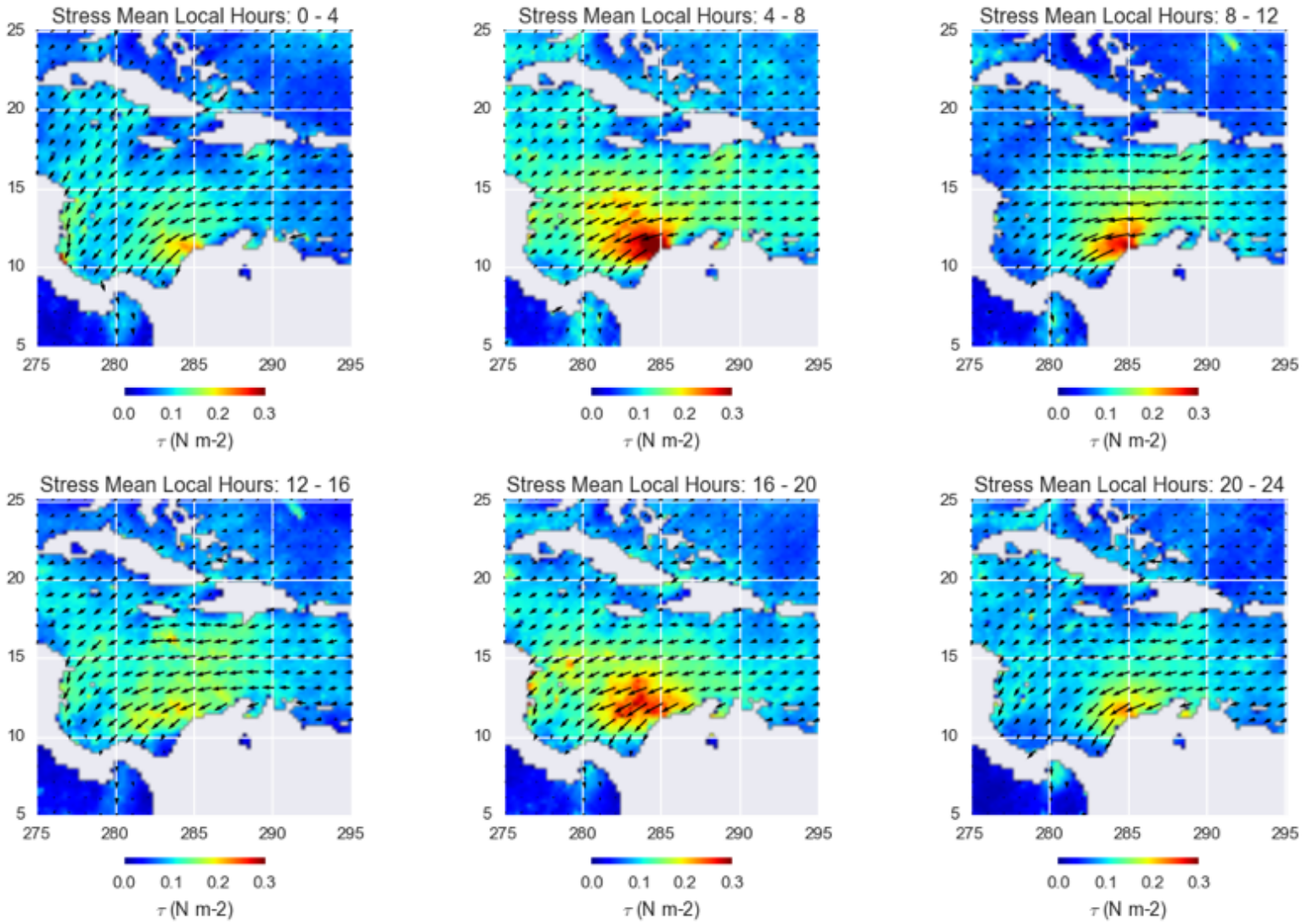
Guajira: February-March



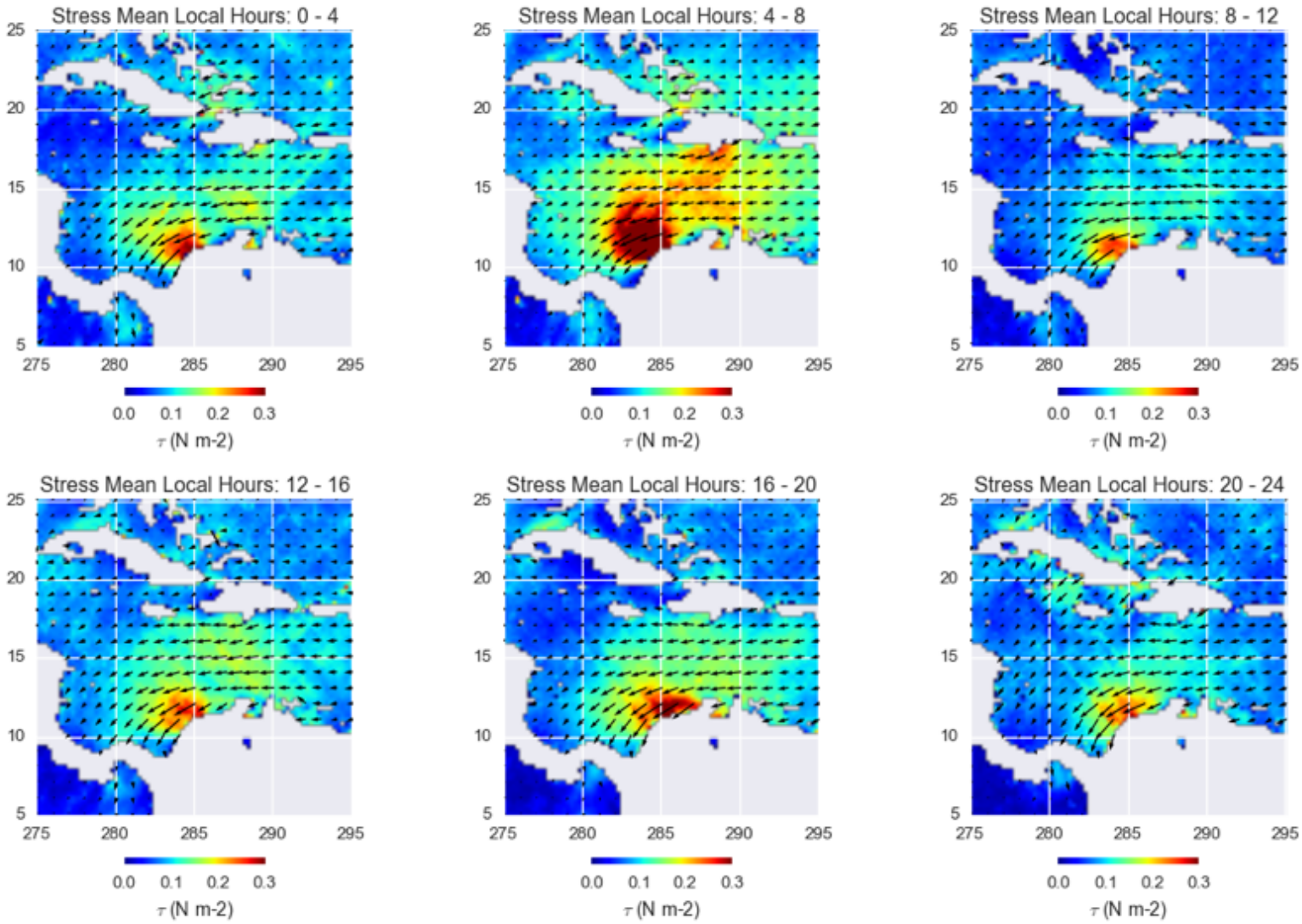
Guajira: October-November



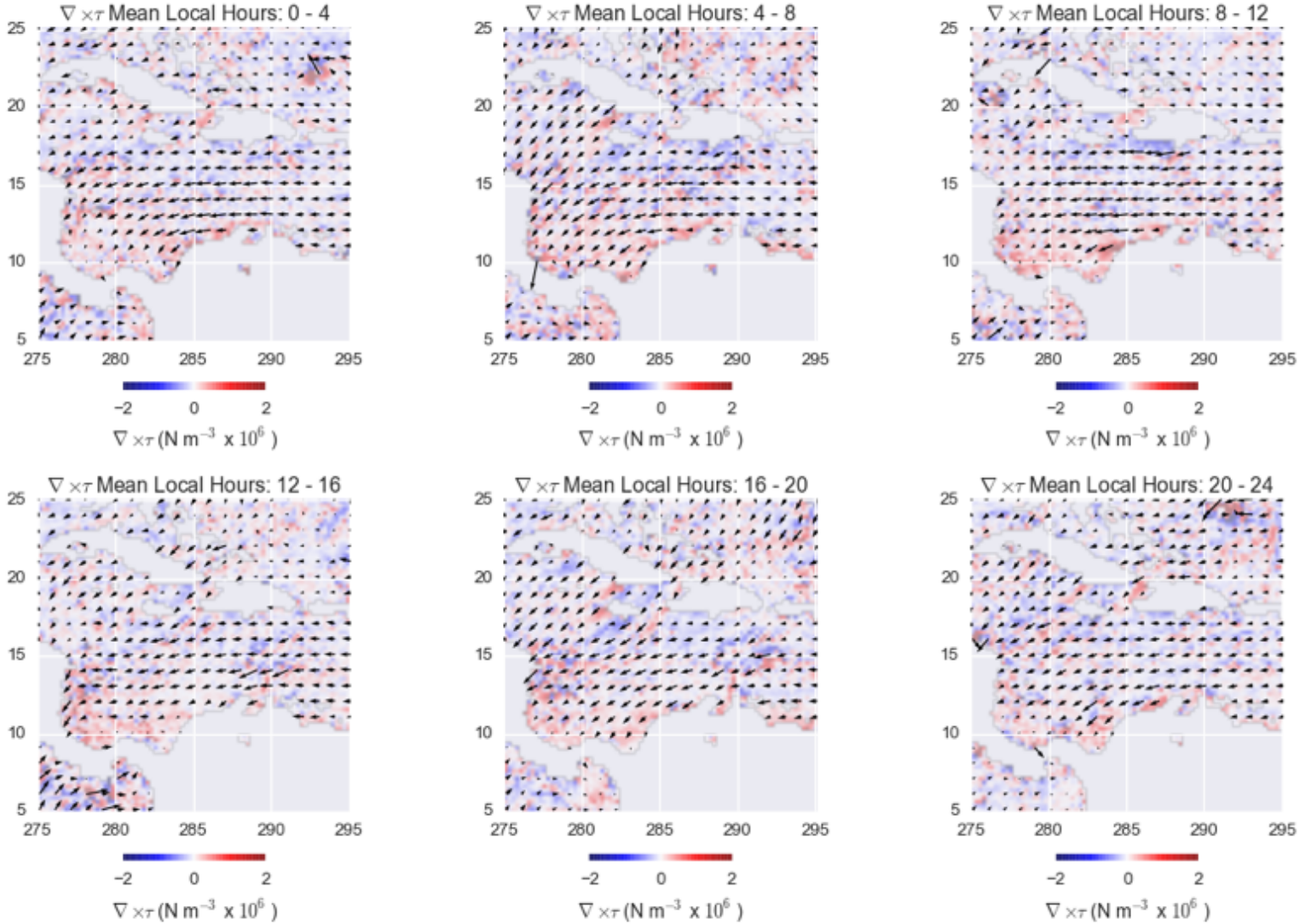
Guajira: December-January



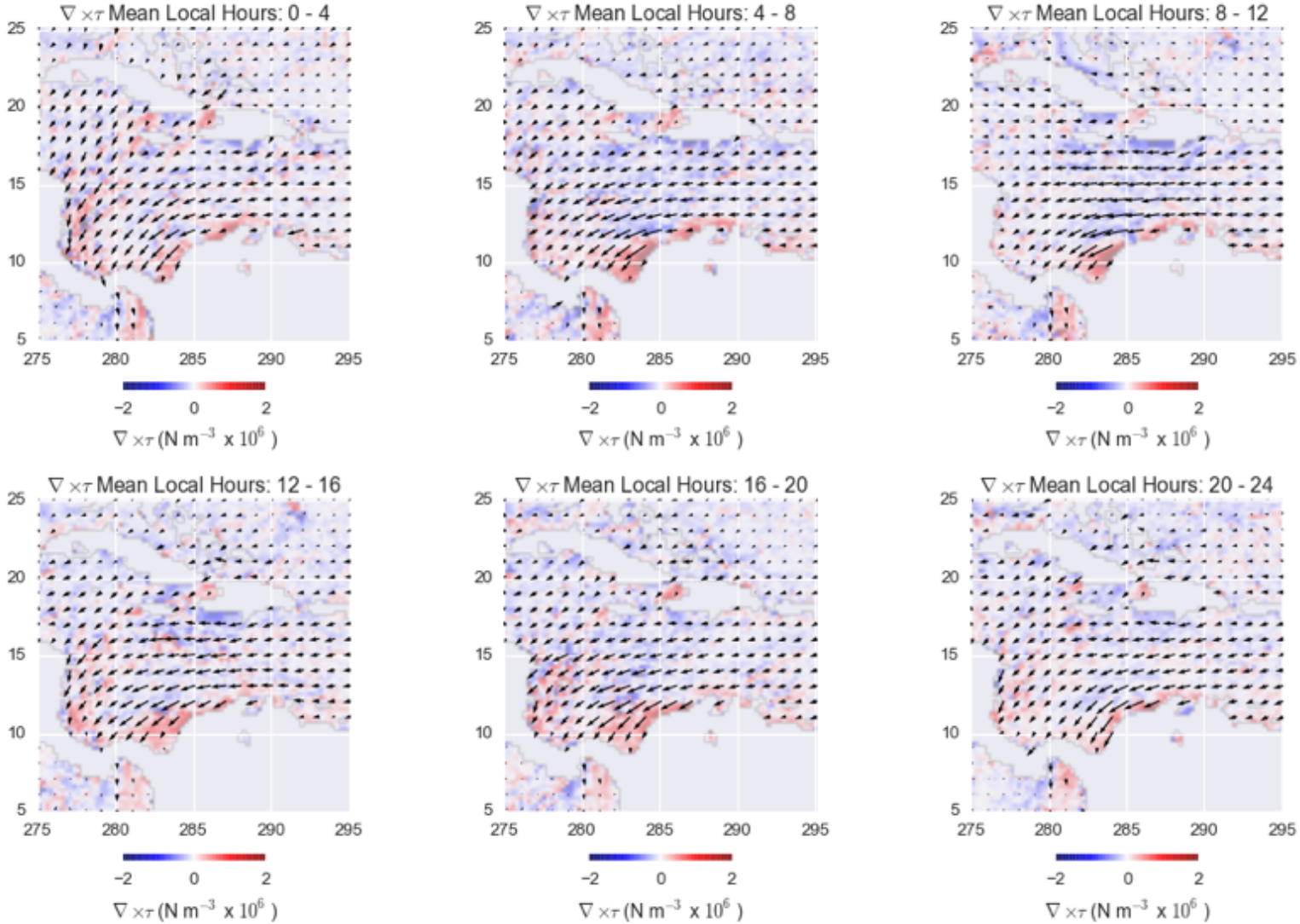
Guajira: February-March



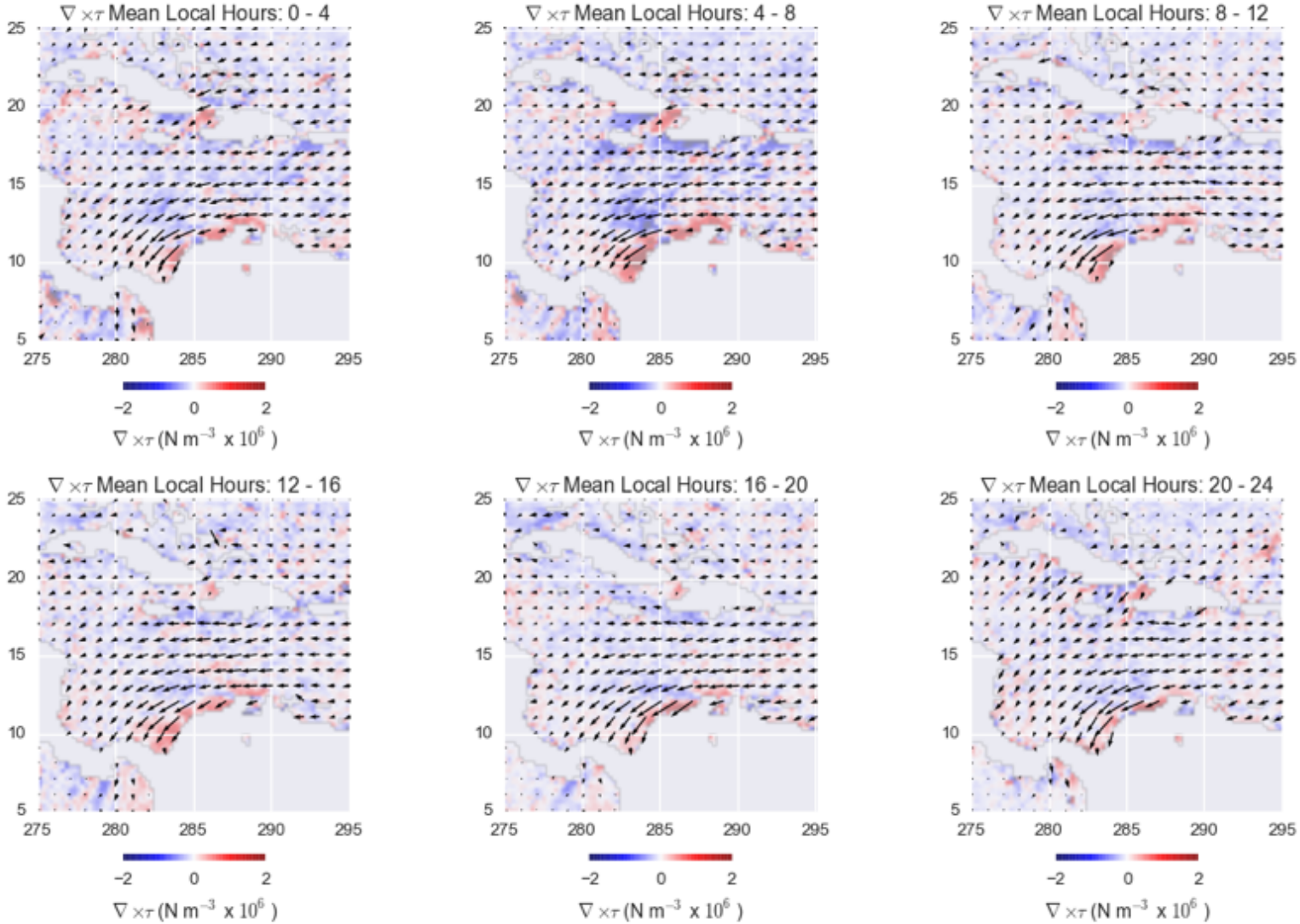
Guajira: October-November



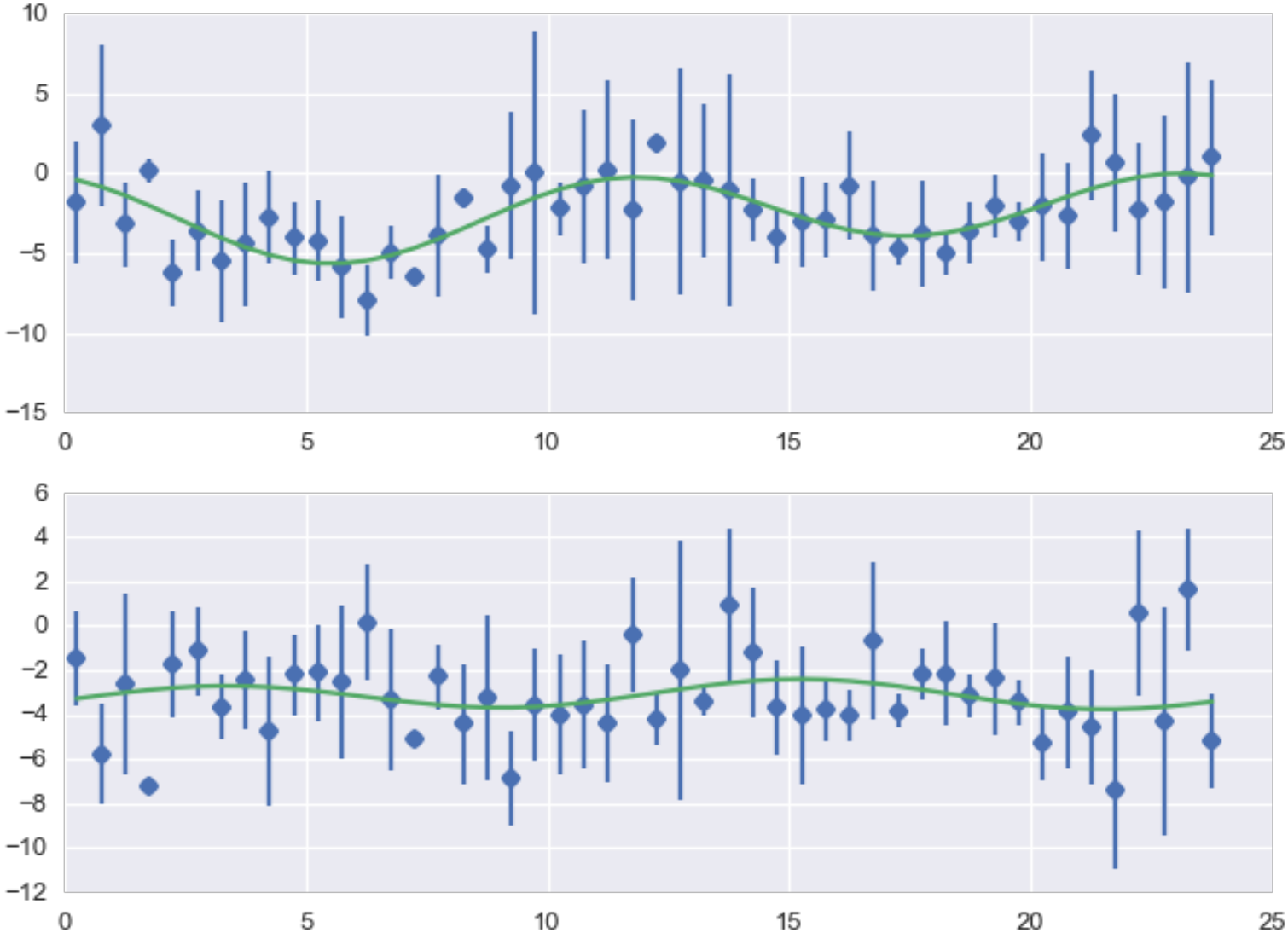
Guajira: December-January



Guajira: February-March

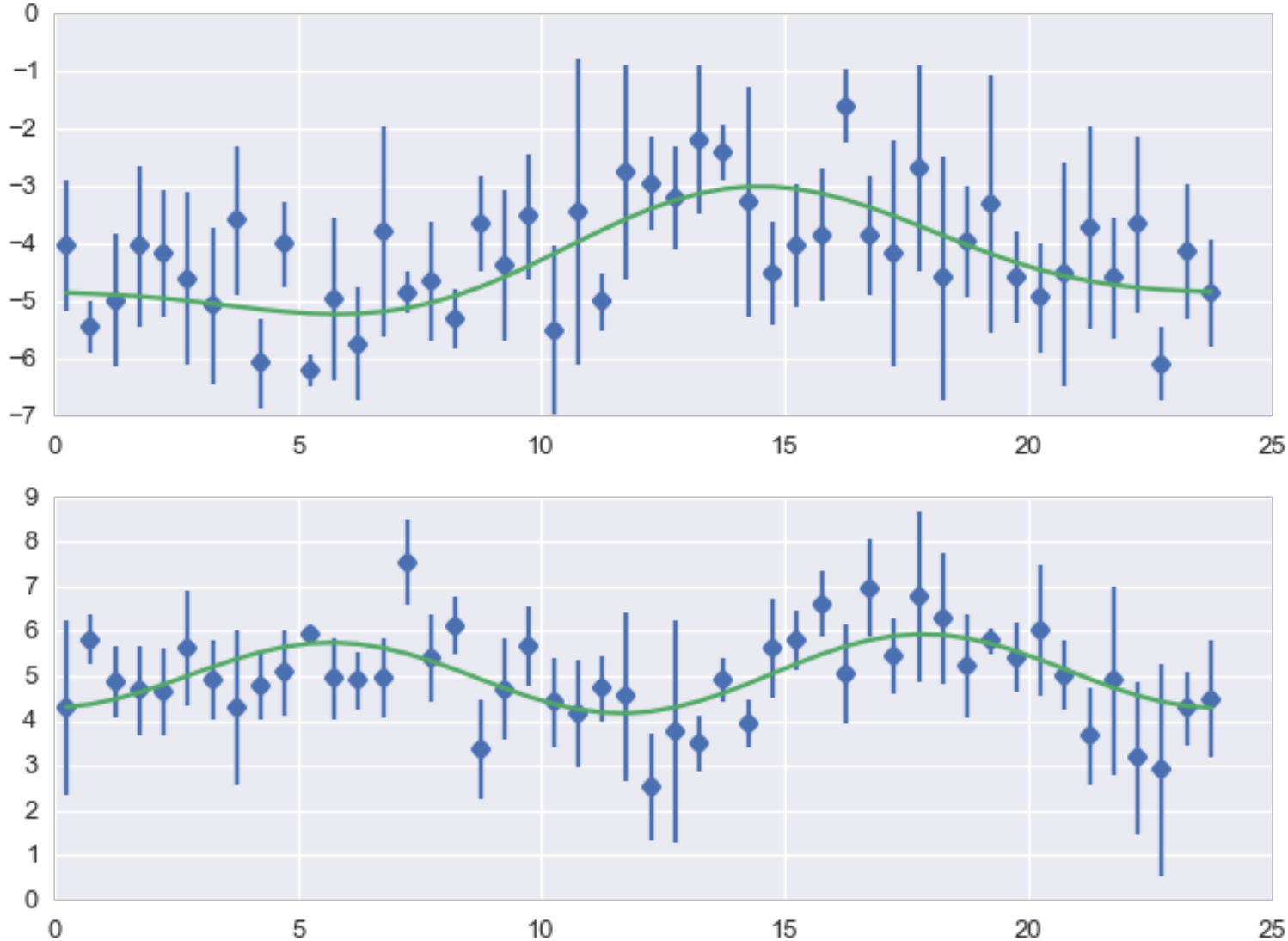


Semi-Diurnal Variability
Tropical Example



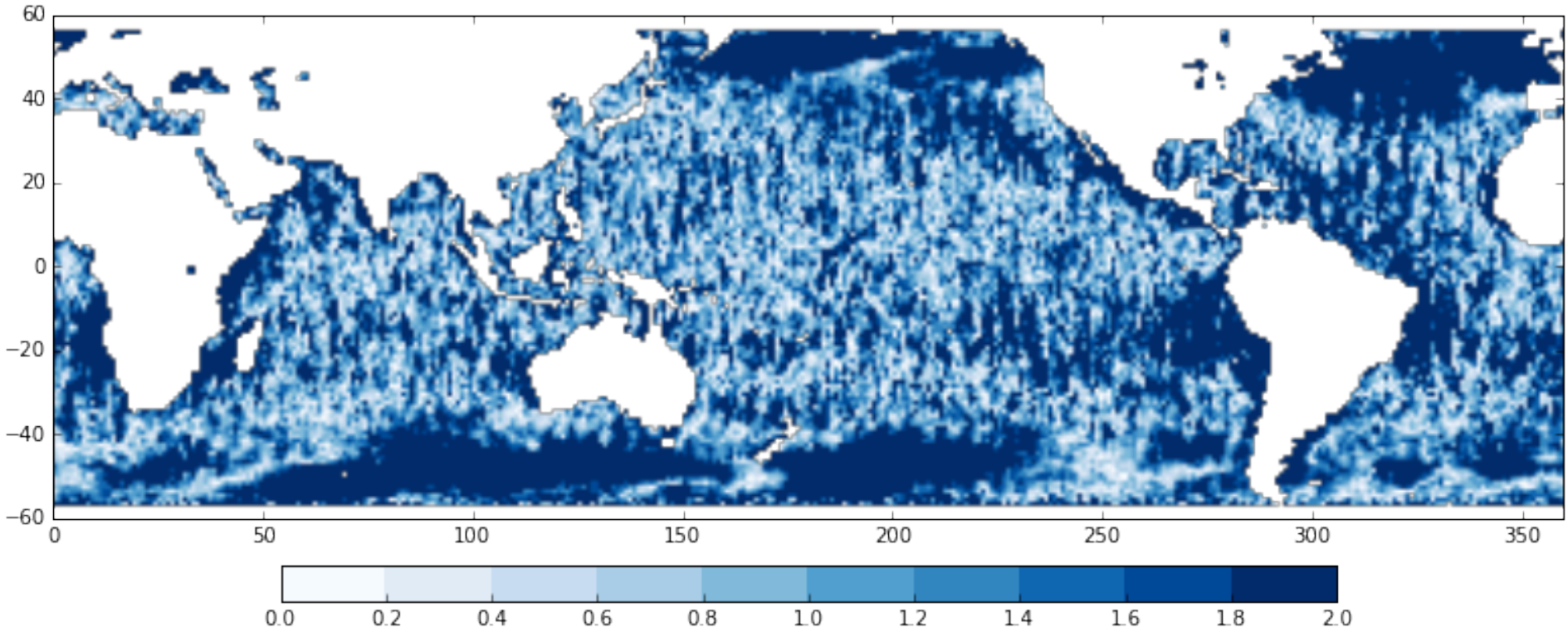
Latitude: 10° S, Longitude: 200° E

Diurnal & Semi-Diurnal Variability
Sub-Tropical Example

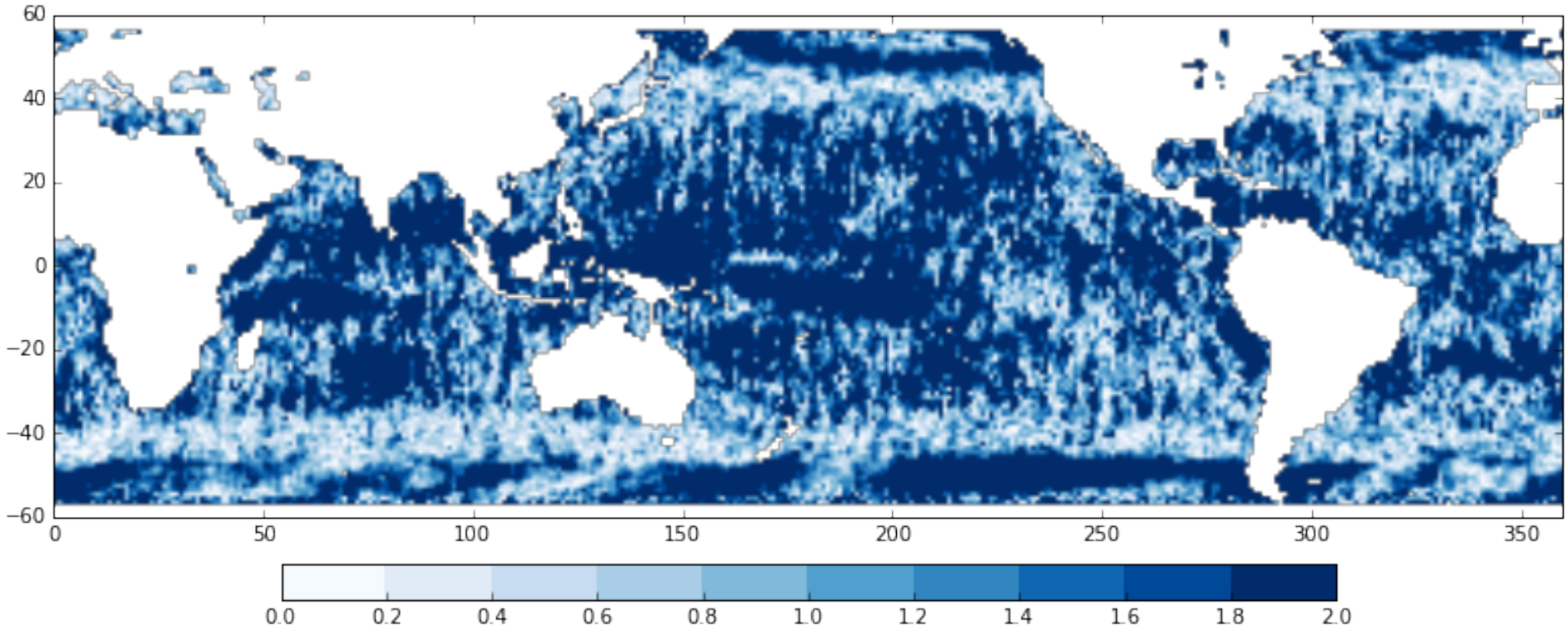


Latitude: 20° S, Longitude: 280° E

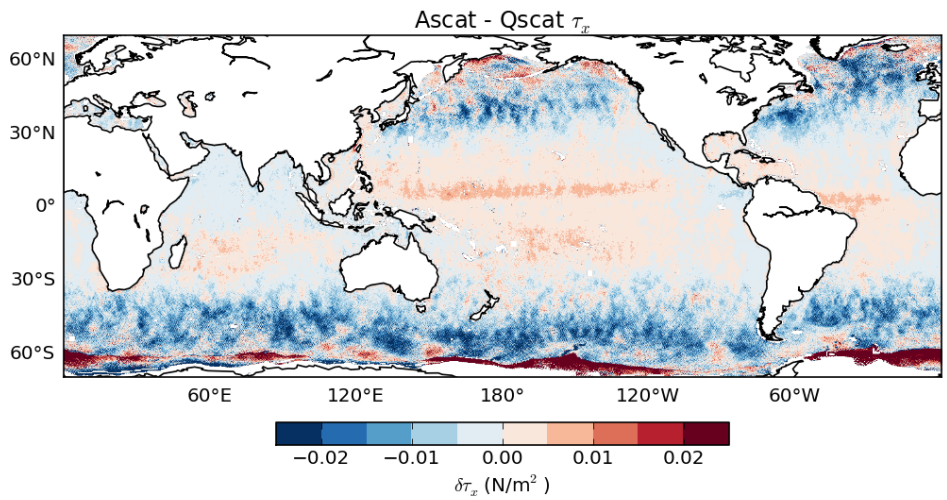
U Diurnal Amplitude SNR

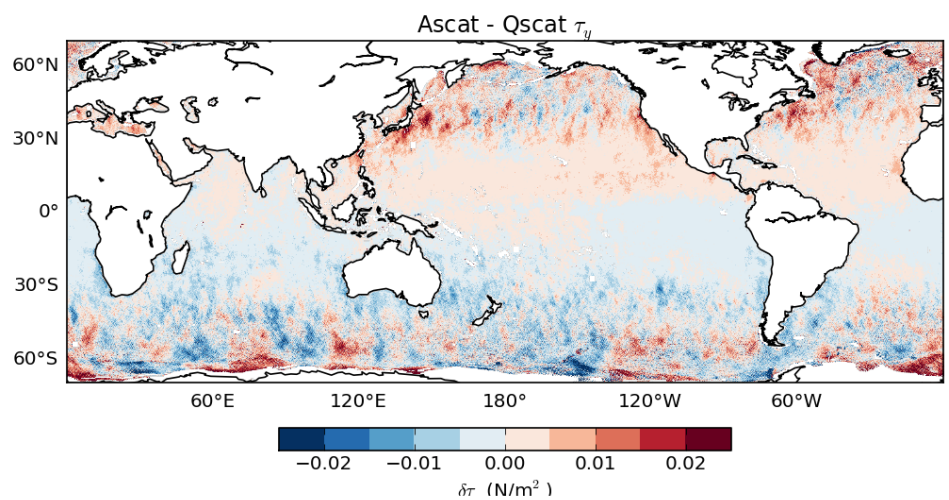


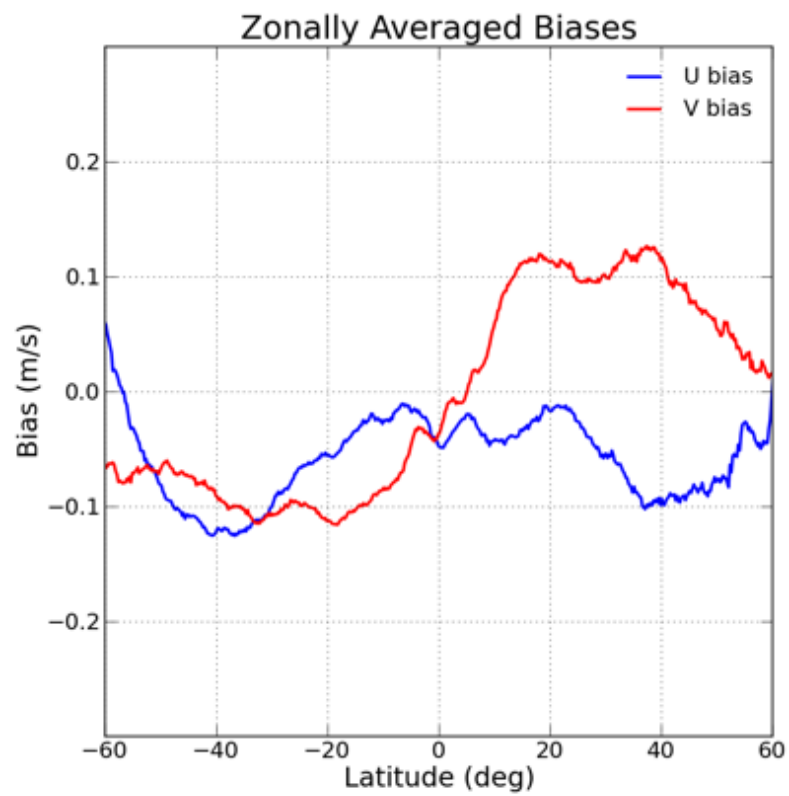
U Semi-Diurnal Amplitude SNR



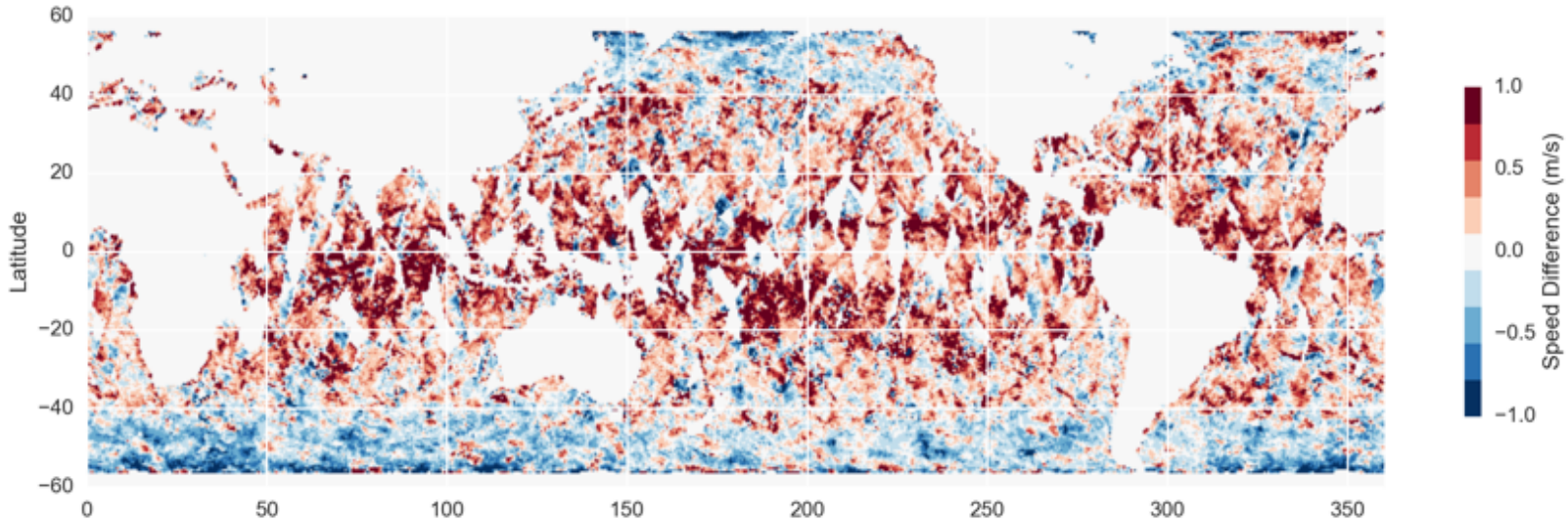
QuikSCAT-ASCAT Differences



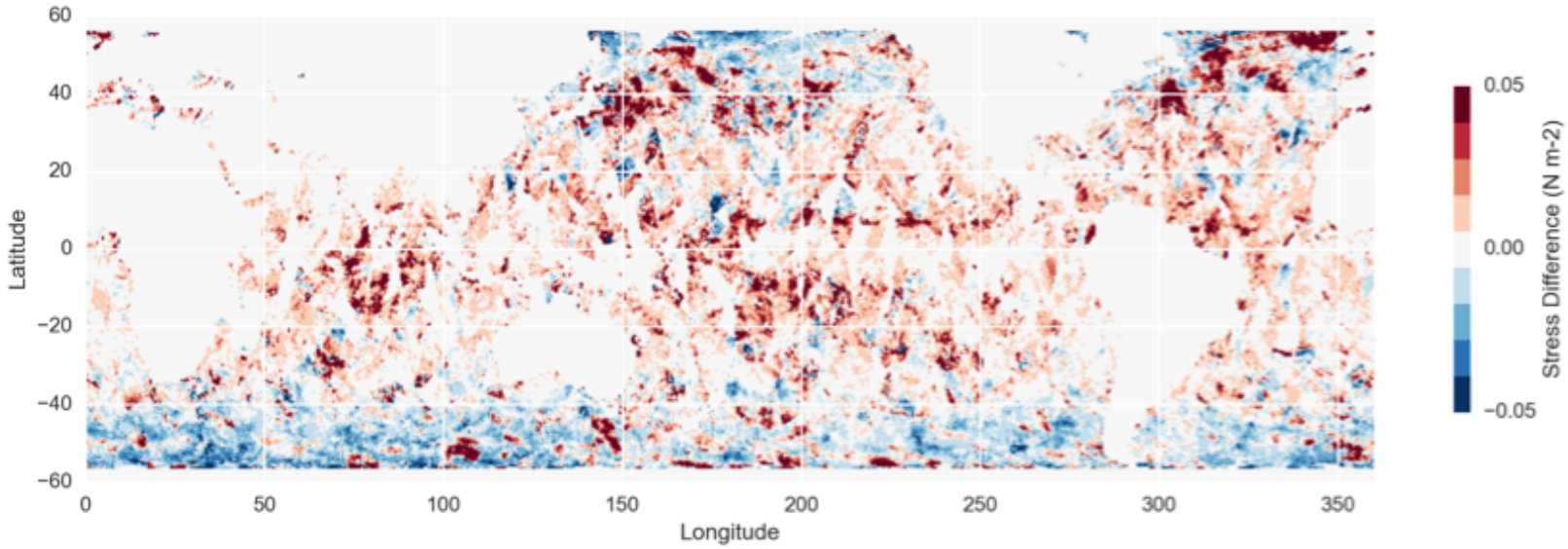


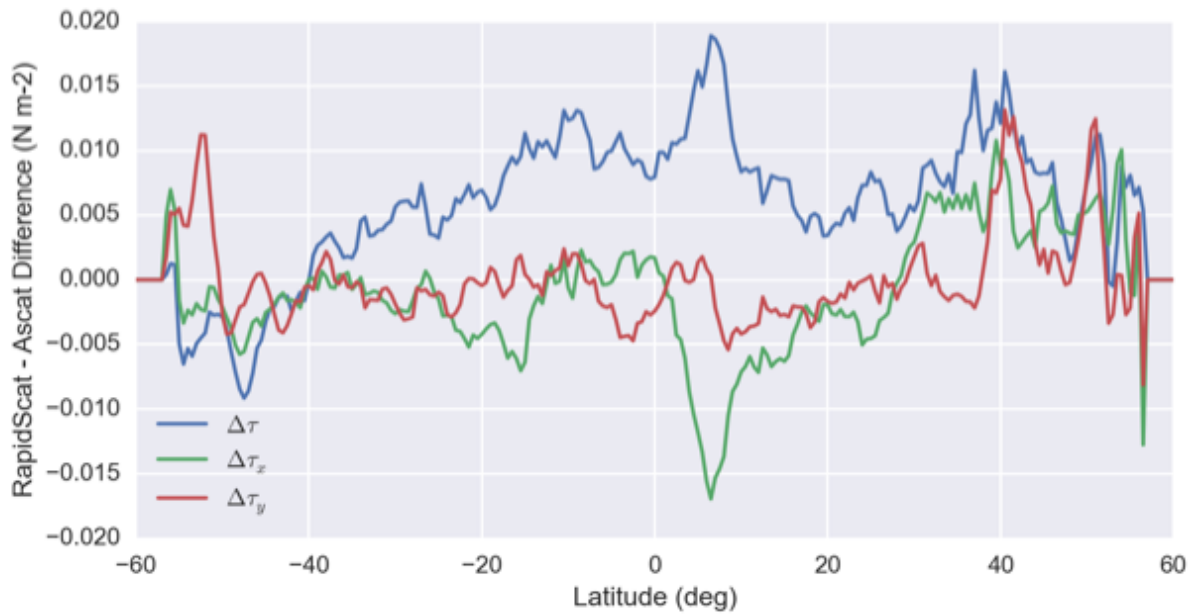


RapidScat-Ascat Wind Speed Difference Geographic Distribution

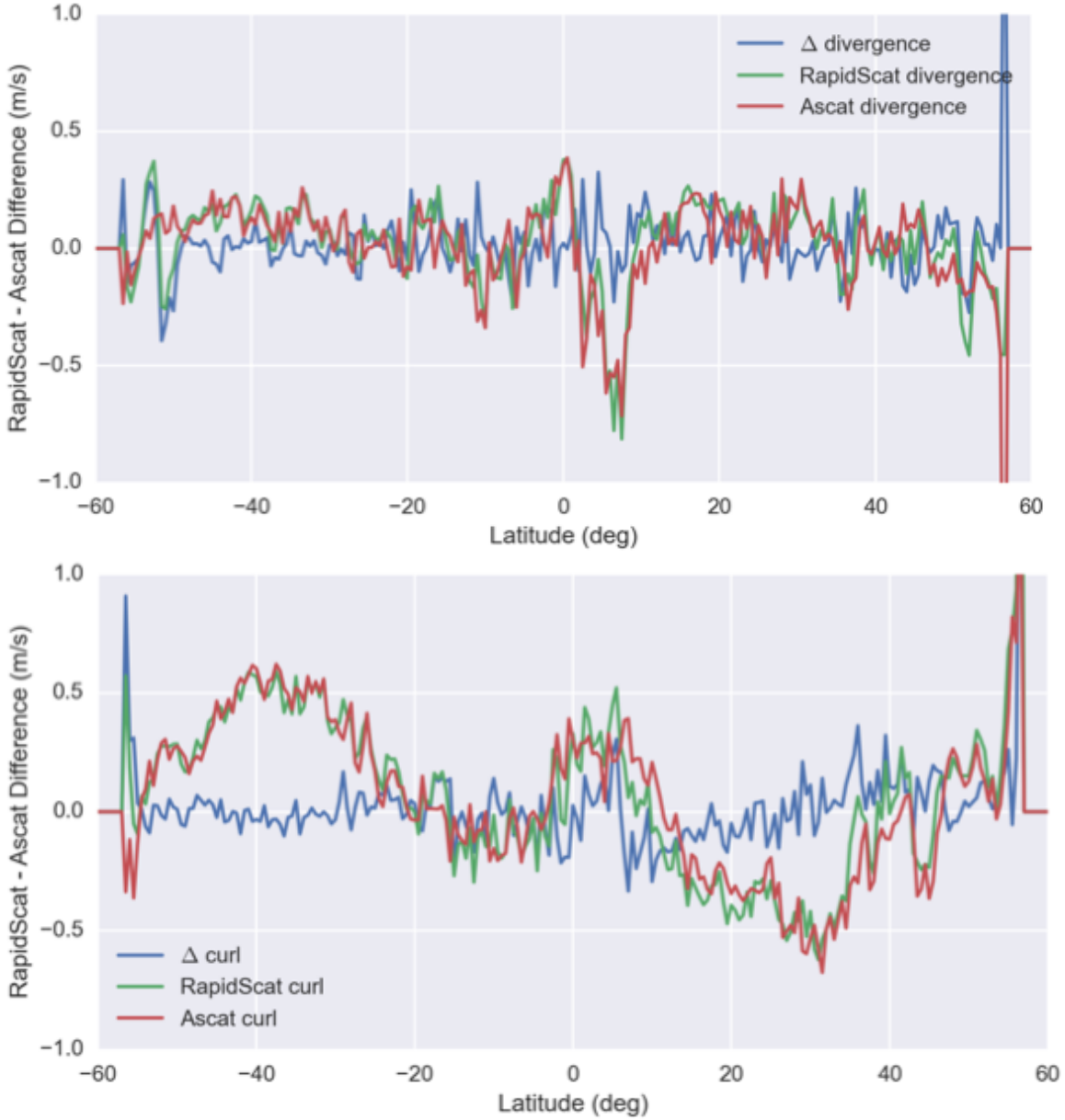


RapidScat-Ascat Wind Stress Difference Geographic Distribution

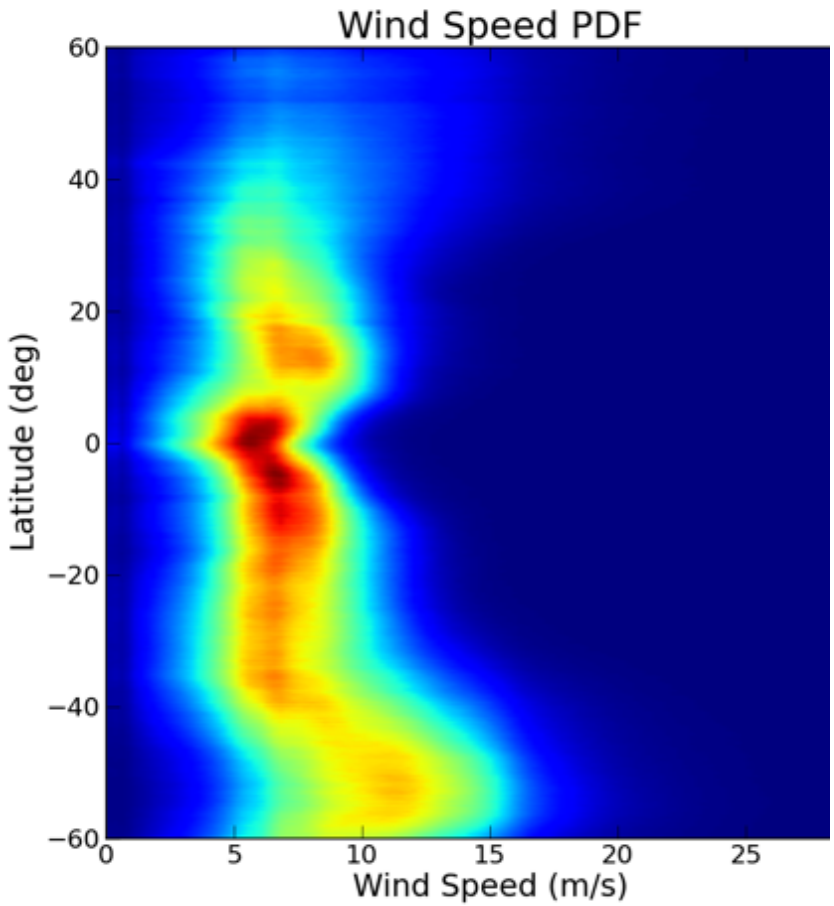


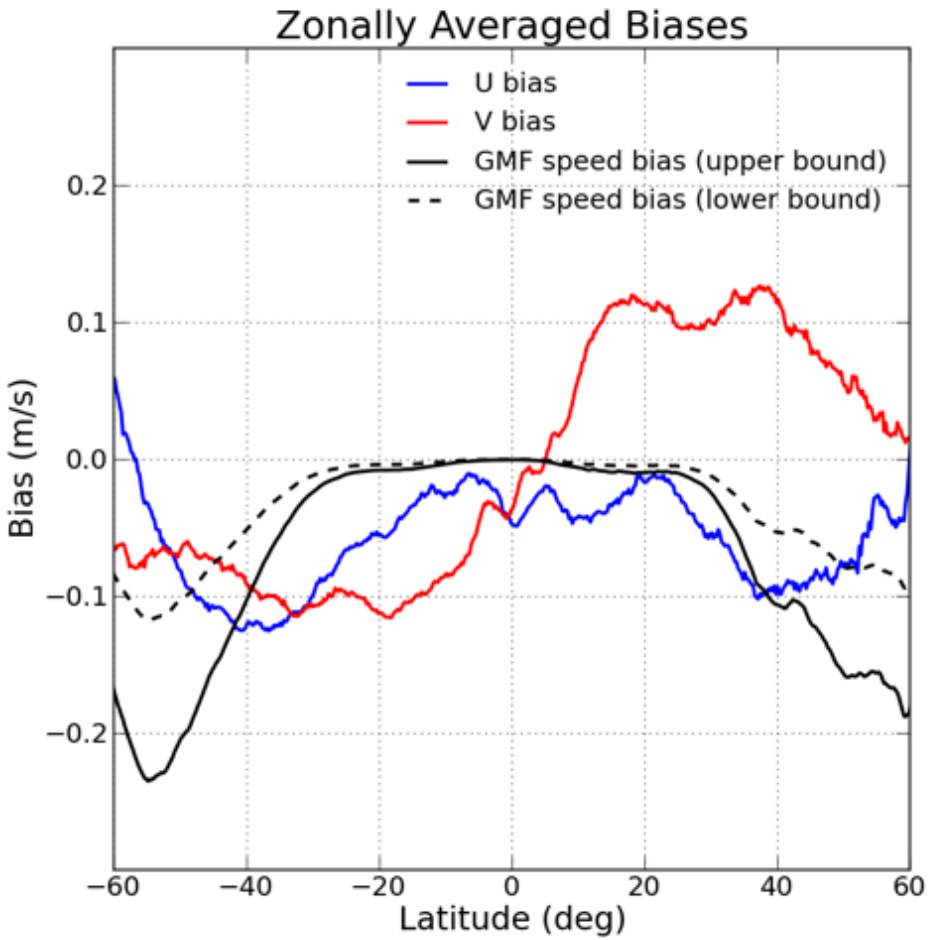


Zonally Averaged Wind Divergence and Curl

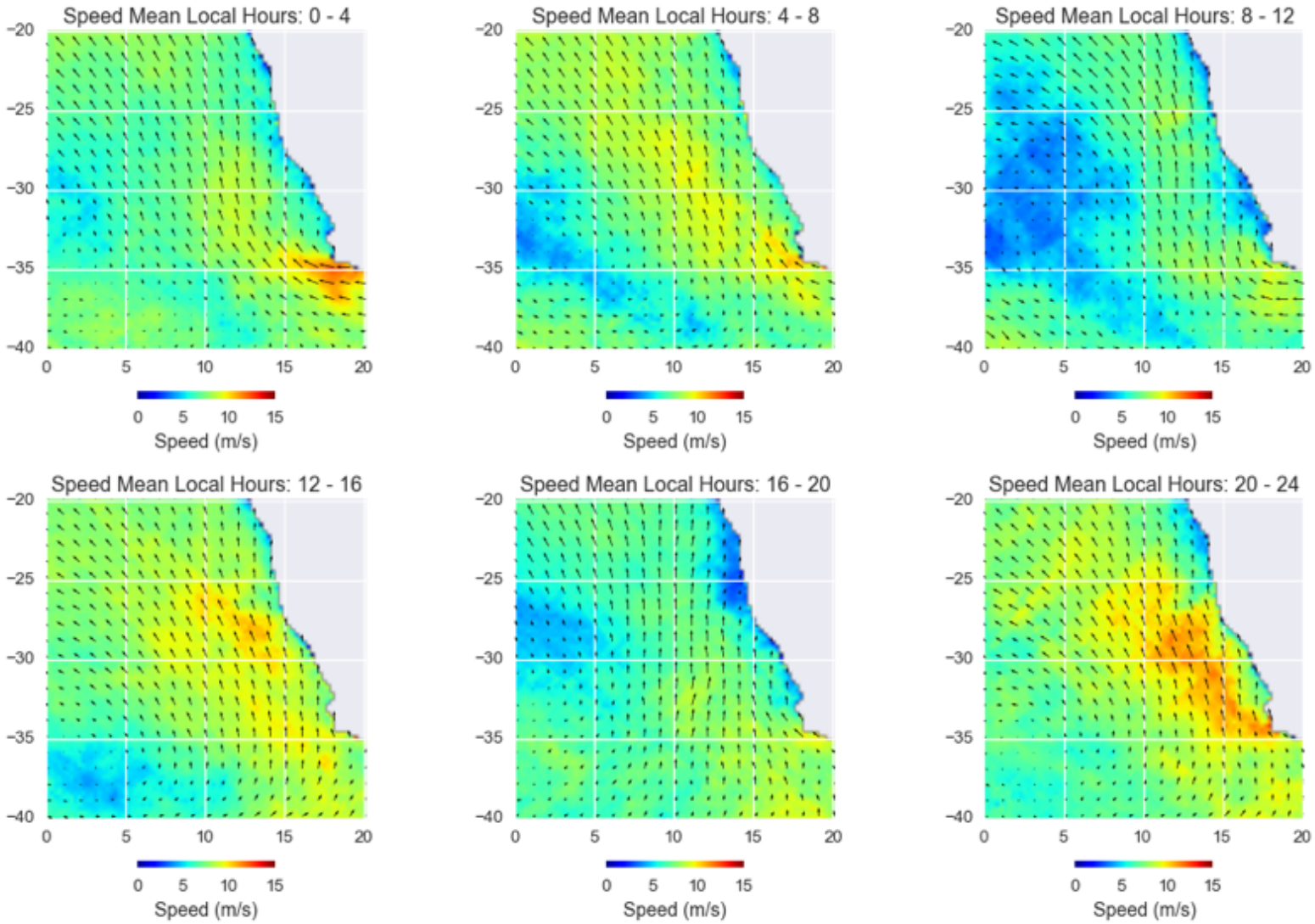


GMF Effects do not replicate the signature





Benguela: October-November



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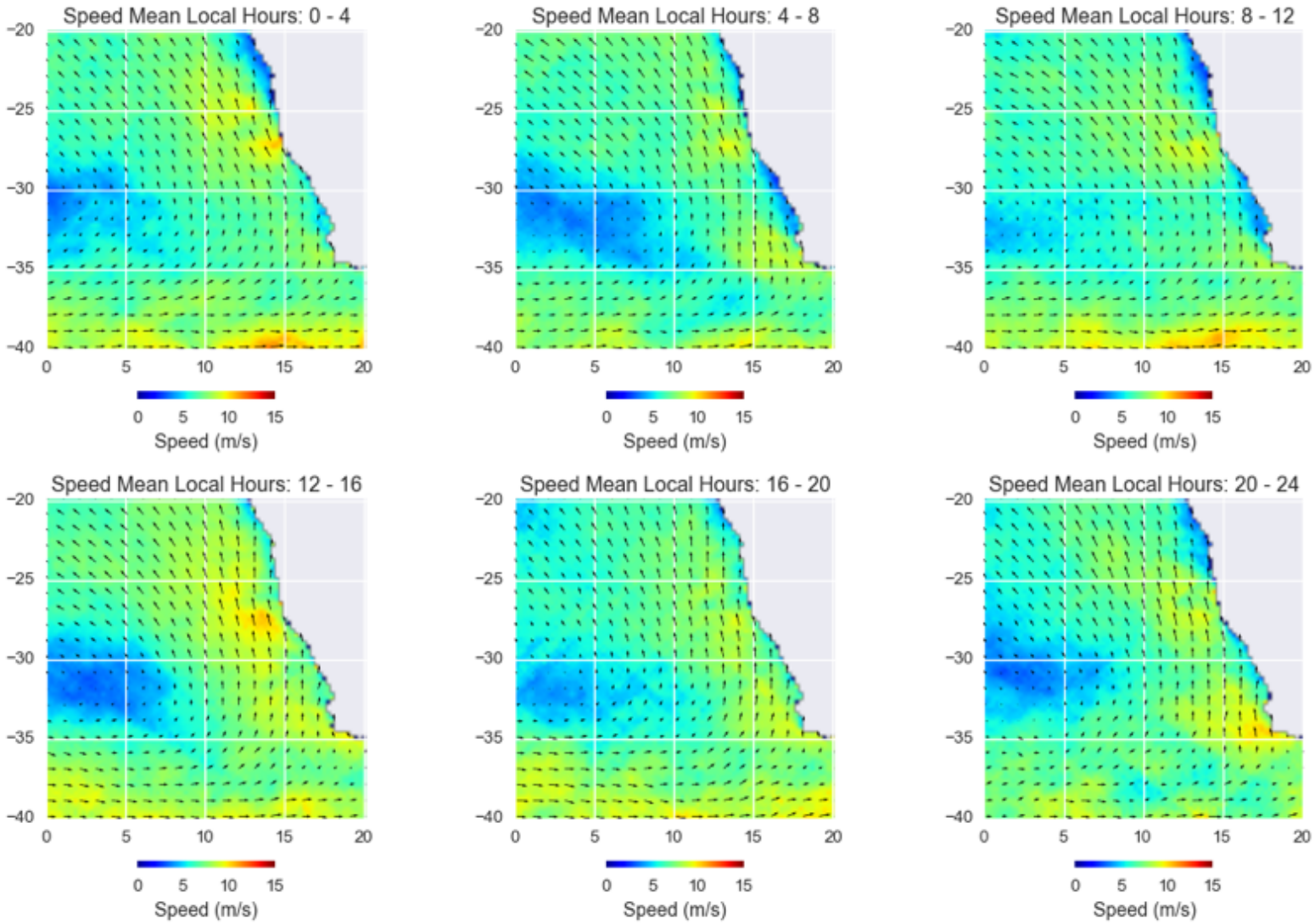
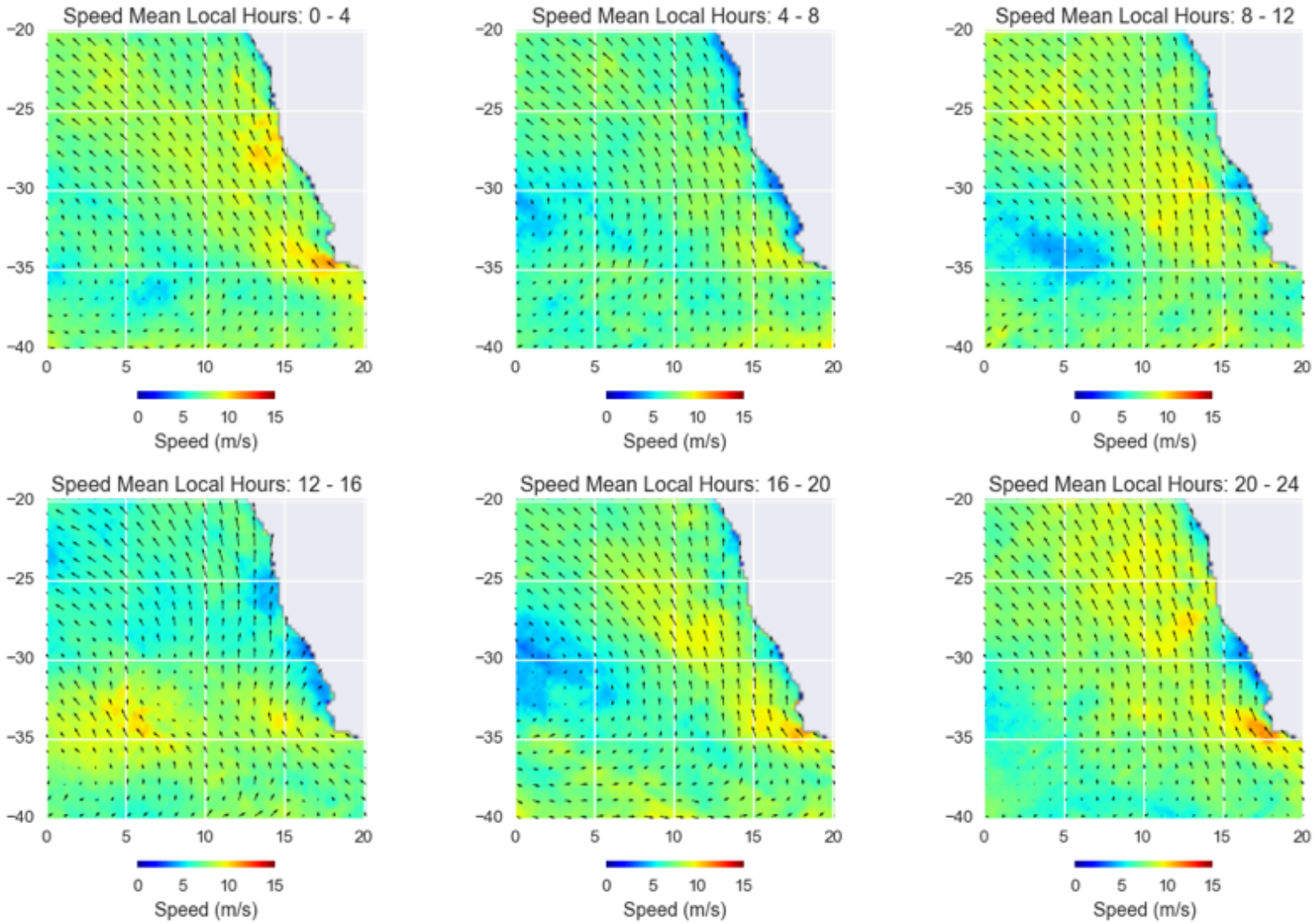
Benguela: December-January



Benguela: February-March