The 2015-16 El Niño evolution and teleconnections inferred from RapidScat, ASCAT and ECMWF winds: does diurnal variability affect the characterization of El Niño-related wind anomaly?

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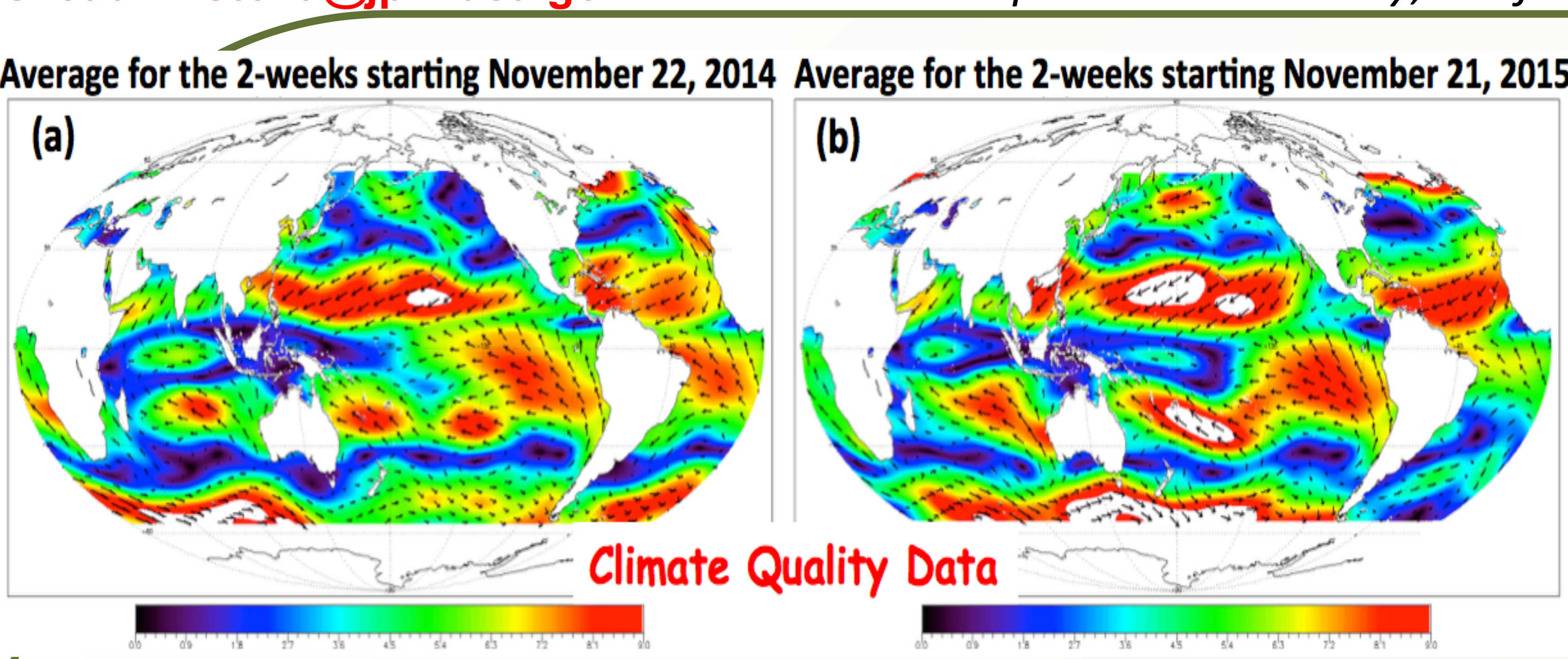
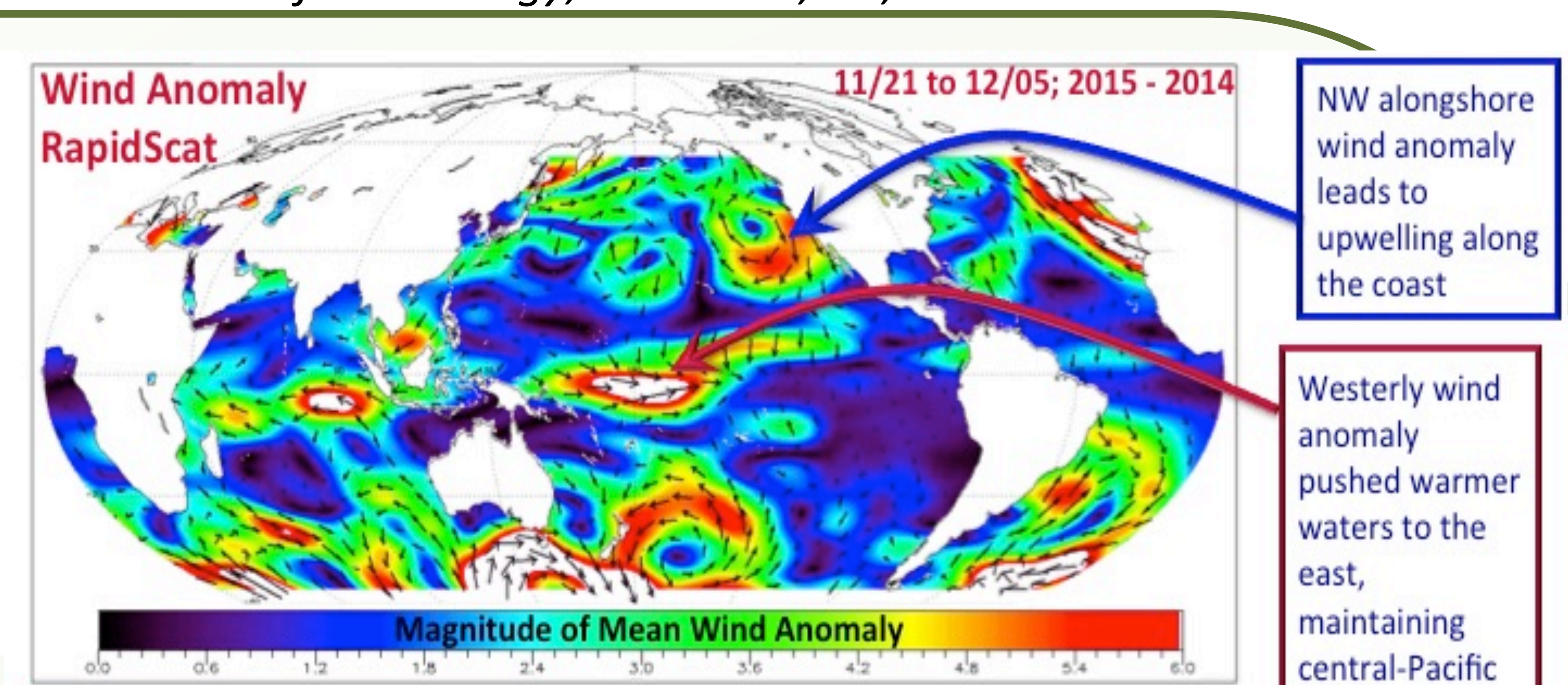
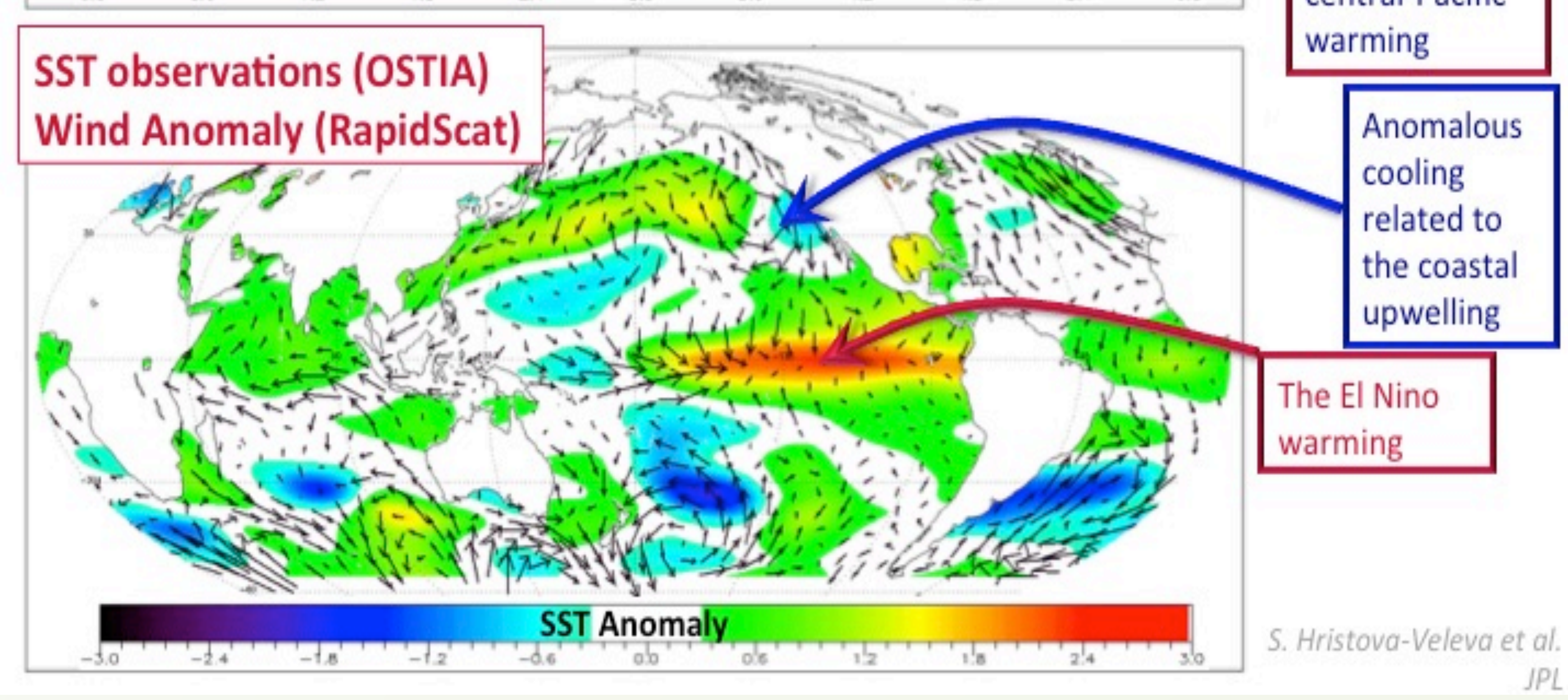






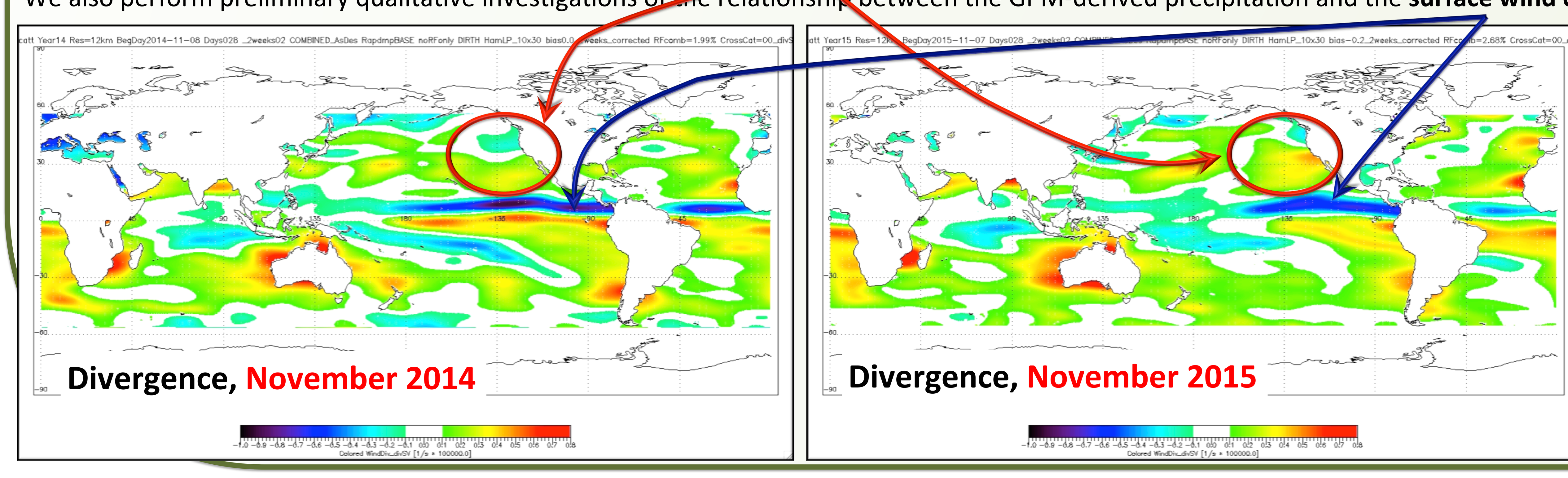
The 2015-16 El Niño event is one of the strongest El Niño observed during the modern instrumentation period, rivaling the two big ones observed by satellites during 1982-83 and 1997-98. Yet, the precipitation anomalies differ from the expectations.

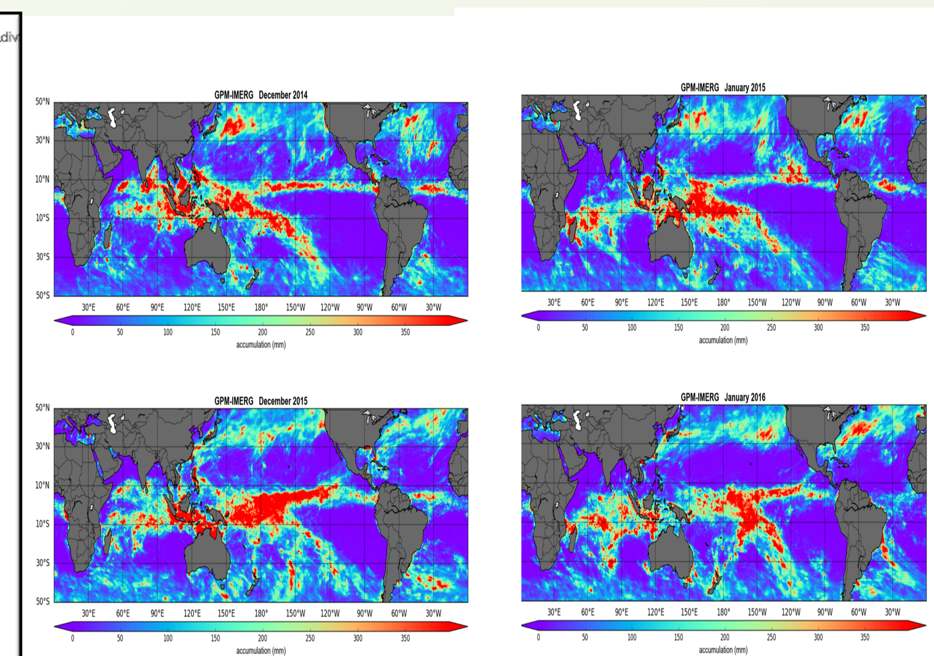
While El Niño events have a significant impact on the entire Earth System, they are most easily visible in measurements of sea surface temperature (SST), sea surface height and near-surface ocean winds. In fact, the signature eastward-blowing anomalous surface winds in the Western and Central Tropical Pacific are the pre-cursor and the main driver of the El Nino.

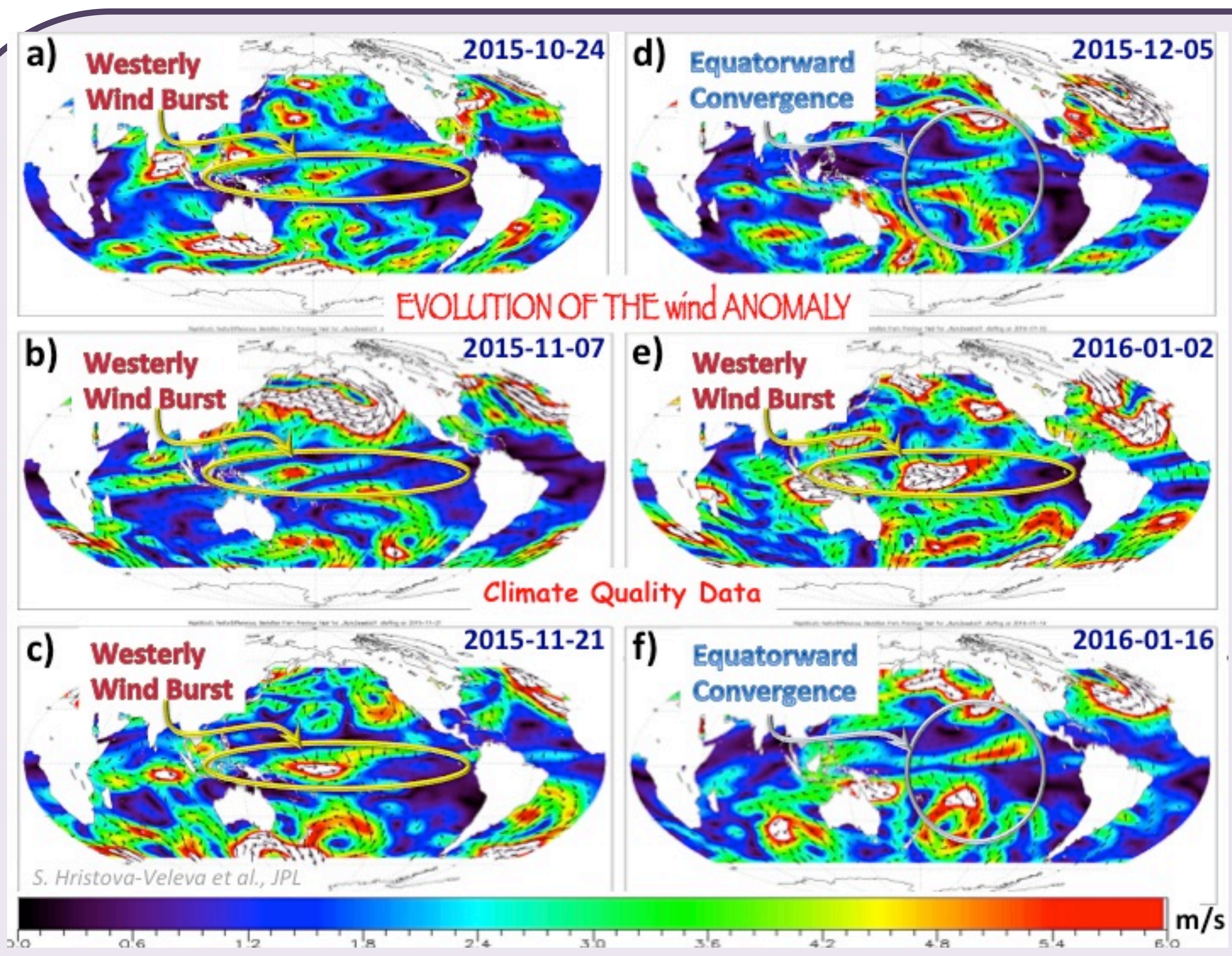
We use observations from NASA's RapidScat, EUMETSAT's ASCAT and also from collocated ECMWF analysis to monitor the evolution of the anomalous winds associated with the 2015-16 El Niño. To detect the El Nino signal, we first compute monthly means of the wind speed, the zonal and the meridional wind components. We then perform a low-pass filter to extract the components of the larger-scale circulation and compute the 2015-2016 anomalies with respect to the corresponding months of 2014-2015.

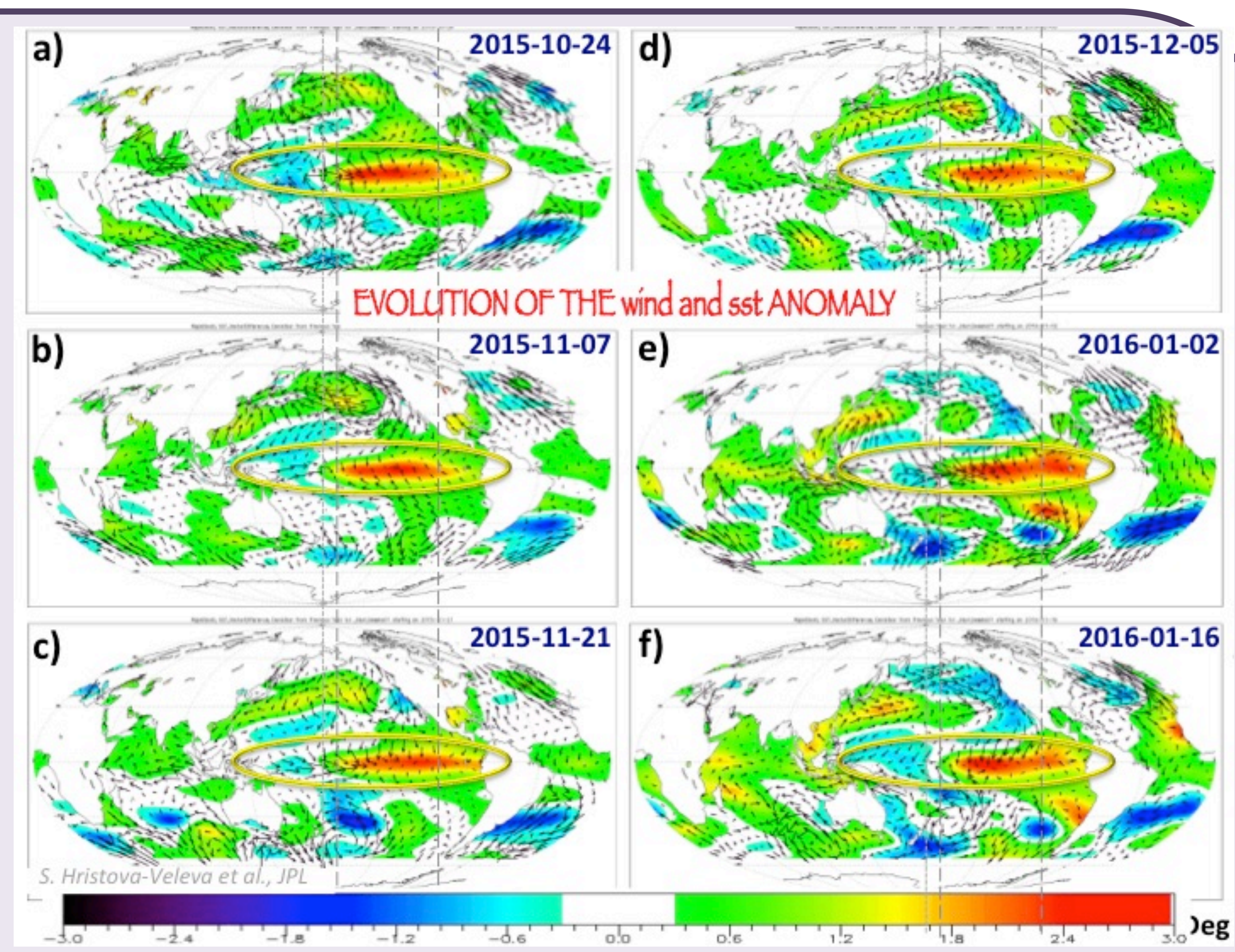
El Niño is known to have basin to global scale teleconnection and impacts. In addition to the characterization of the changes in the tropical Pacific, we will also describe the associated changes in the North and South Pacific. In particular, a strong anticyclonic anomaly is observed in the north-eastern Pacific. This anomalous circulation is likely associated with the **subsidence region (stronger divergence) of a stronger-than-normal Hadley cell**, leading to modification of the midlatitude storm tracks and the related precipitation anomalies.

We also perform preliminary qualitative investigations of the relationship between the GPM-derived precipitation and the **surface wind convergence**.



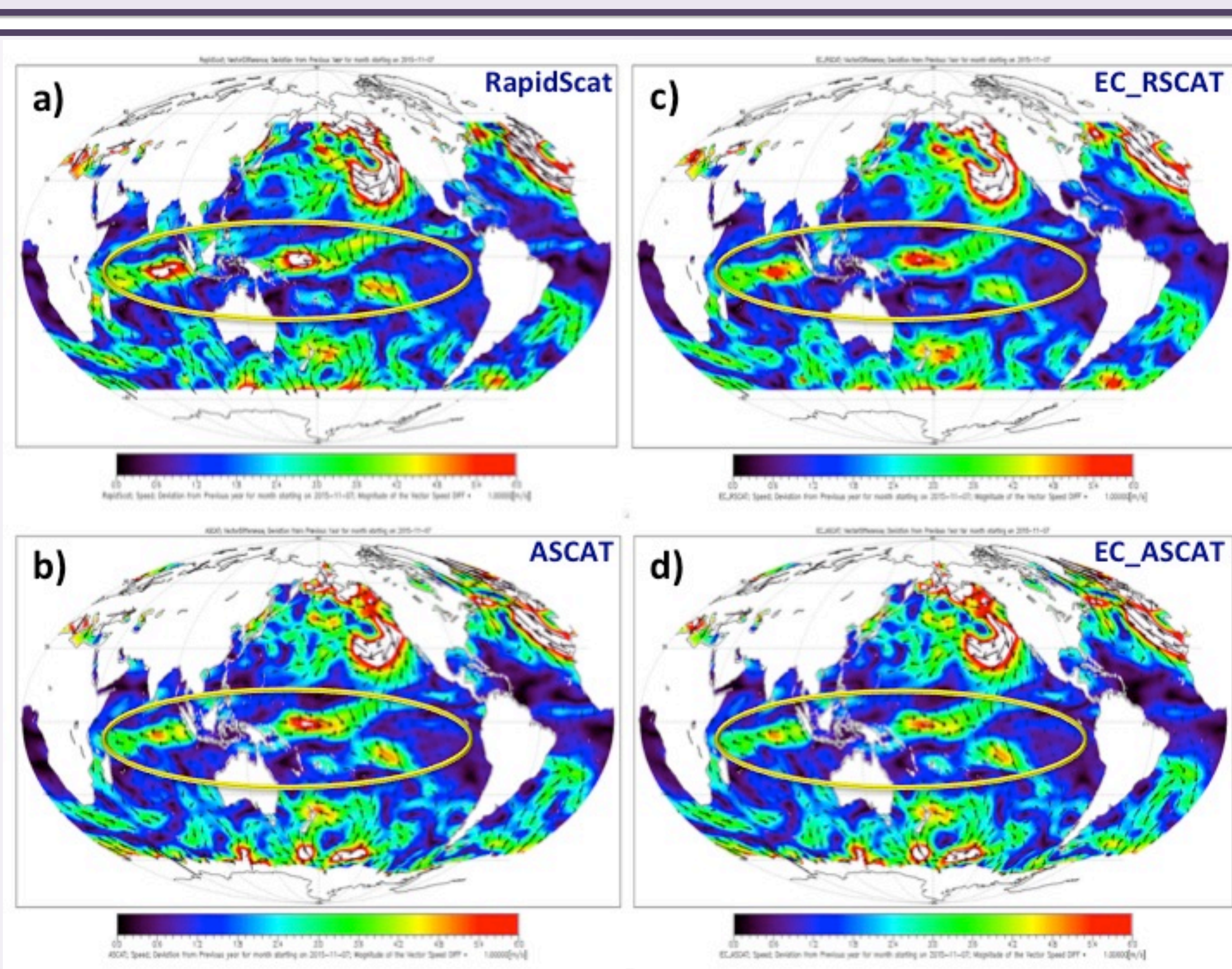






We find fast-evolving wind anomalies and relate them qualitatively to the evolution of the SST field as depicted in the observations-based OSTIA product.

The El-Nino signal as seen in observations from RapidScat (a), ASCAT (b) and in respectively collocated ECMWF analysis – (c) shows the results for the ECMWF analysis collocated with RapidScat while (d) shows the results from the ASCAT-collocated ECMWF analysis. Presented is the 2015 anomalous winds for the month of November (with respect to 2014). In all cases, the colors represent the wind speed anomaly (the magnitude of the anomalous mean wind components), while the vectors illustrate the direction of the anomaly winds. The El-Nino signal is very clearly evident in the eastward blowing anomalous winds observed in the tropical western and central Pacific, as shown in panel. The El Nino signal is also seen in the anomalous stronger convergence into the tropical eastern Pacific, as evidenced by the stronger winds moving toward the equator observed in this region.



We also compare the strength of the El Nino surface wind anomalies as depicted from RapidSCAT to that determined from ASCAT, and from collocated ECMWF analysis.

We find that the signal is stronger in the scatterometer observations (either RapidScat or ASCAT) as compared to that determined from collocated ECMWF analysis suggesting that the model, even during the analysis stage, is not capturing very well the large-scale circulation.

Furthermore, the signal is stronger in the RapidScat observations as compared to that from non-collocated, independent ASCAT observations.

Most importantly, analysis of the El Nino signal in collocated ECMWF winds shows that the ECMWF winds that are collocated with RapidScat show a stronger El-Nino signal than the ECMWF winds that are collocated with ASCAT. Hence, the signal might be stronger when sampling through the diurnal cycle, as RapidScat does.

The dependence of the strength of the ECMWF El-Nino signal on whether the model winds are sampled (collocated with) RapidScat or ASCAT shows the importance of sampling and the significance of the diurnal variability that is not well understood.