‘Assessing the influence of El Niño on the California precipitation regime during the satellite precipitation era’

Presentation by,

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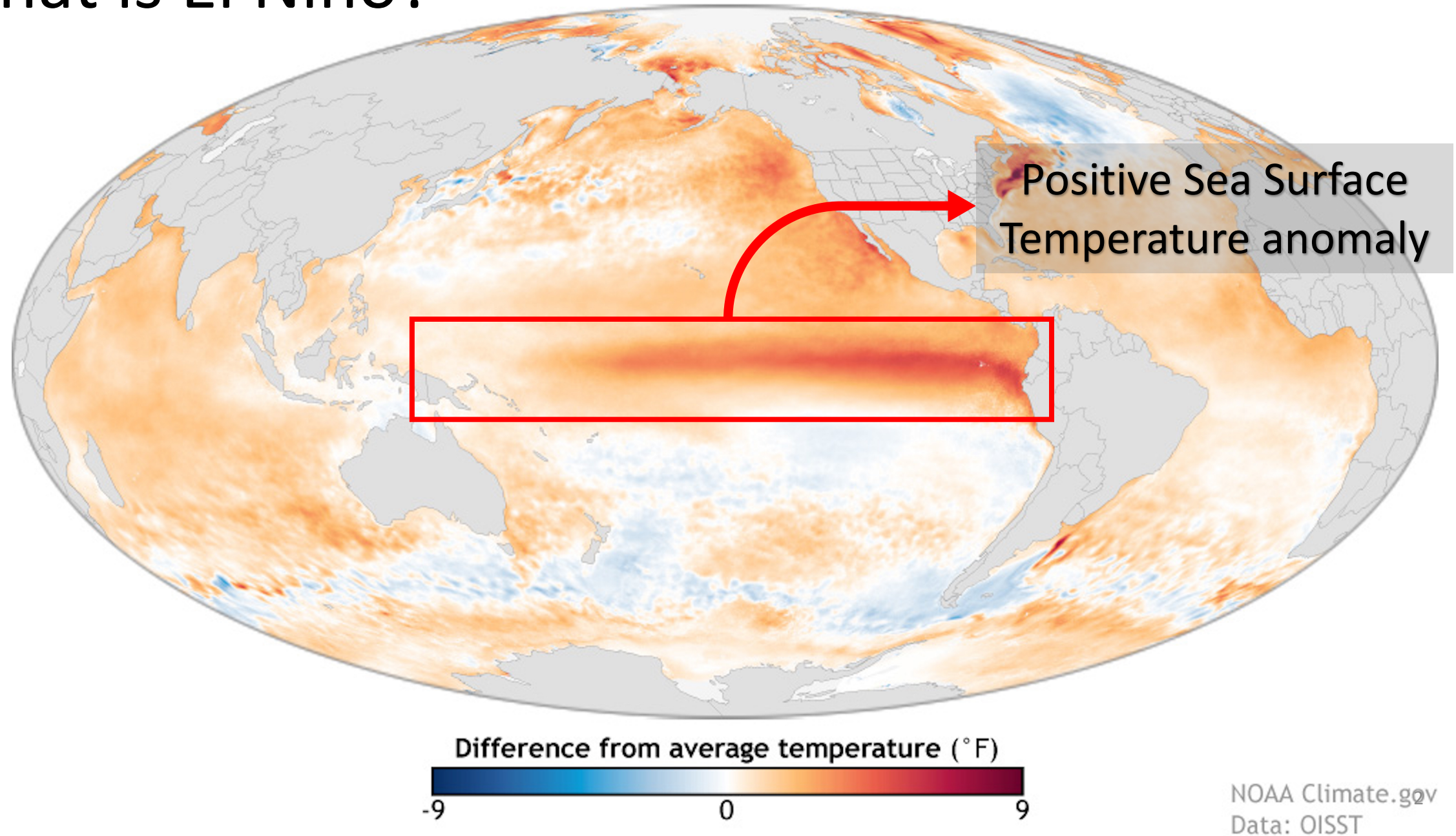
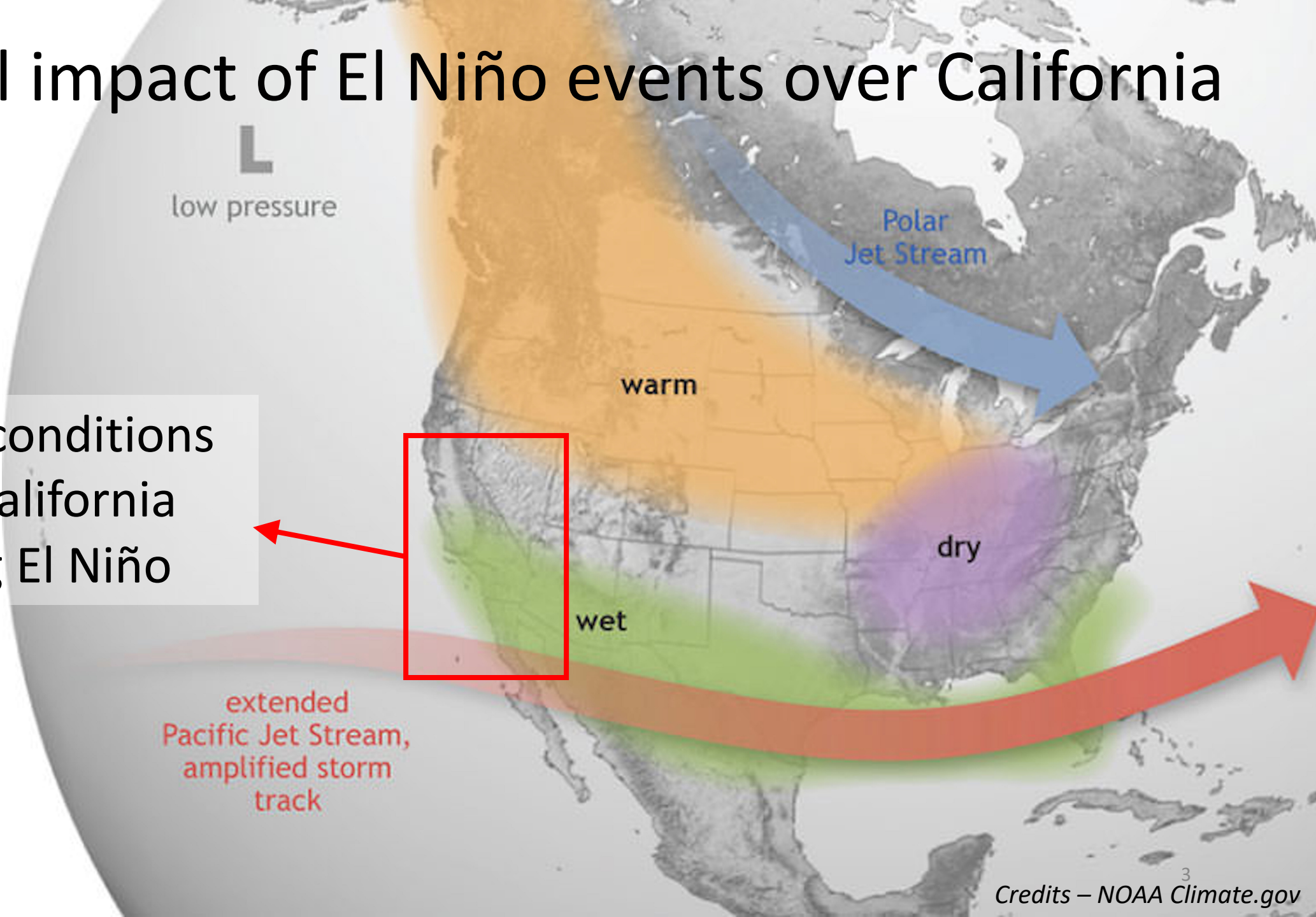
What is El Niño?



Historical impact of El Niño events over California

Wetter conditions over California during El Niño

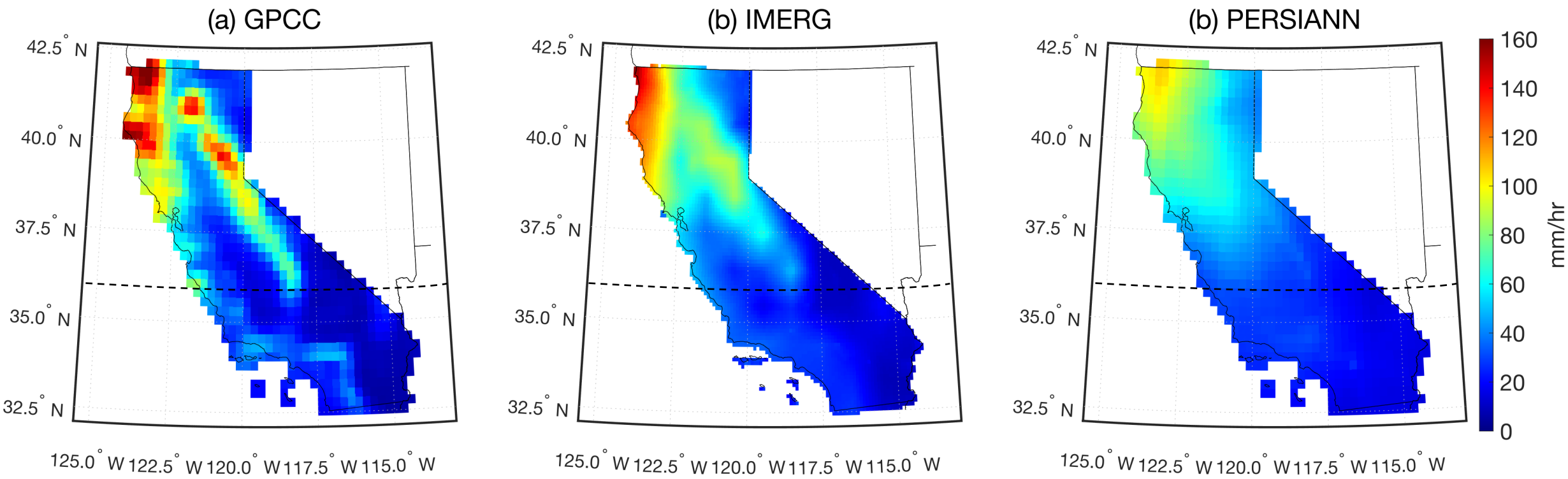


Credits – NOAA Climate.gov

Datasets

- Ground based precipitation product
  - Global Precipitation Climatology Center **(GPCC)** precipitation dataset
- Satellite Precipitation products
  - Integrated Multi-satellitE Retrievals for GPM **(IMERG)** precipitation product
  - Precipitation Estimation from Remotely Sensed Information using Artificial Neural Networks – Climate Data Records **(PERSIANN)** precipitation product
- El Niño Southern Oscillation (ENSO) Index
  - Multivariate ENSO index (MEIv2)

Fig.1 Mean precipitation from 2001 - 2019



Spatial res : 0.25° x 0.25°
Temporal res : 1 month

Spatial res : 0.1° x 0.1°
Temporal res : 1 month

Spatial res : 0.25° x 0.25°
Temporal res : 1 month

Northern California : 36° N–42° N ; Southern California : 32° N–36° N

Method

- Relationships between between El Niño and northern and southern California winter precipitation from 2001/01 to 2019/12 are examined.

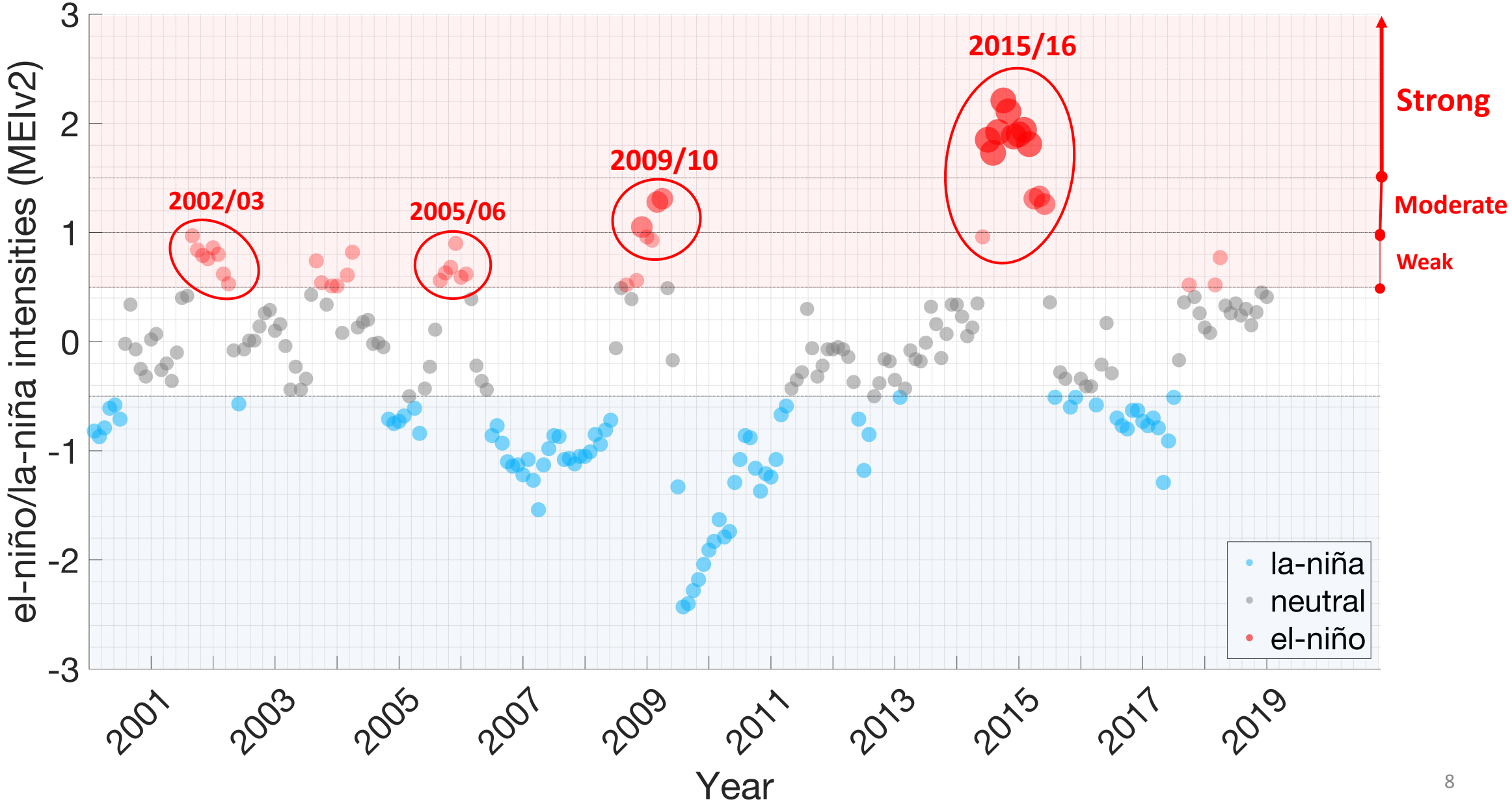
- Seasonal Classification
  - Winter – Nov, Dec, Jan ,Feb, Mar, Apr
  - Early winter – Nov, Dec, Jan
  - Late winter – Feb, Mar, Apr

Method

- Identification of El Niño events
  - El Niño events are defined when the MEI reaches the threshold of +0.5 °C for at least 5 consecutive months.

- Classification of El Niño events
  - Weak : $0.5 < MEI \leq 1.0$
  - Moderate : $1.0 < MEI \leq 1.5$
  - Strong : $MEI > 1.5$

Fig.2 El Niño intensities during 2001 - 19



Method

- Spatial Correlation (Pixel wise correlation)
  - We calculated precipitation anomalies for each dataset and regressed it with the ENSO index (MEIv2) to calculate the Pearson correlation coefficient between precipitation anomalies and ENSO index at every grid cell.
  - The correlation coefficient is tested for 95% confidence, and significantly correlated pixels are hatched (figure 3,4).

Fig.3 Spatial Correlation : California Precipitation & MEIv2

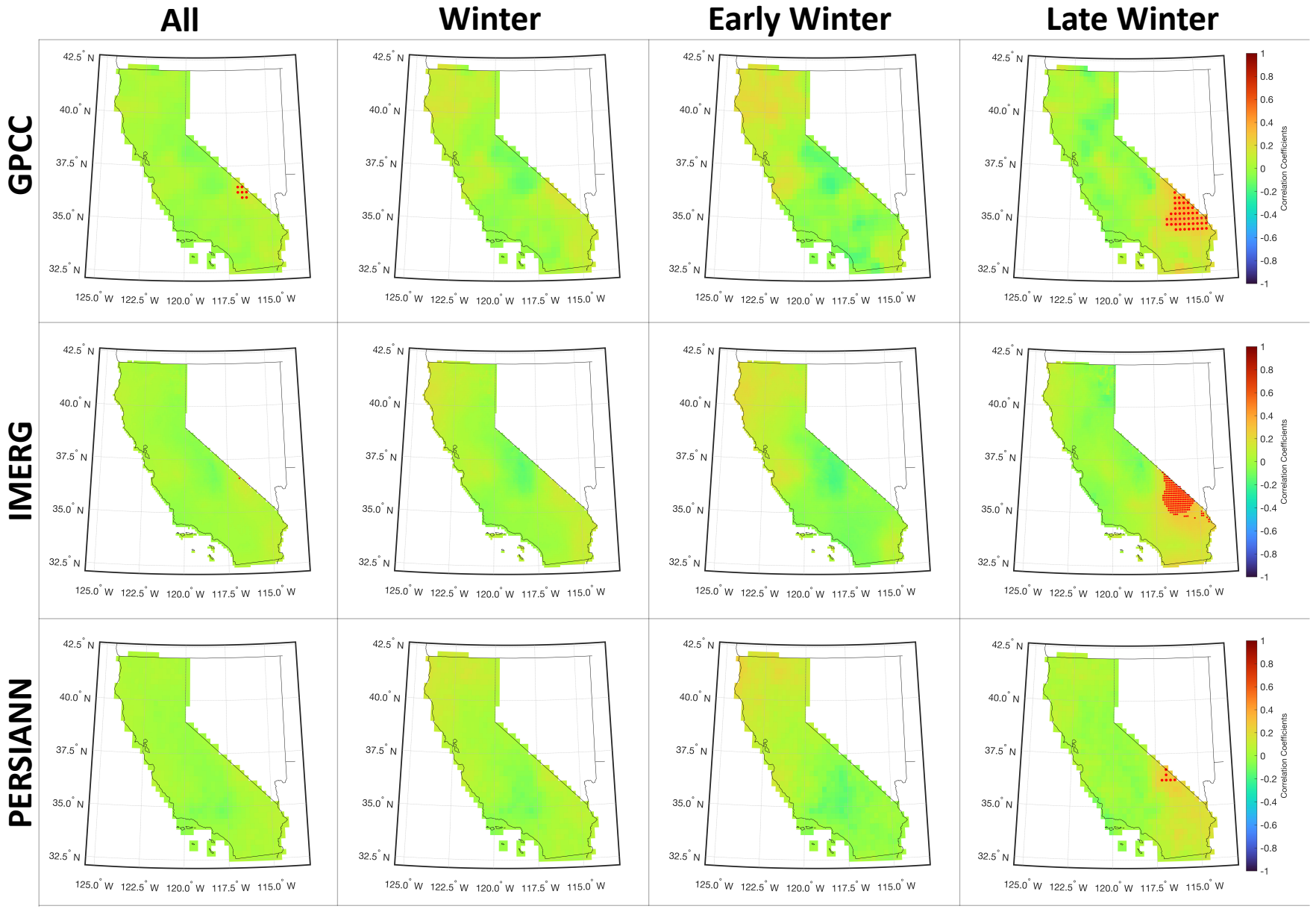


Fig.4 Spatial Correlation : California late winter precipitation & MEIv2 during El Niño months (MEIv2 > 0.5)

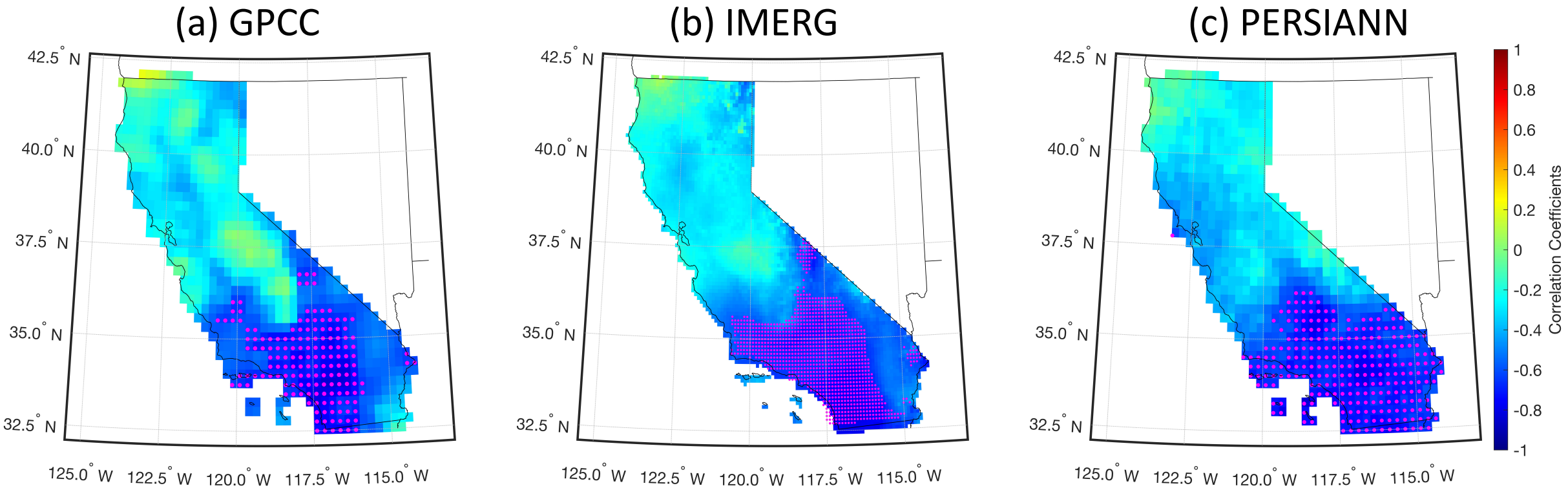
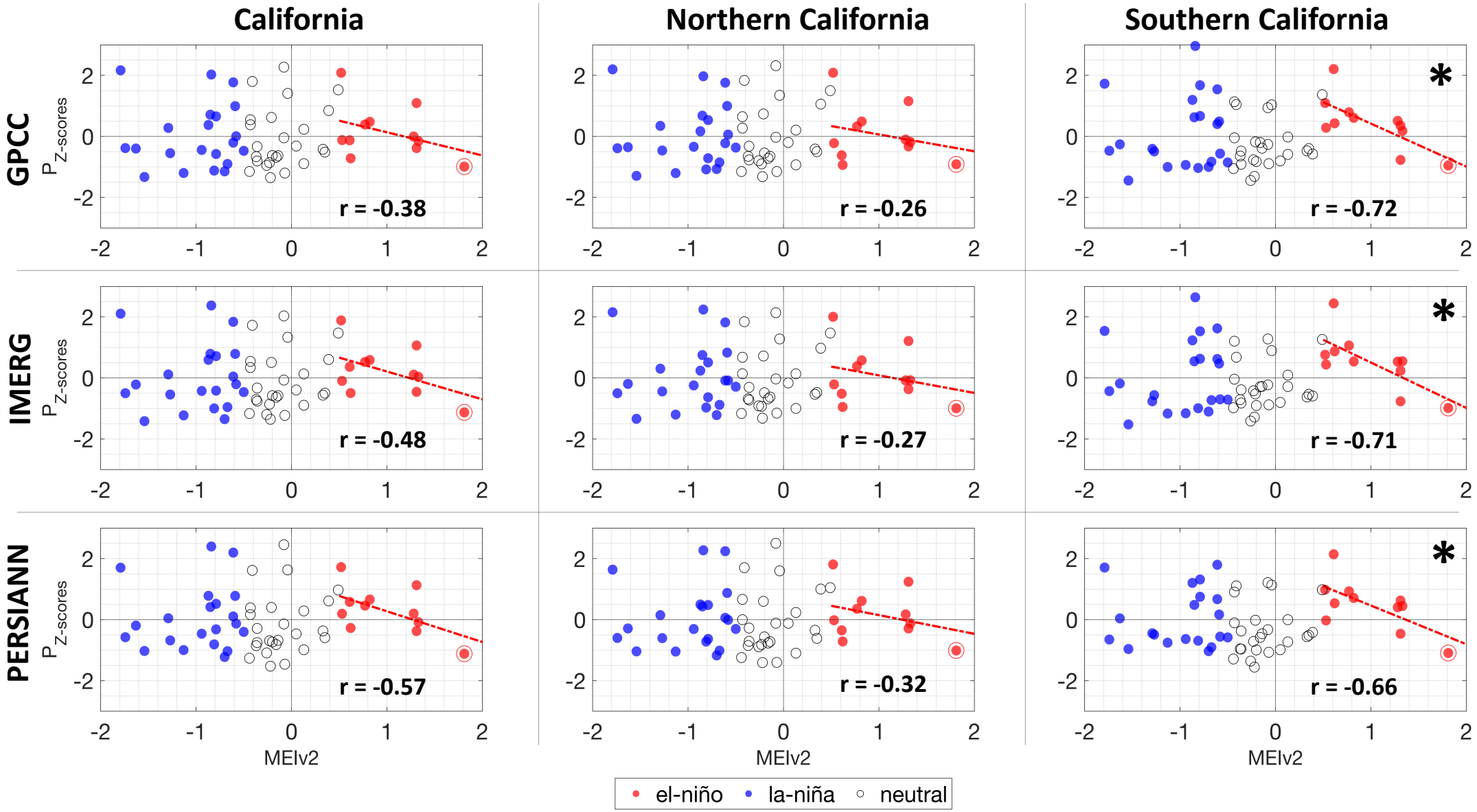
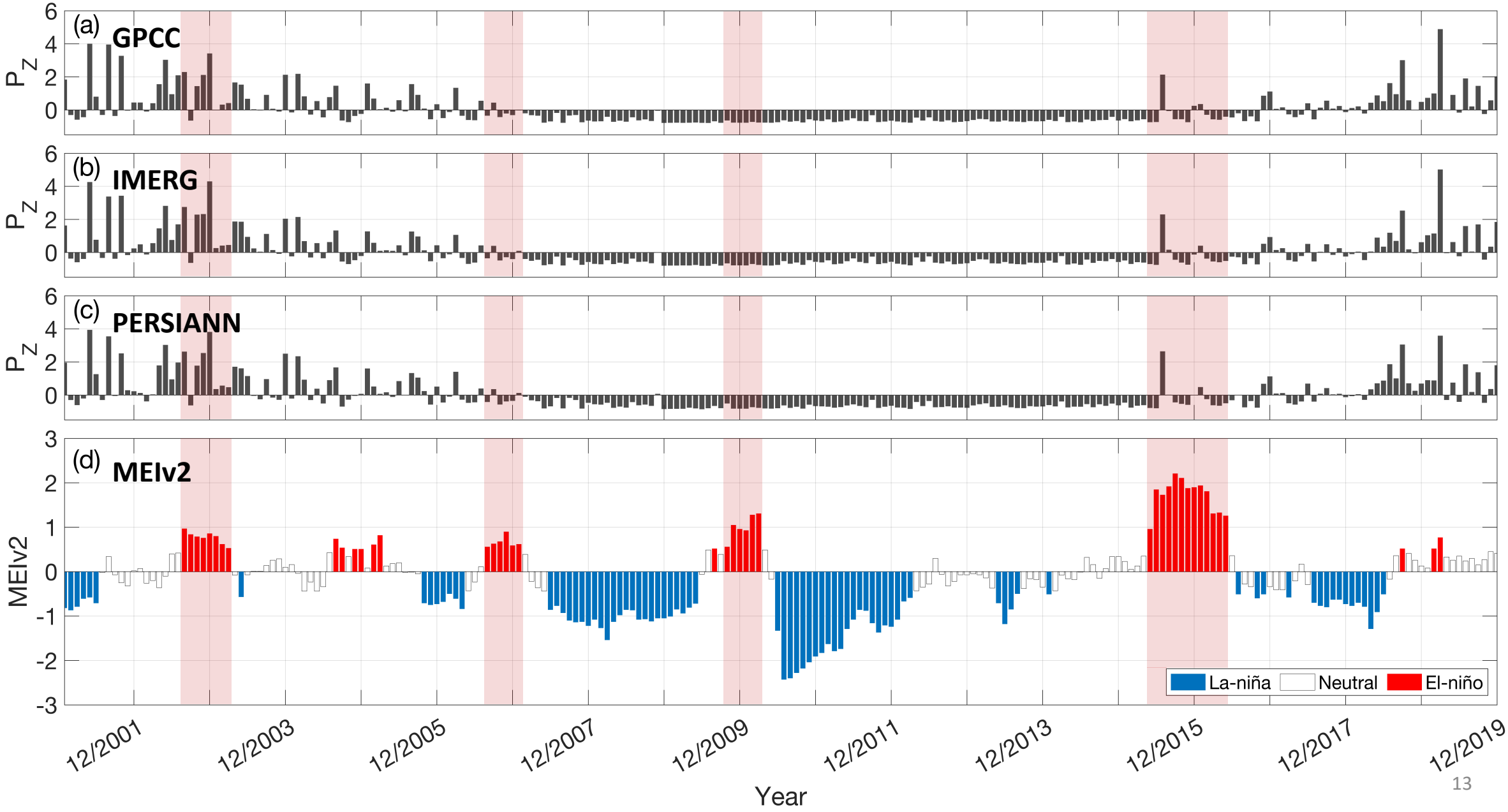


Fig.5 California late winter precipitation & MEIv2



r = correlation coefficient; * = Significant correlation

Fig. 6 Time series : Precipitation & MEI over Southern California



Conclusion

- ✓ Historically, strong El Niño events of 1982/83 & 1997/98 brought heavy precipitation over California.

- ✓ As our study shows, the 2015/2016 El Niño - one of the strongest events ever recorded and has been generally considered similar and comparable to another extreme events - the 1997/1998, 1982/83 El Niño events, failed to bring above average precipitation over California

- ✓ The failure of the seasonal rain predictions in the winter of 2015/16, along with the subsequent and equally unpredicted end to the California drought in the winter of 2016/17, has raised questions about the predictability of California seasonal rainfall, as well as its general relationship with El Niño–Southern Oscillation (ENSO).

Conclusion

- ✓ Many climate models project that the influence of ENSO in driving extremes will increase, along with the number of these extremes overall, in the twenty-first century.

- ✓ Studies have also suggested that the teleconnection mechanisms that underlie ENSO and its associated impact on California will intensify and/or shift position as a result of climate anomalies in a warmer climate.

- ✓ Global warming might have already increased the likelihood of extreme events through changes in ENSO. Hence, it is important to understand influence of ENSO over California precipitation under warming conditions.

References

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