The Effect of the 2015–2016 ENSO Event on the Earth's Rotation

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Geodesy, Astronomy and Geophysics in Earth Rotation

July 18-23, 2016
Wuhan, China

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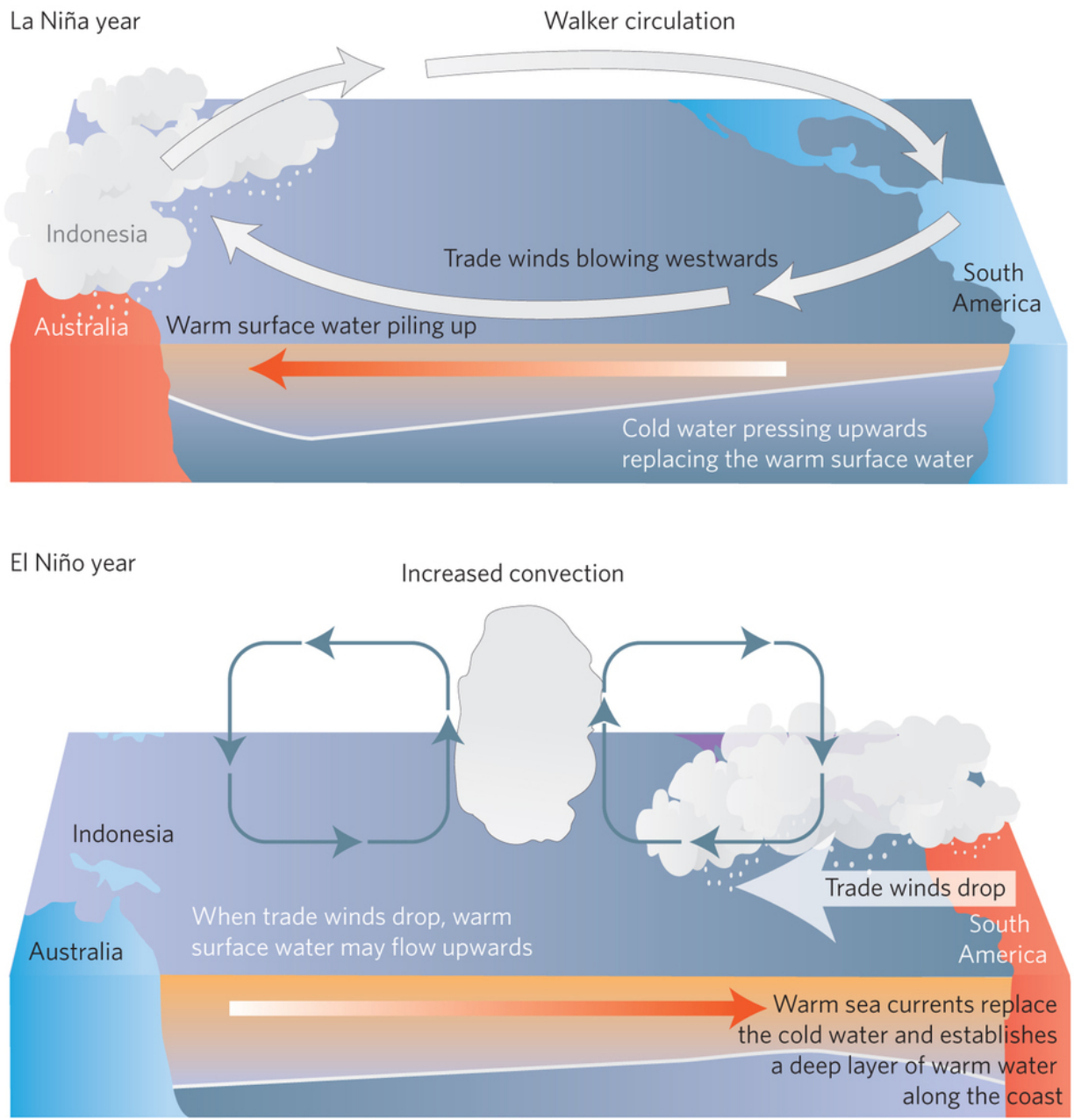
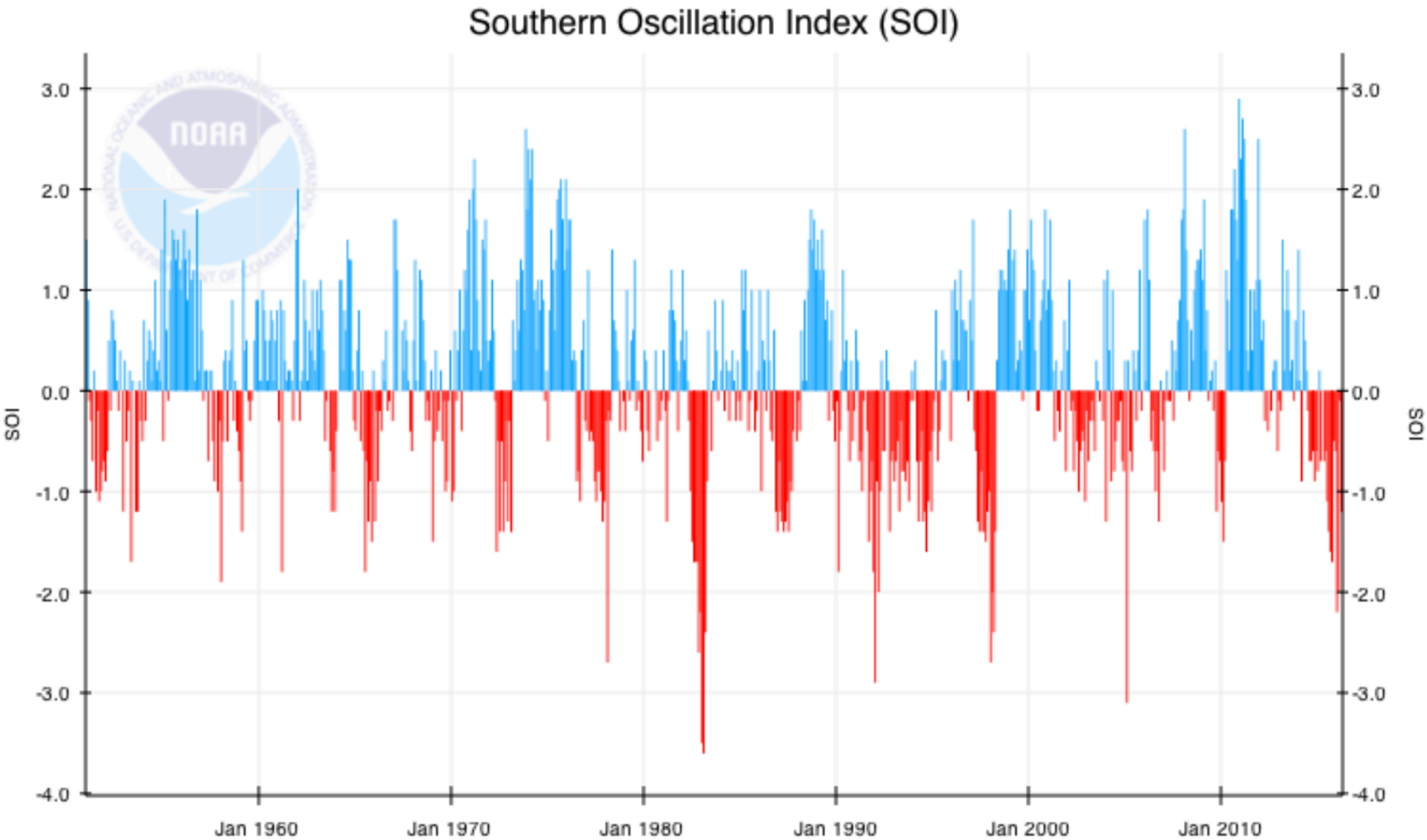
The El Niño / Southern Oscillation



(Heffernan, 2014)



Source: http://www.cpc.ncep.noaa.gov/data/indices/soi

SOI: Standardized difference in (Tahiti – Darwin) sea level pressure anomalies

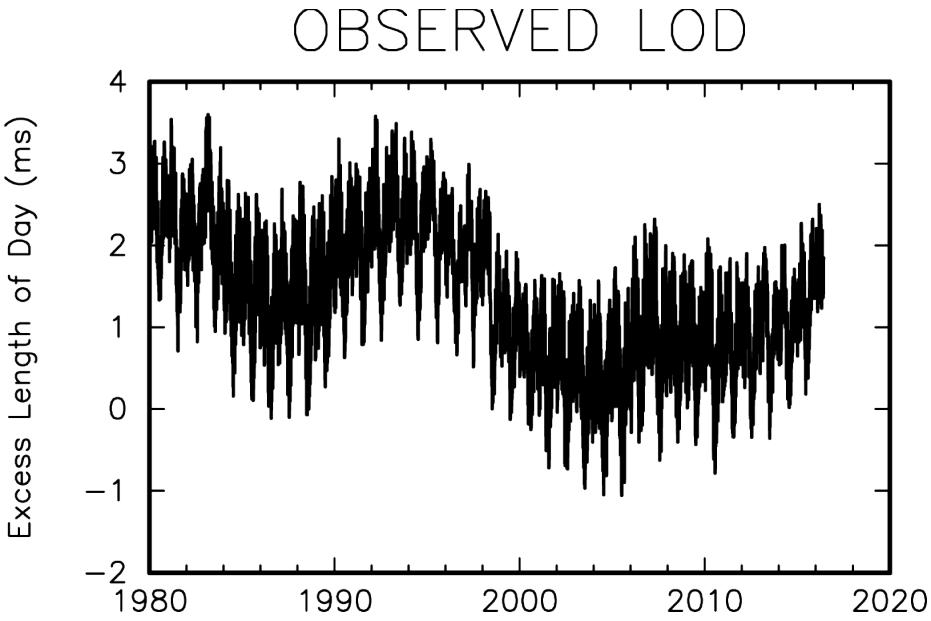
ENSO and LOD

- During an ENSO event
  - Southern Oscillation Index decreases
    - Standardized difference in (Tahiti – Darwin) sea level pressure anomalies decreases
  - Tropical easterlies collapse
    - Atmospheric angular momentum due to winds increases
    - Solid Earth's angular momentum decreases
    - Length of day increases
- Investigate effect of 2015–2016 ENSO on LOD
  - Compare observations of LOD to models of AAM
    - In interannual frequency band
    - After removing tidal signals from LOD

Data Sets and Processing

- Observed length of day
  - COMB2015 combined EOP series
    - Combination of optical astrometric, LLR, SLR, VLBI, & GPS observations
    - Polar motion rate observations not used (contaminated by tidal artifacts)
    - Daily values at midnight spanning January 20, 1962 to June 1, 2016
  - Remove solid Earth and ocean tides
    - Yoder et al. (1981) model for solid Earth; Kantha et al. (1998) model for oceans
  - Remove seasonal signal
    - Annual and its harmonics to 1/8 cpy
  - Isolate interannual band
    - Low pass filter at 1 cpy; high pass filter at 1/8 cpy
- Compare with atmospheric angular momentum
  - NCEP/NCAR reanalysis AAM
    - Wind & inverted barometer pressure terms
    - Daily values at midnight spanning January 2, 1948 to April 10, 2016
  - Remove seasonal signal & isolate interannual band as for lod

Observed Length-of-Day



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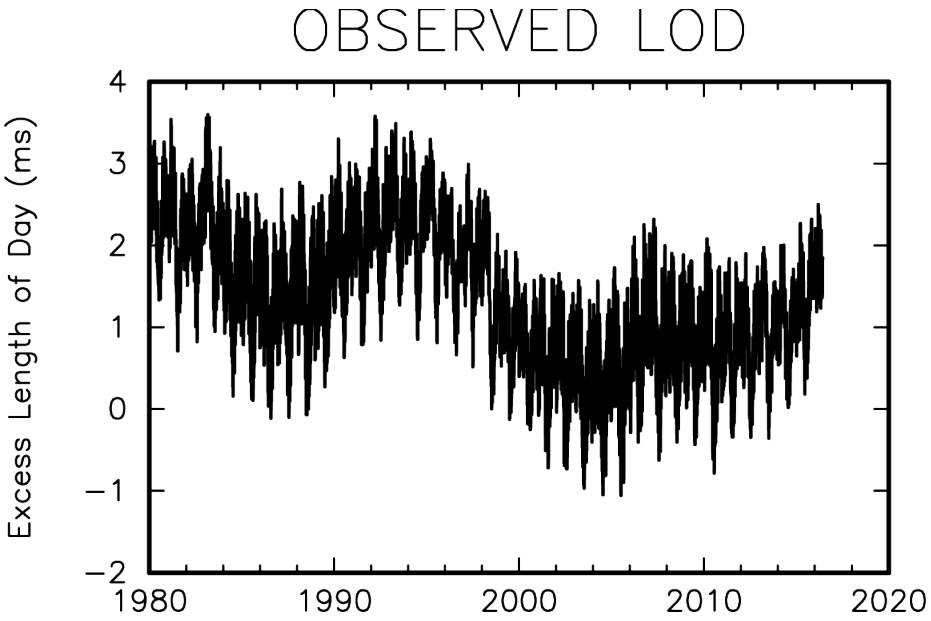

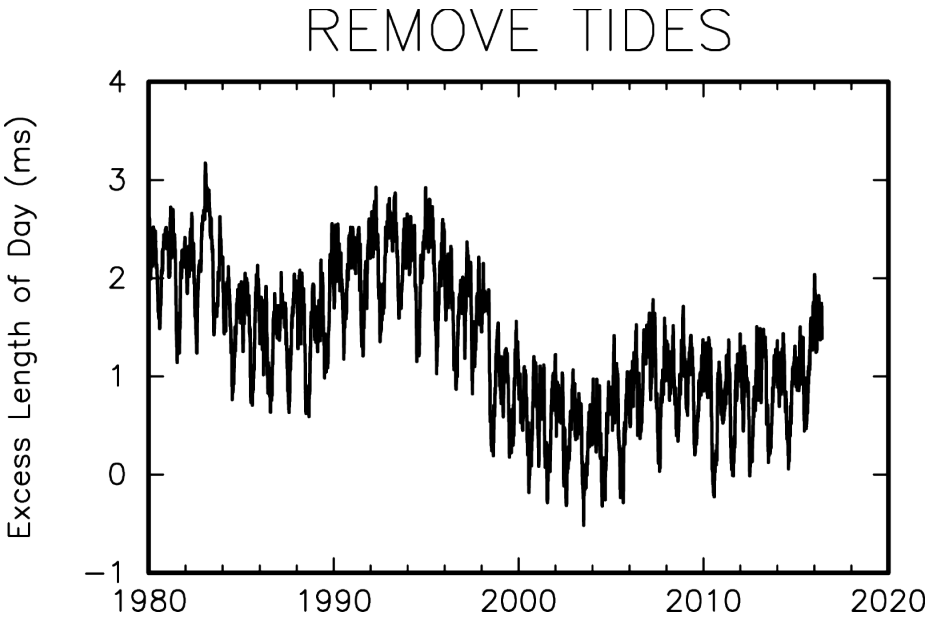

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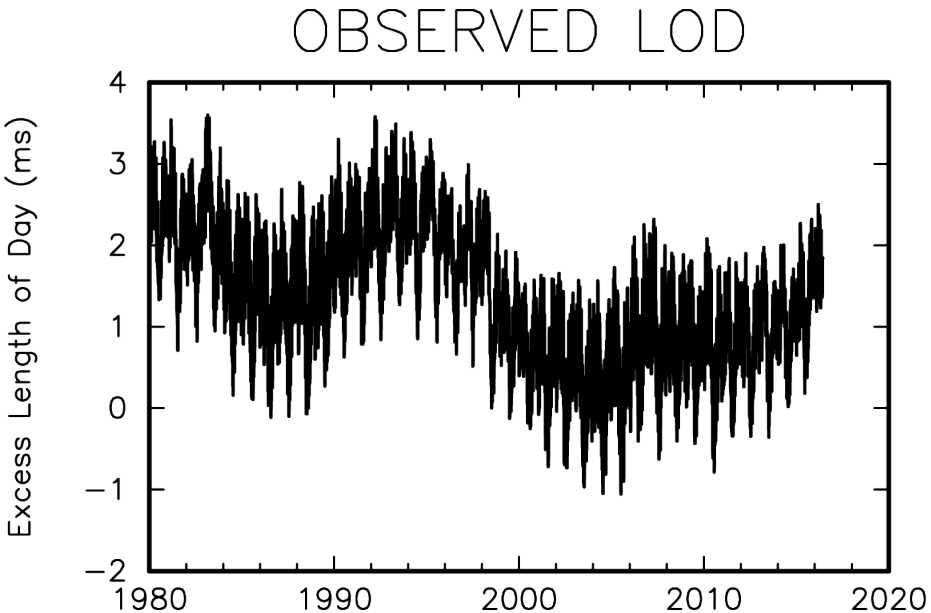

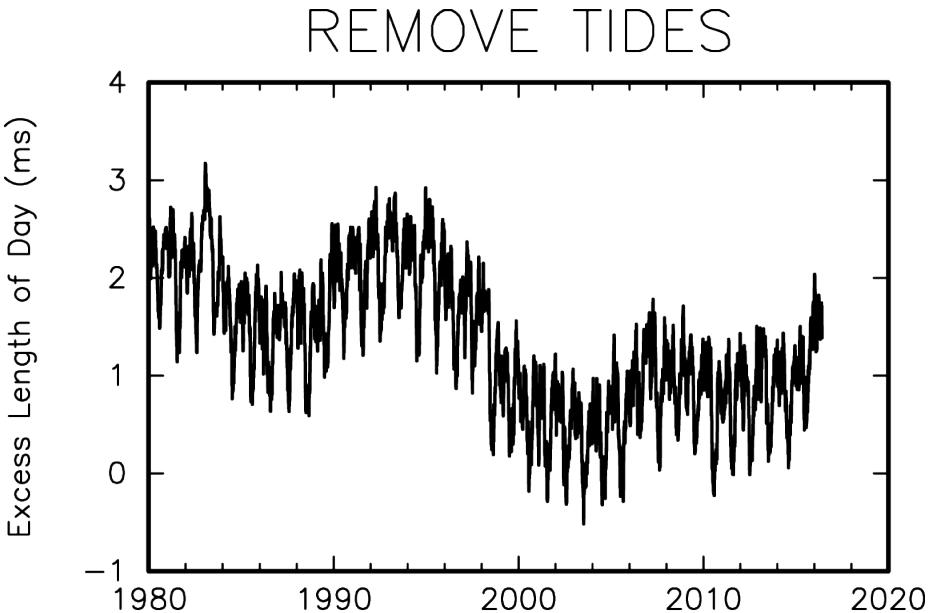

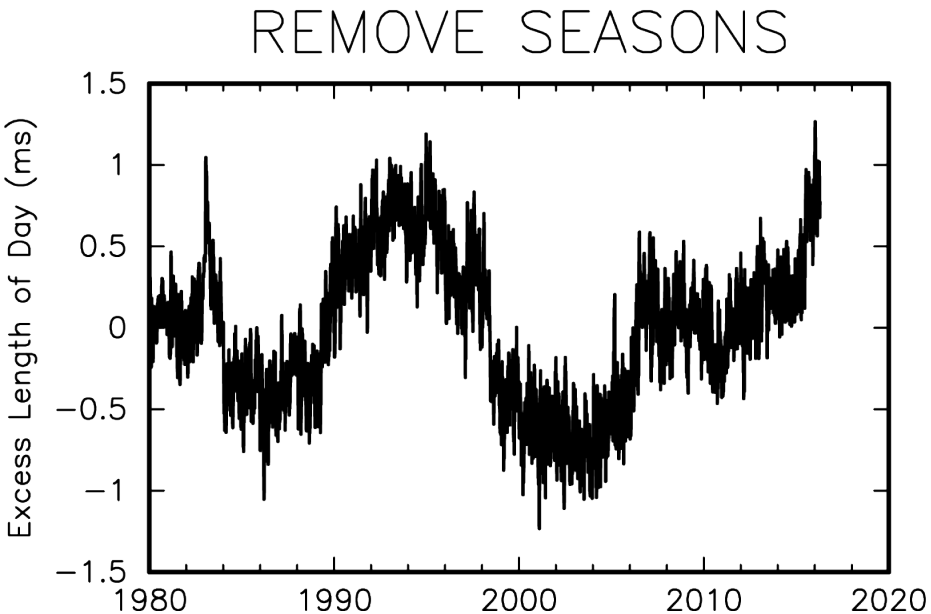

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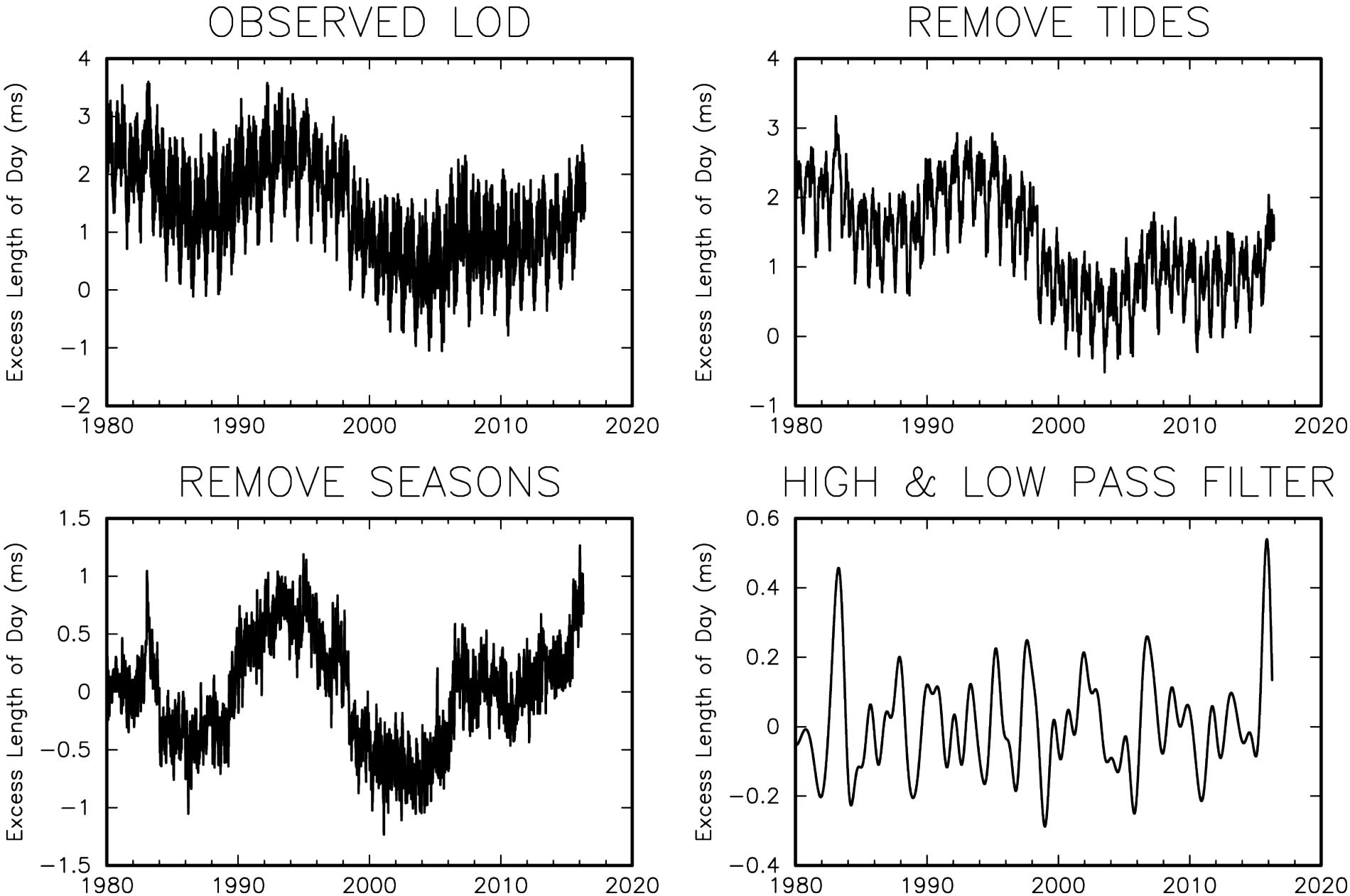
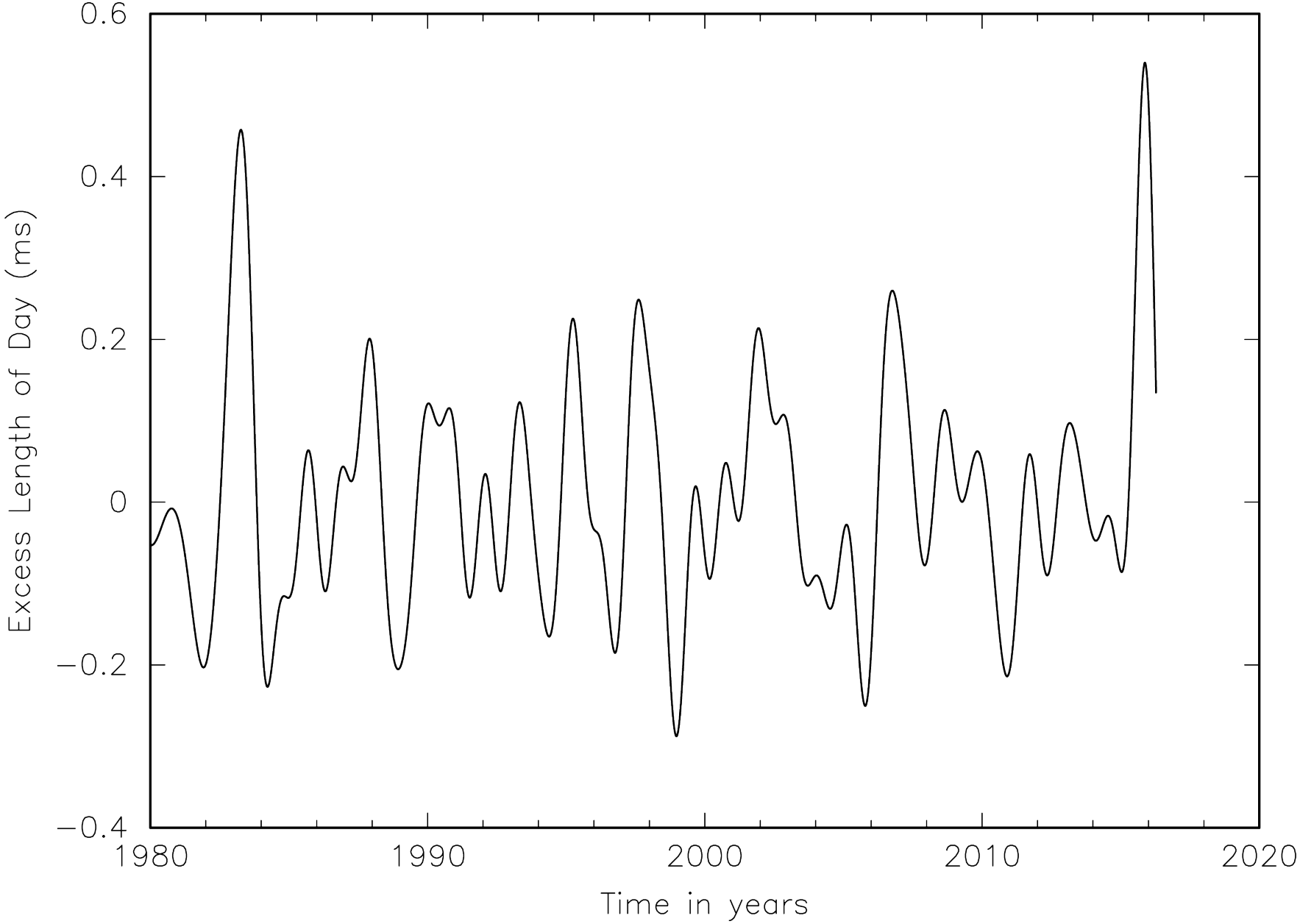


Interannual Length-of-Day



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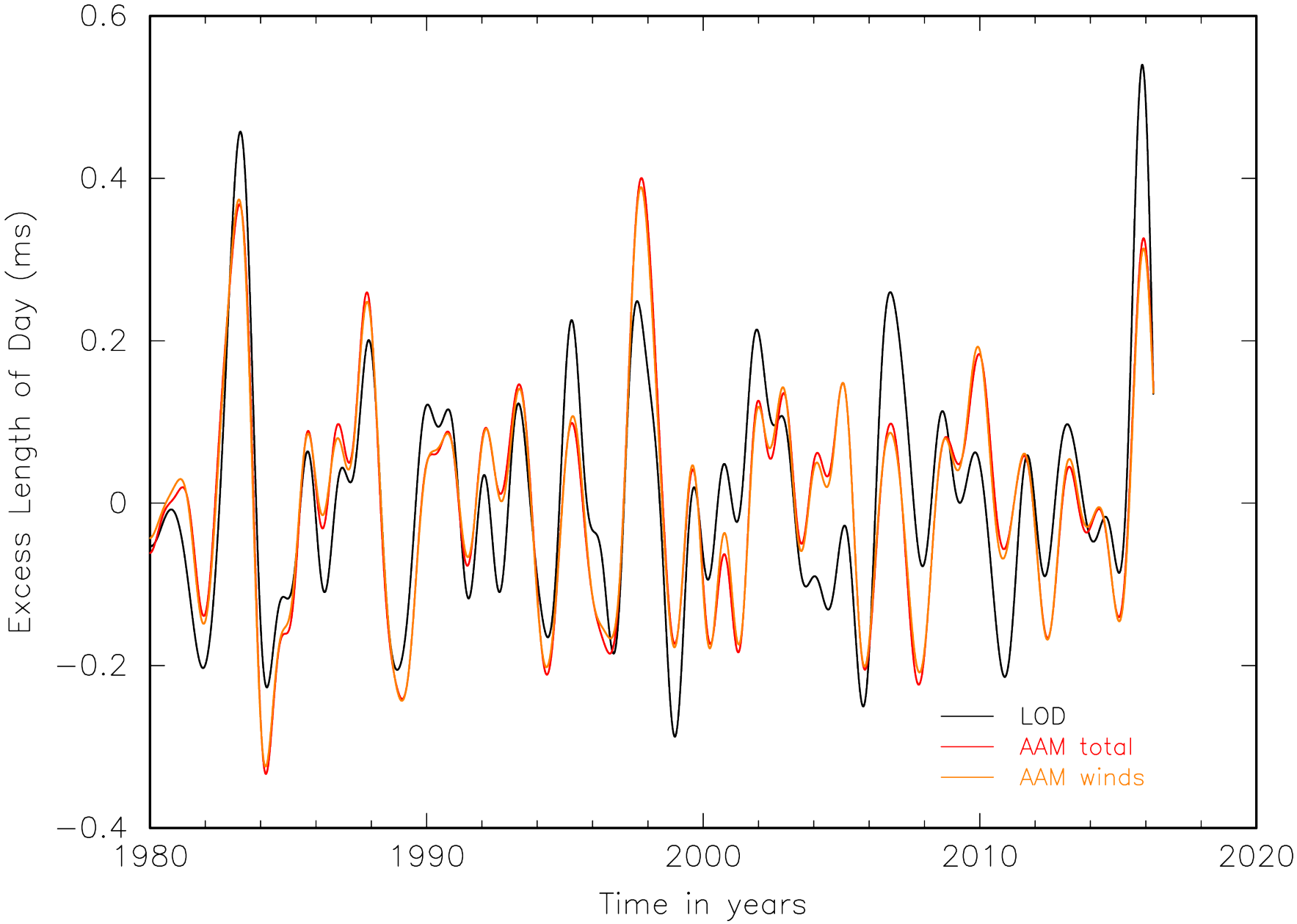

Summary

- El Niño / Southern Oscillation
  - Most prominent feature of climate system on interannual timescales
    - Occurs every 4–6 years
  - Has major impact on interannual LOD variations
- 2015–2016 ENSO event
  - Had as large an impact on LOD as 1982–1983 event
- Comparison of interannual LOD with AAM
  - AAM appears to explain only part of LOD variation
    - Unlike 1982–1983 event
- What is impact of oceans?
  - Can OAM explain rest of observed LOD variation?