Does El Niño Intensity Matter for California Precipitation?


* NOAA/ESRL/PSD  
# CIRES/Univ. Colorado-Boulder
CA Rainfall During El Niño Is Mixed

Statewide Wet During the Two VS El Niño
Statewide Wet During Half MS El Niño

Nov-Apr 1896-2014 Statewide Precipitation

VS El Niño

* = MS El Niño
Questions

1. Is statewide November-April California wet symptomatic of the sensitivity to sea surface temperature (SST) forcing during very strong (VS) El Niño?

2. Is there a difference in impacts of VS El Niño and moderate-to-strong (MS) El Niño?

3. How do risks for wet vs. dry rainy season conditions change with El Niño?
Observed Data

- U.S. Climate Division Precipitation from Vose et al. 2014
- SST from Hurrell et al. 2008
Model Simulations

• Driven by observed monthly time-varying SST, sea ice, greenhouse gases and ozone for 1979-2014
• Three models and 130 ensembles
  • CAM5 – 50 ensembles
  • GFSv2 – 50 ensembles
  • ECHAM5 – 30 ensembles
• Aggregate all ensemble members
  • All models simulate similar regional California precipitation during ENSO
Define ENSO Events

• Centered On December-February Season
• ENSO Category Definition
  • VS El Niño: Niño3.4 > 2.0°C
  • MS El Niño: 2.0°C > Niño3.4 > 1.0°C

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<tr>
<th>Category</th>
<th>January of Season</th>
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SST Anomalies During VS and MS El Niño Are Different

Average SST Anomaly During VS and MS El Niño
Strong Regional Rainfall Changes With VS El Niño

North and Central California sensitive to VS El Niño only

Nov-Apr Precipitation During El Niño

Observed
Strong Regional Rainfall Changes With VS El Niño

North and Central California sensitive to VS El Niño only
Strong Regional Rainfall Changes With VS El Niño

Southwest U.S. more sensitive to VS than MS El Niño
VS El Niño Shifts the Rainfall Odds Regionally

- North and Central California sensitive to VS El Niño only
- Overall shift to statewide wet conditions during VS El Niño
VS El Niño Shifts the Rainfall Odds Regionally

- North and Central California sensitive to VS El Niño only

- Overall shift to statewide wet conditions during VS El Niño
VS El Niño Nearly Eliminates Odds of Below Average Rainfall

- VS El Niño-driven regional below average rain is 5%
- VS El Niño significantly increases regional odds of 150% and 200% of normal
Midseason Maximum During VS El Niño

Monthly Model Simulation Precipitation During VS El Niño
Late Season Maximum During MS El Niño

Monthly Model Simulation Precipitation During MS El Niño
Questions

1. Is statewide California November-April wet symptomatic of the sensitivity to sea surface temperature (SST) forcing during very strong (VS) El Niño?

**VS El Niño forces in excess of 130% of average precipitation**

2. Is there a difference in impacts of VS El Niño and moderate-to-strong (MS) El Niño?

**North and Central California is sensitive to only VS El Niño**

3. How do risks for wet vs. dry rainy season conditions change with El Niño?

**VS El Niño nearly eliminates the odds of below average November-April rainfall**