Drought simulation over west US.

---*Final Report*

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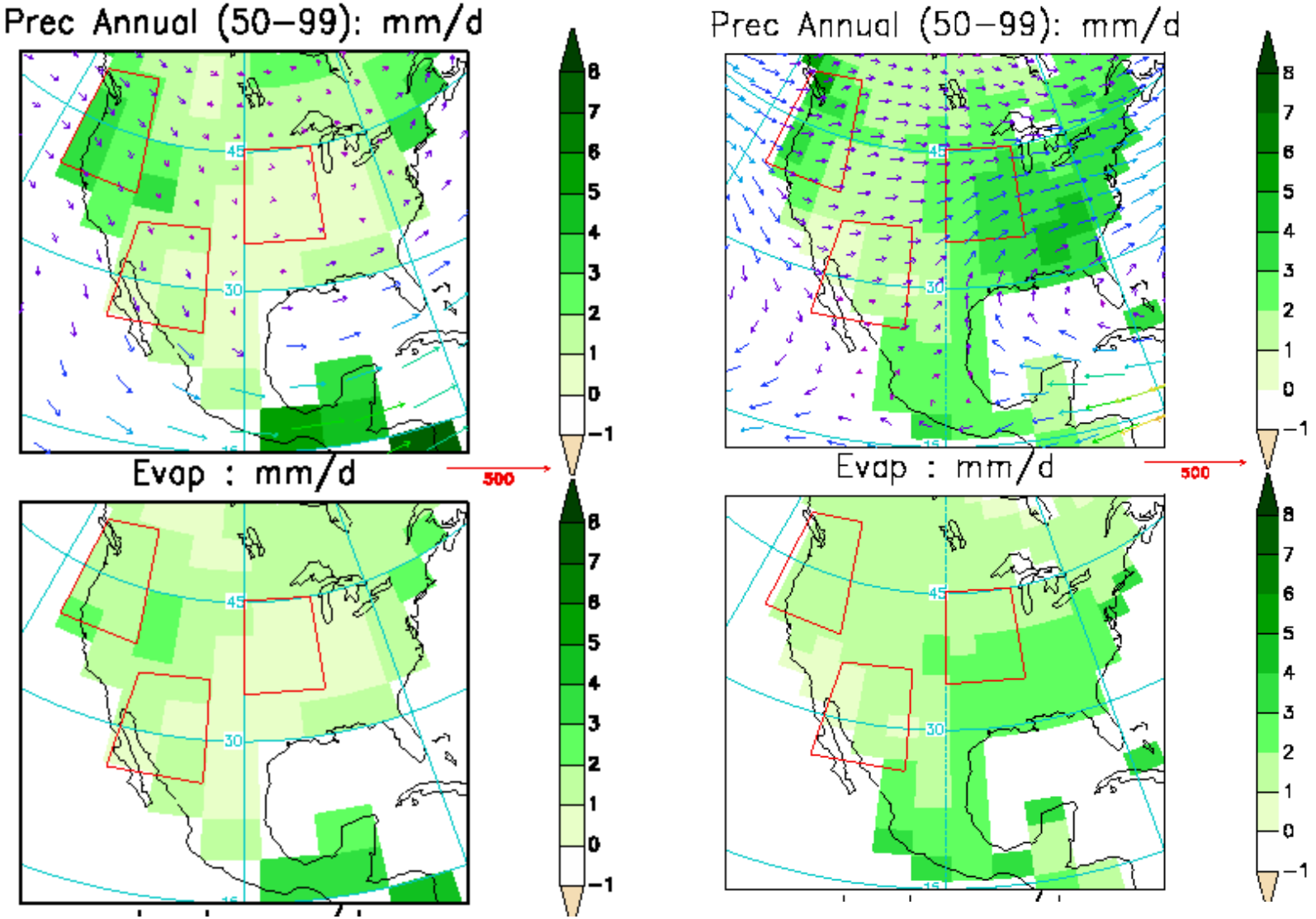
Wen Mi

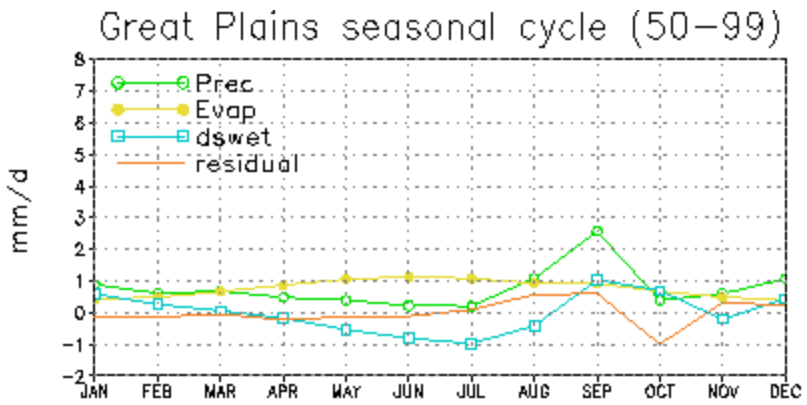
Project

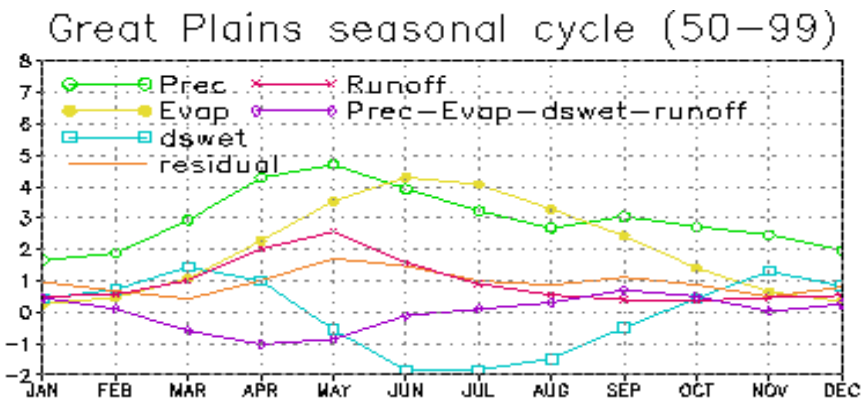
- Comparison between Hadley Center simulation and C20C experiment by QTCMs (Dr. Zeng)

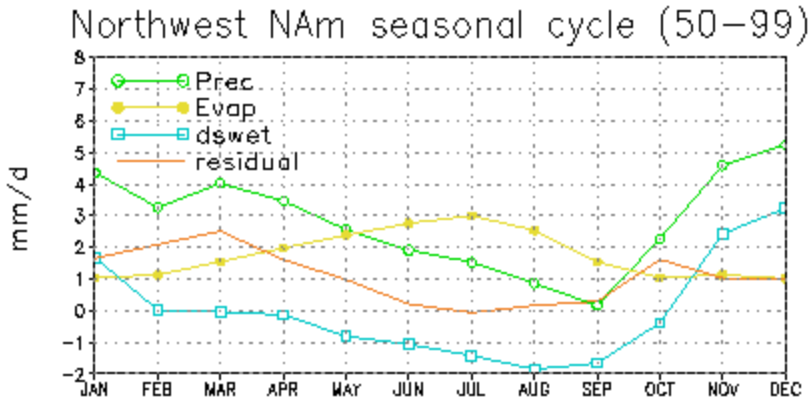
- Climatology—C20C test

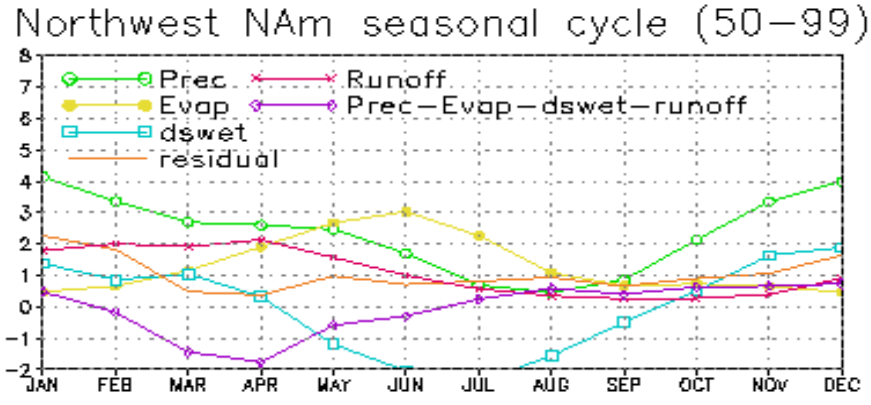
Climatology




Great Plains seasonal cycle (50–99)
mm/d
Prec
Evap
dswet
residual
JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC


Great Plains seasonal cycle (50–99)
Prec
Evap
dswet
residual
Runoff
Prec–Evap–dswet–runoff
JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC


Northwest NAm seasonal cycle (50–99)
mm/d
Prec
Evap
dswet
residual
JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC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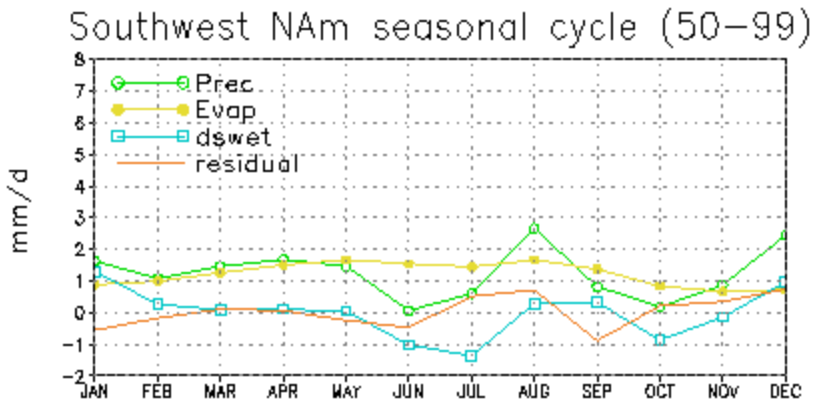
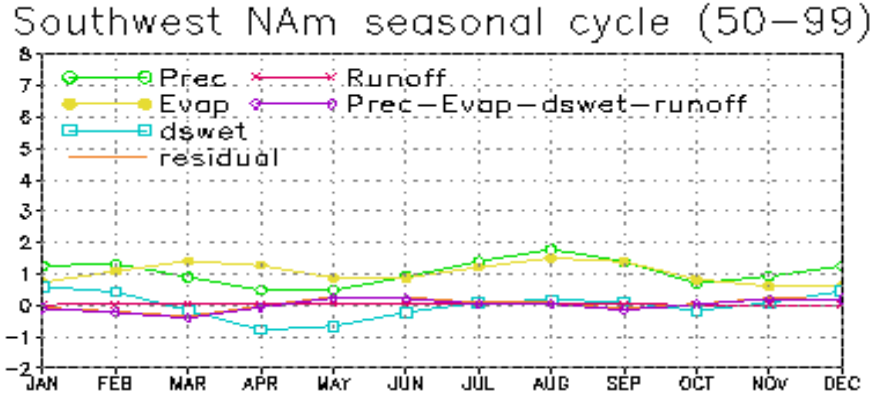

Southwest NAm seasonal cycle (50–99)
mm/d
Prec
Evap
dswet
residual
JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC


Southwest NAm seasonal cycle (50–99)
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residual
Runoff
Prec–Evap–dswet–runoff
JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC

Southwest of North American

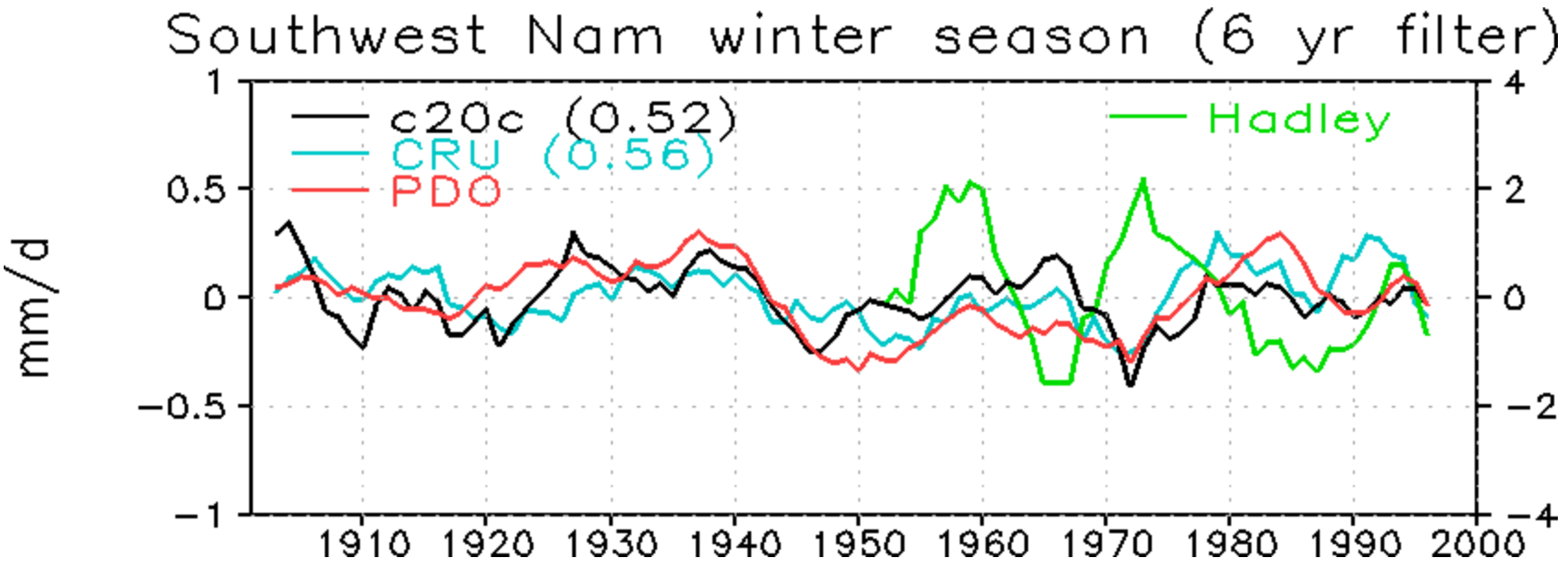


Fig. 6: Southwest of North American domain averaged winter season precipitation index after 6-year running mean filter. Light blue line is for CRU time series, black for C20C, red for PDO index and green is Hadley data. Unit (mm/day)

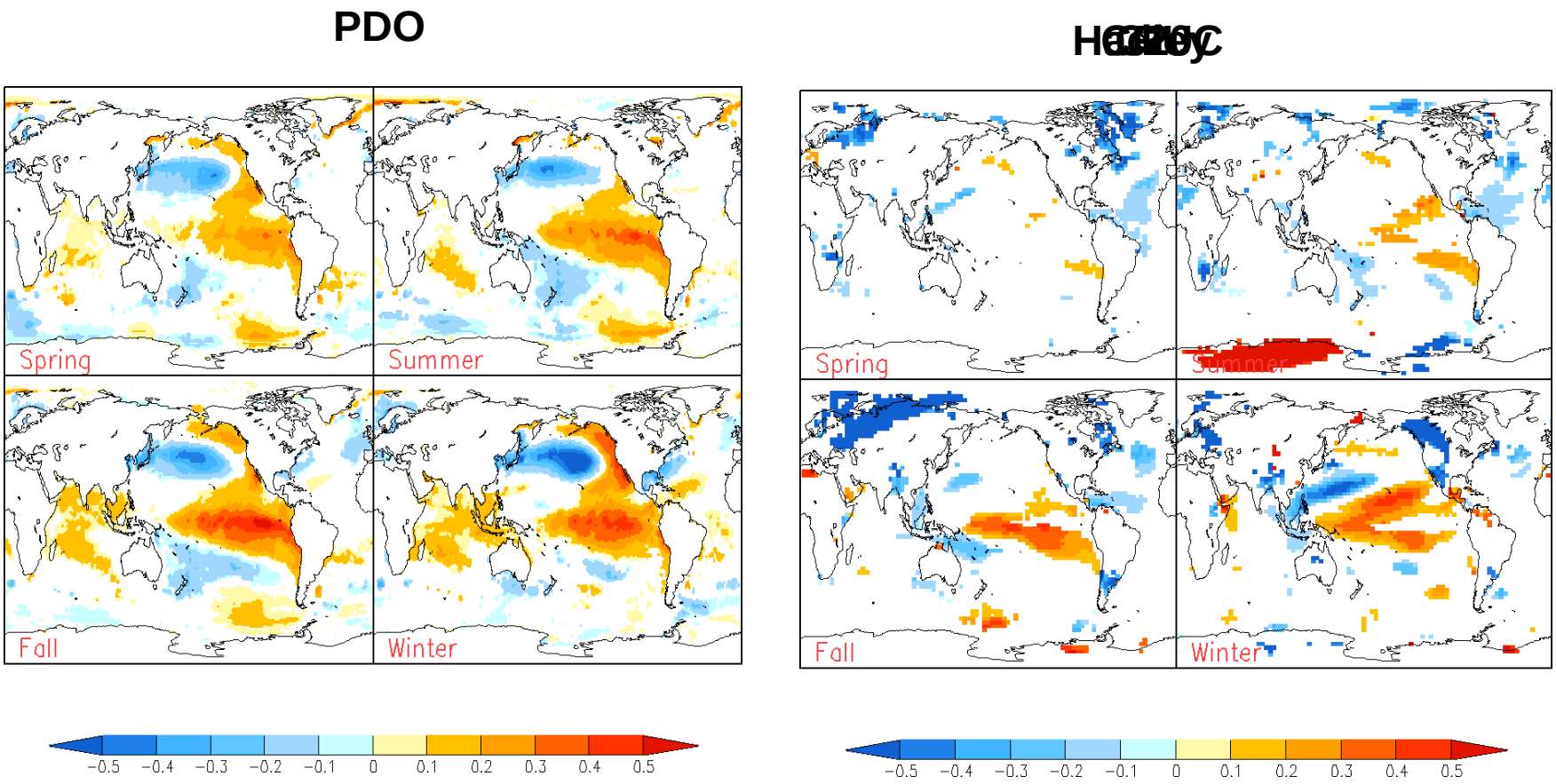


Fig. 7: 4-season regressions of SST with Southwest of North American precipitation Unit(c). The shaded area pass 95% significance test.

Northwest of North American

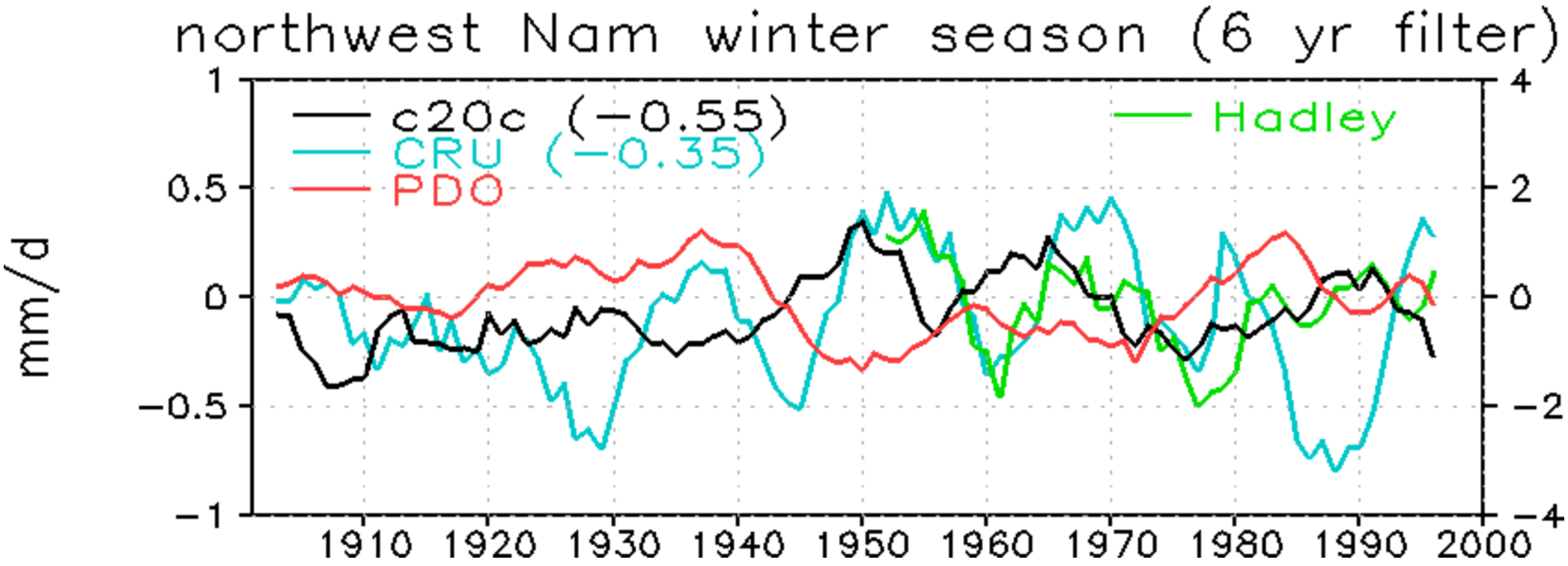


Fig.8:Northwest region of North American domain averaged winter season precipitation index after 6-year running mean filter. Light blue line is for CRU time series, black for C20C, red for PDO index and green is Hadley data. Unit (mm/day)

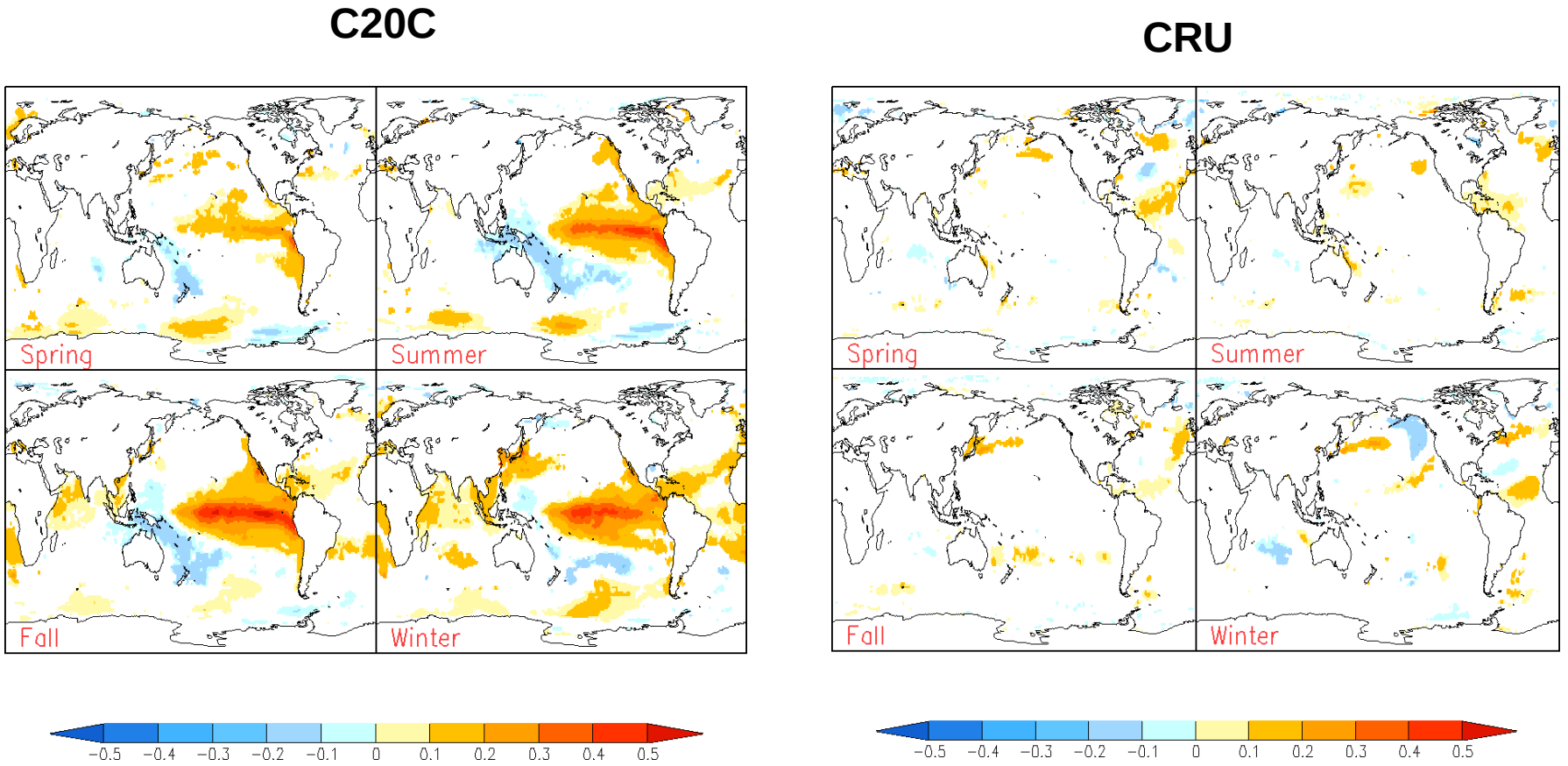
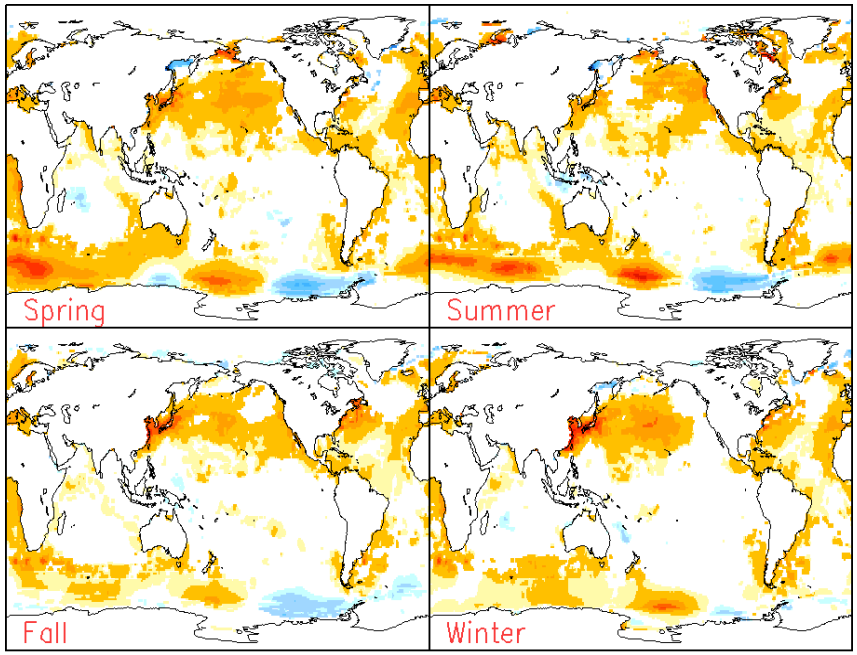
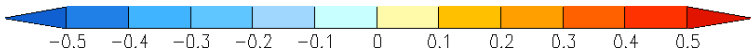


Fig. 9: left) 4-season regressions of SST with southwest region of North American precipitation index for C20C simulation; right) 4-season regressions of SST with southwest region of North American precipitation index for CRU; The shaded areas pass the 95% significance test.

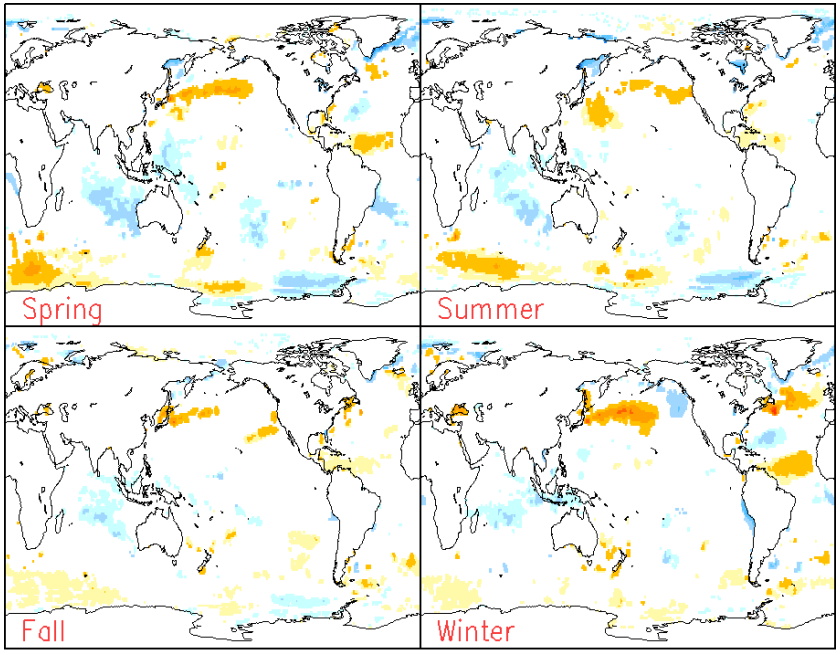
After 6 year running mean

C20C





CRU



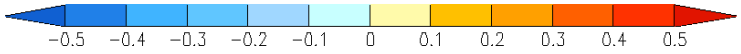


Fig. 10 left) 4-season regressions of SST with southwest region of North American precipitation index after 6 year filter for C20C simulation; right) 4-season regressions of SST with southwest region of North American precipitation index after 6 year filter for CRU simulation Unit(C). The shaded areas pass the 95% significance test.

PDO linkage with variation of winter precipitation in North American

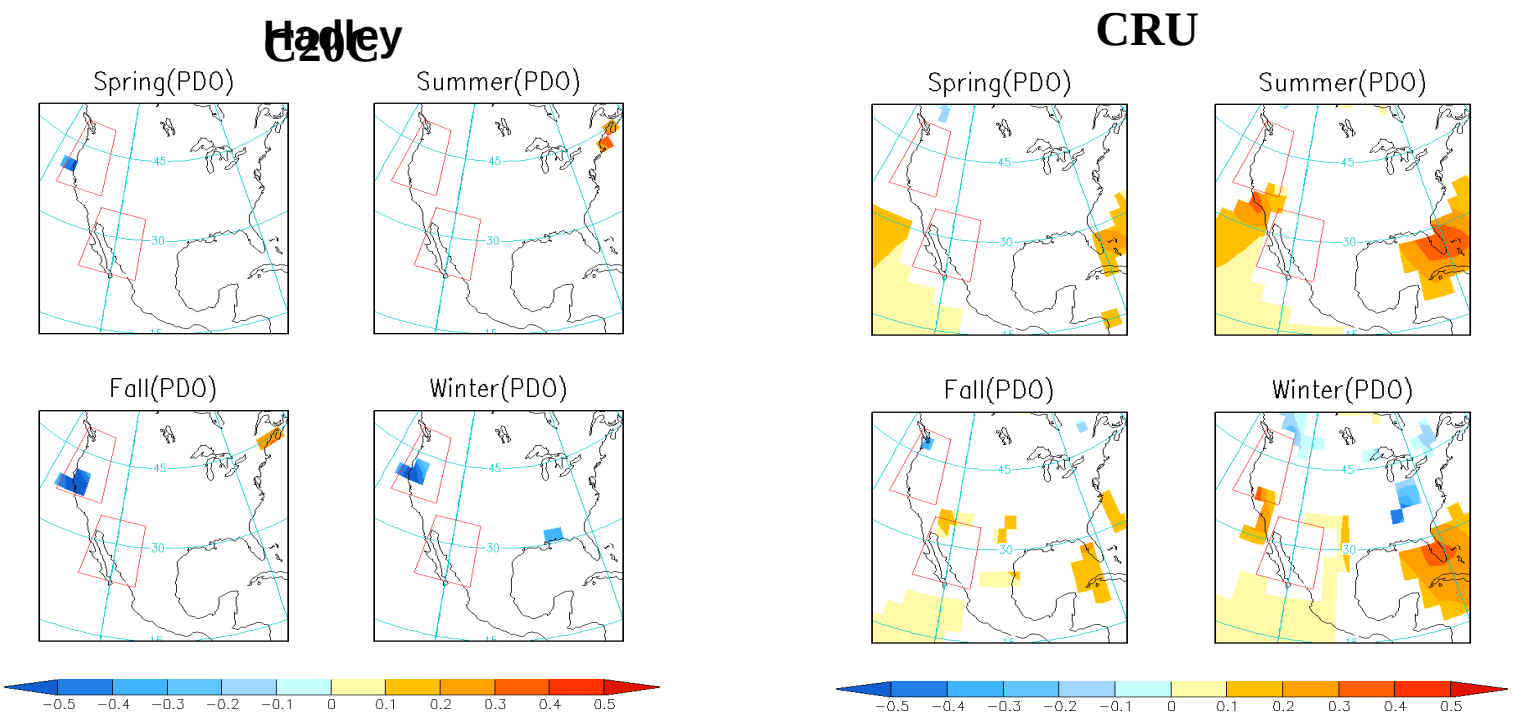


Fig. 10: 4-season regressions of PDO index with variation of winter precipitation in North American. a) C20C; b) CRU; c) Hadley Centre. The shaded areas pass the 95% significance test. Unit (mm/day)

Conclusion

1. **Climatology:**

- C20C: eastward shift in center and east coast, reasonable result in west coast;
- Hadley: capture the main features of precipitation climatology over US

2. Climate of Southwest of US is largely influenced by PDO

- C20C, CRU are strongly positively correlated to PDO index. Their relationships are significant. No such obvious correlation from Hadley Center simulation was found.

Conclusion

3. Northwest of US

- C20C precipitation serials is negatively correlated to PDO index, which could be masked by higher frequency signal (i.e. ENSO).
- CRU has a slight negative correlation with PDO. The regression show week signal of PDO, but no ENSO signal.
- Hadley Center simulation has no significant ENSO/PDO signal

3. Analysis of PDO index regression with winter precipitation pattern in North American are consistent with our above results.

Uncertainties and limitation

1. C20C (QTCM) and Hadley use different SST forcing ;
2. Modeling simulation has different time coverage.
3. Some variables, such as soil wetness are not defined identically from two model.
4. We only analyzed precipitation. Other hydroclimate variables could be investigated in future work.
5. Further research is needed to reveal the underlying mechanisms.