

Supplemental Material

CORDEX Ensemble Spread (historical)

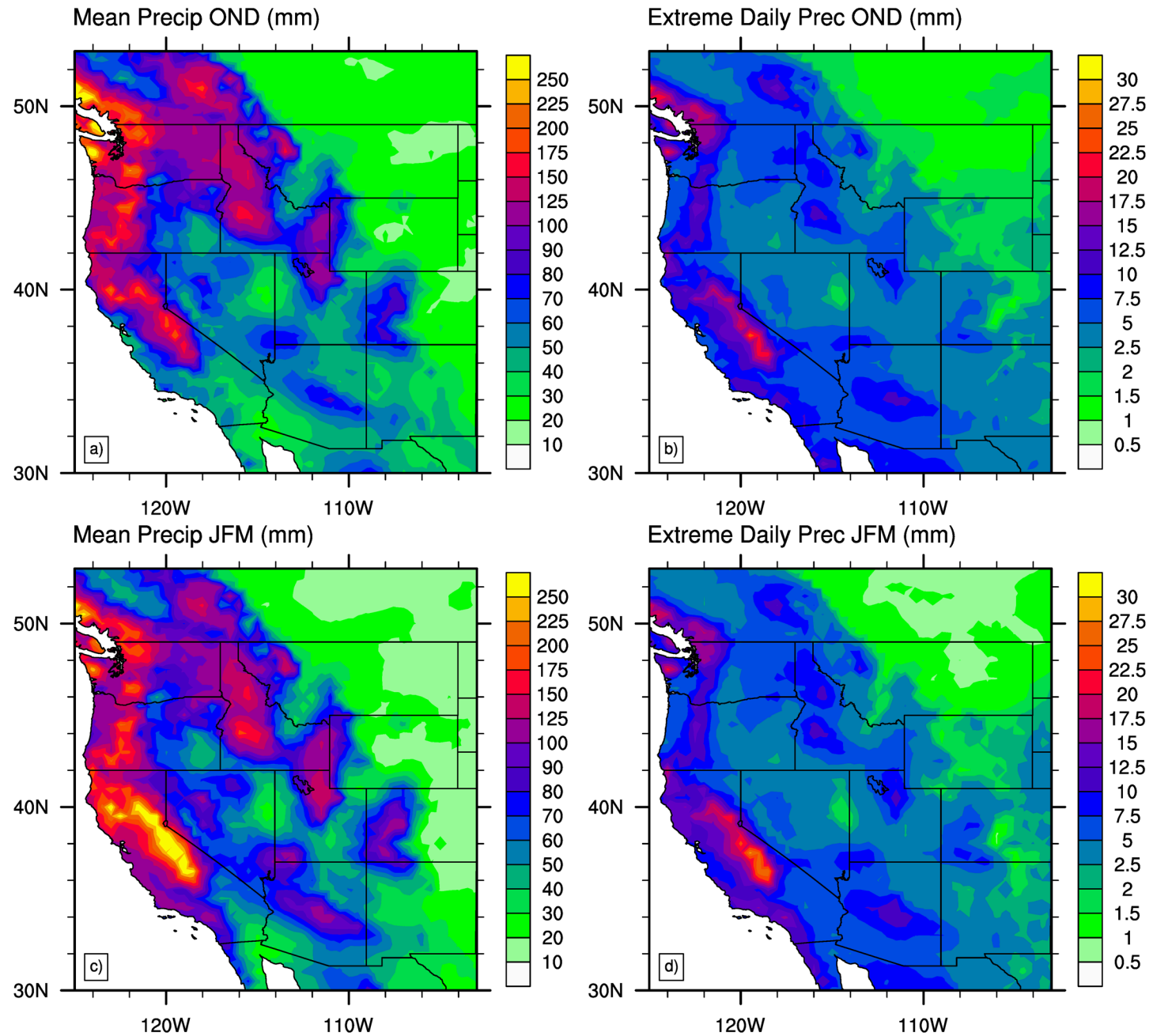


Figure SM1. a) Standard deviation of all NA-CORDEX individual model members in historical (1976 – 2005) mean monthly OND precipitation (mm, as shaded); b) as in a) except for 99th percentile daily precipitation; c) as in a) except for JFM; d) as in b) except for JFM.

CORDEX Historical Monthly Climate (mm/30days)

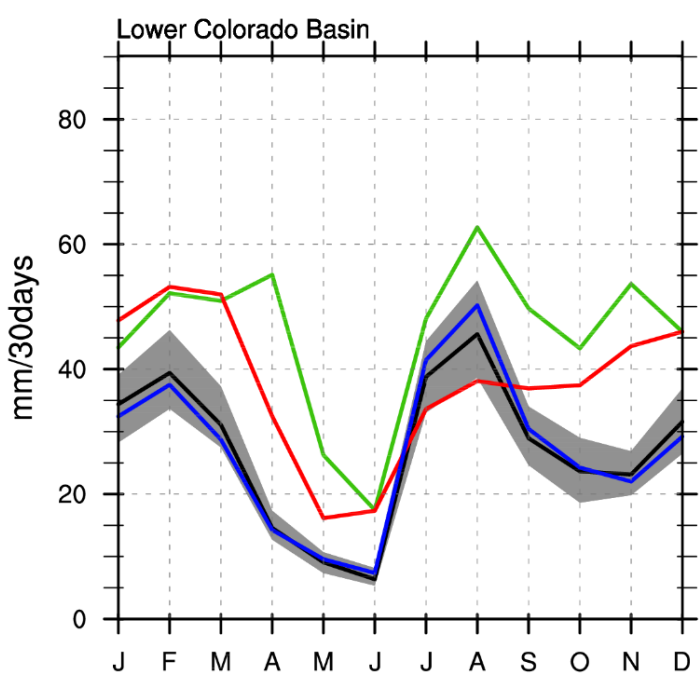
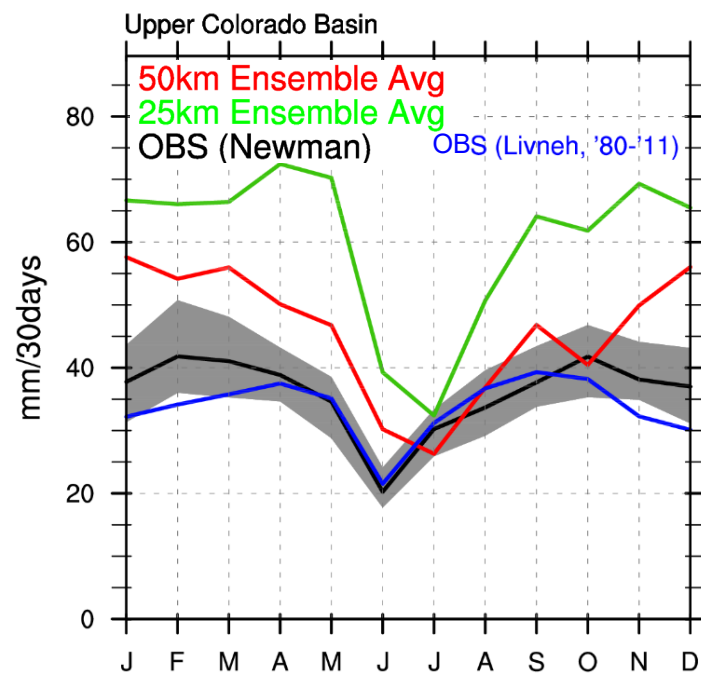
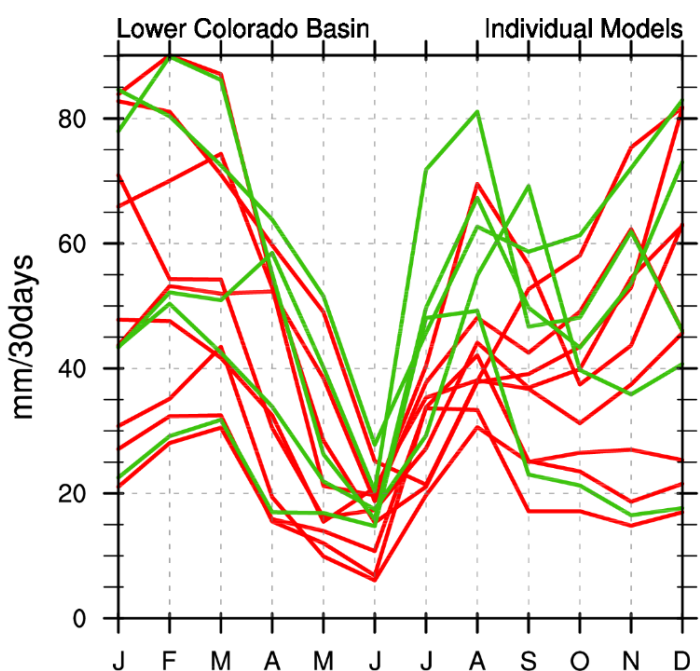
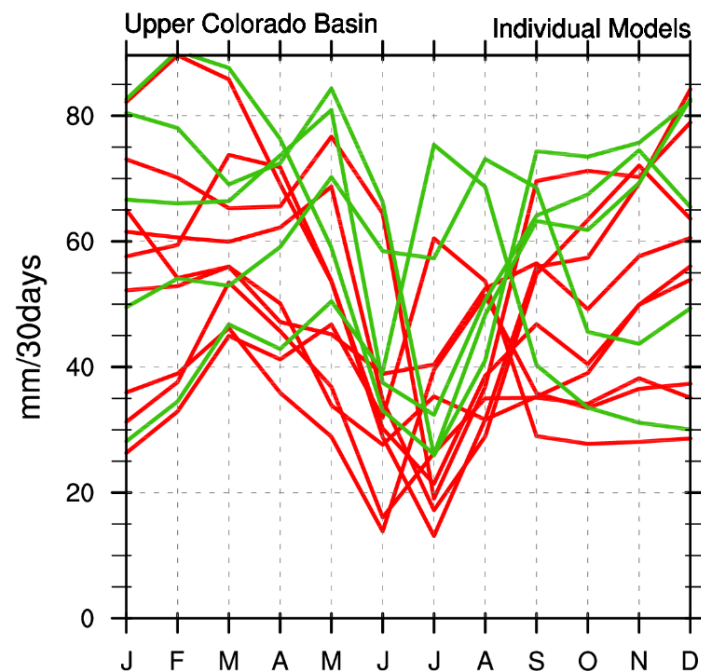


Figure SM2. Colorado Basin Precipitation Seasonal Cycle: a) Upper and Lower Colorado Basin as labeled; b) monthly mean monthly historical precipitation (mm/30 days) averaged over the Upper Colorado Basin with 50-km (25-km) simulations shown in red (green); c) as in b) except for over the Lower Colorado Basin; d) 50-km (red line) and 25-km (green line) simulation historical (1976 – 2005) ensemble mean precipitation versus reanalysis precipitation (Newman et al. (2015) in black and Livneh et al. (2013) in blue. Gray shaded area shows Newman et al. (2015) uncertainty bounds containing the full range of the 100 ensemble members; e) as in d) except for Lower Colorado Basin.

CORDEX Historical 99th Percentile of Daily Precipitation in JFM (mm)

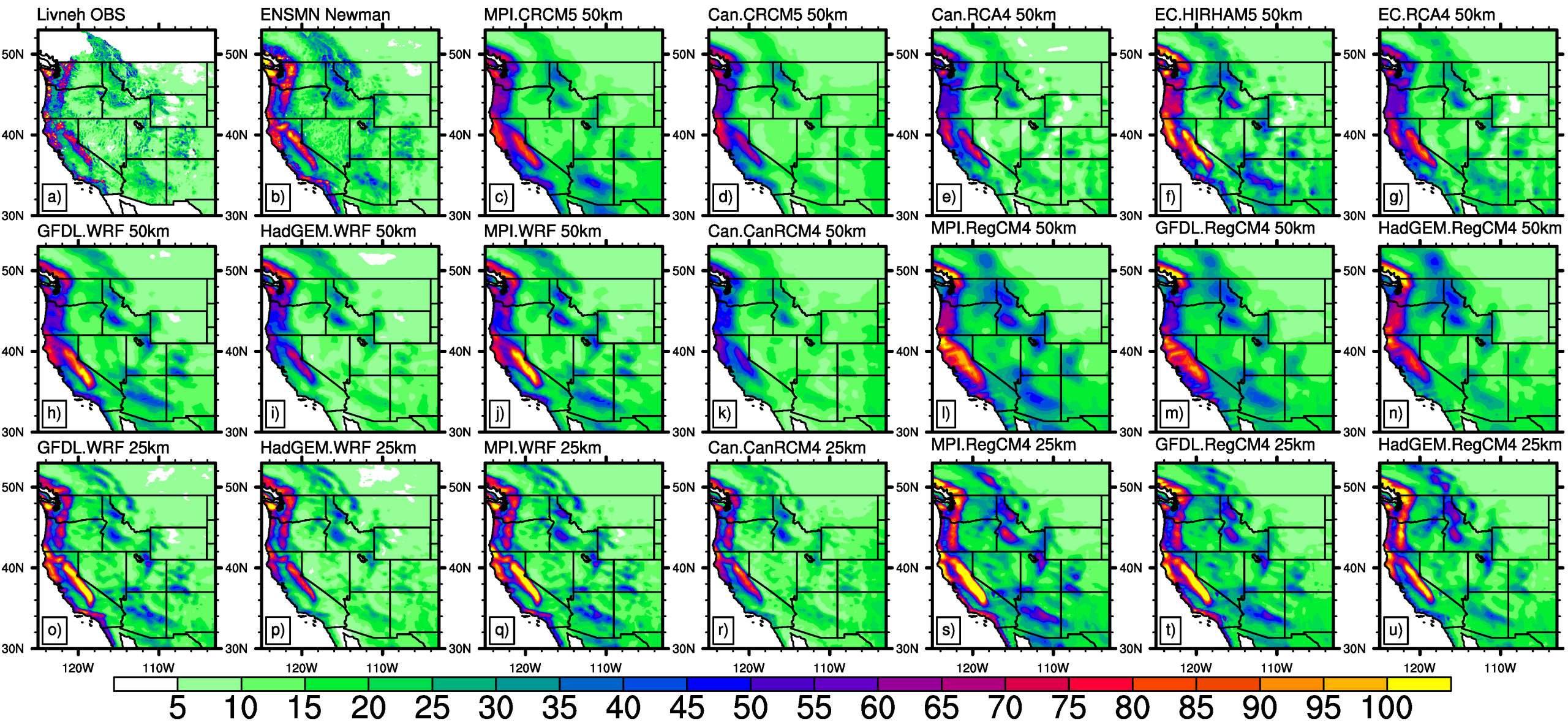


Figure SM3. Historical (1976 – 2005) JFM mean 99th percentile daily precipitation for each NA-CORDEX model listed in Table 1, as labeled in c) – u). a) Livneh et al. (2013) reanalysis precipitation (mm); b) Newman et al. (2015) ensemble average reanalysis 99th percentile daily precipitation (mm) for same time period.

CORDEX Historical Daily 99th% Precip by Month

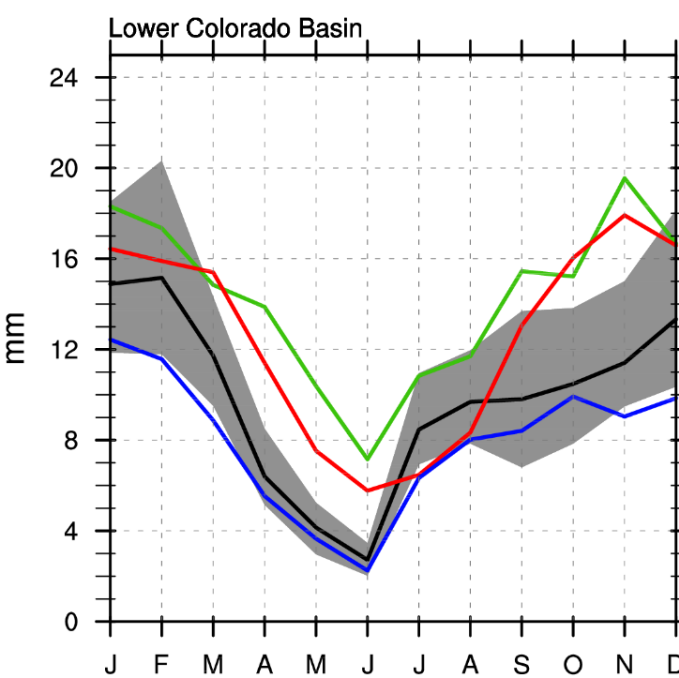
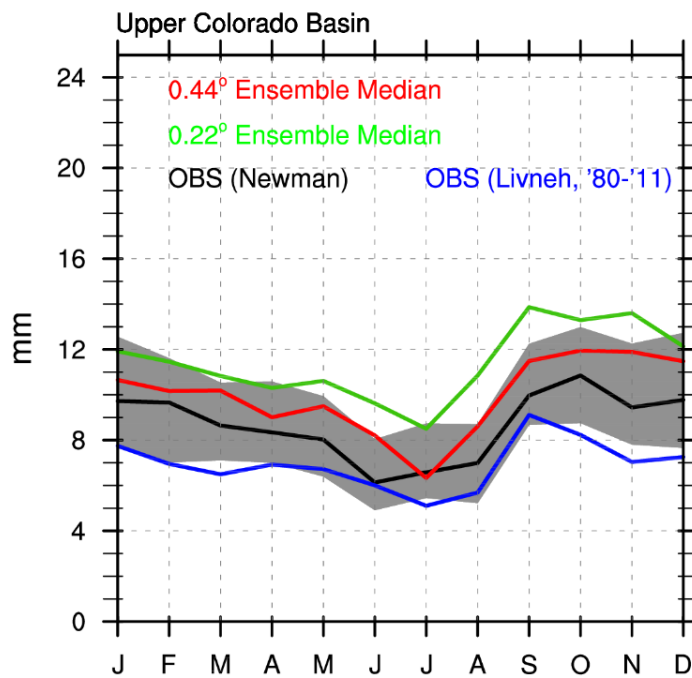
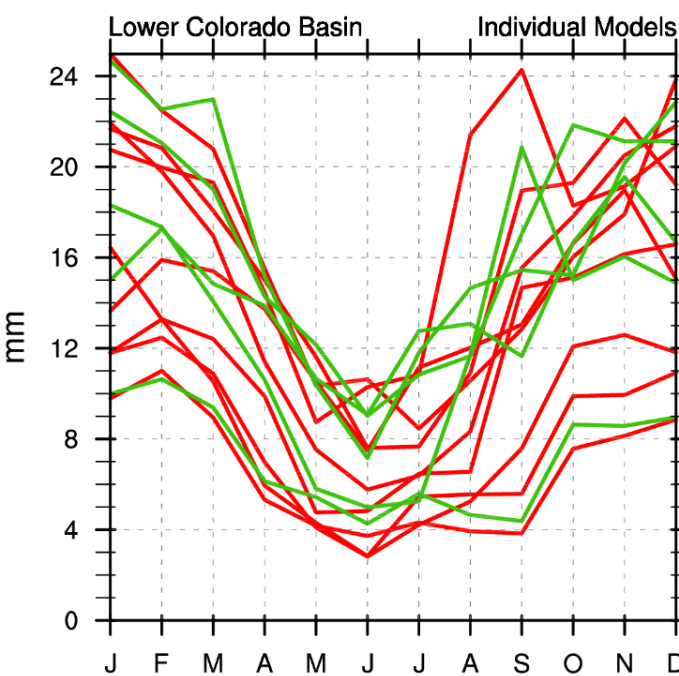
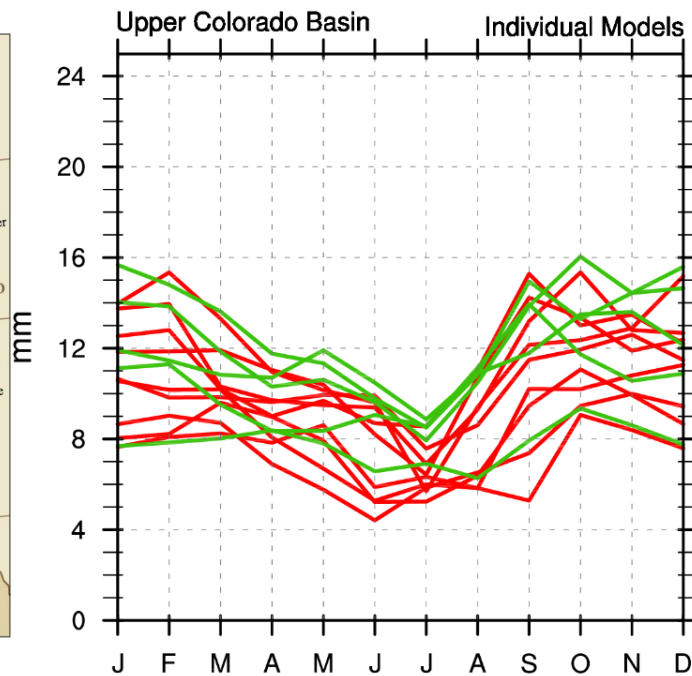


Figure SM4: as in Fig. SM3 except for 99th percentile daily precipitation

Median Seasonal Max SWE Historical (mm)

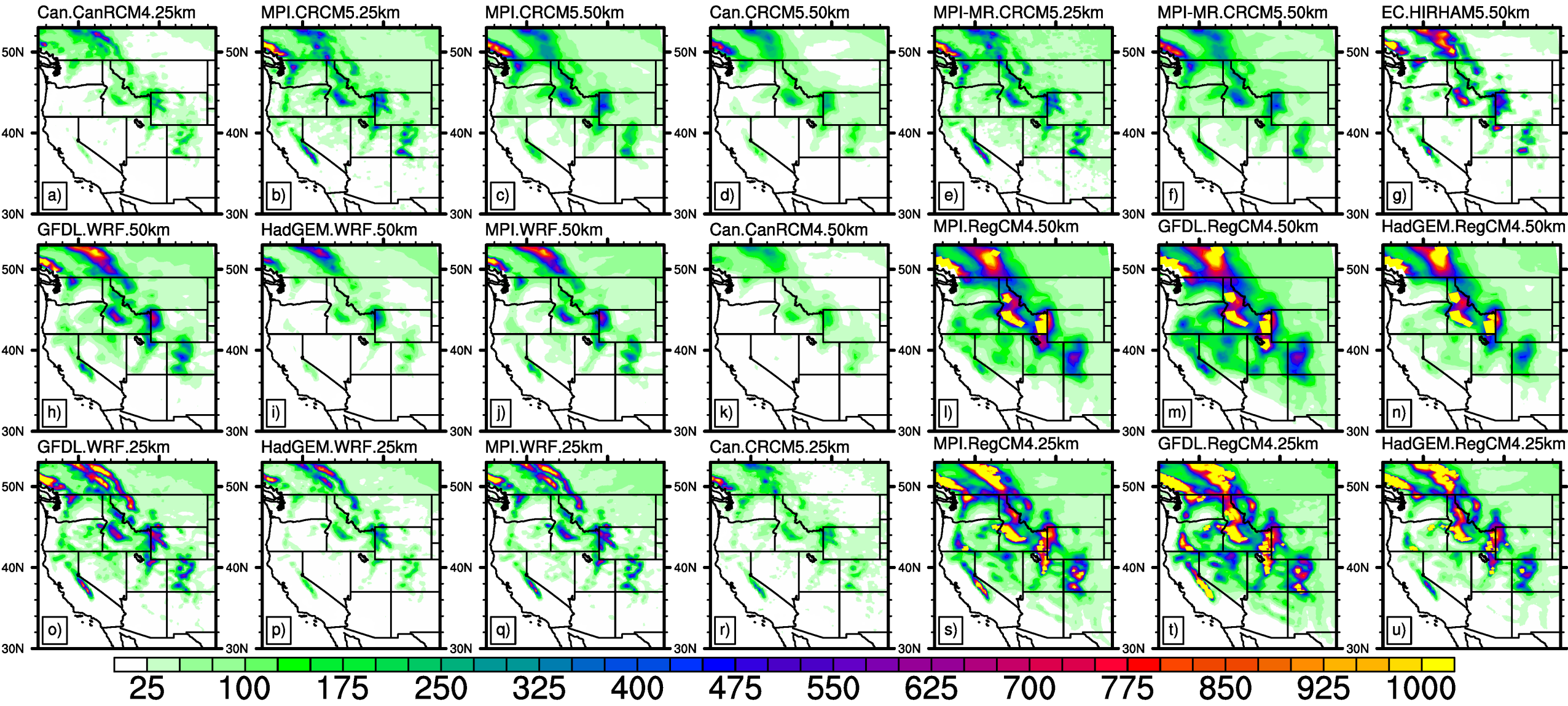


Figure SM5. Historical (2004 – 2018) median seasonal maximum snow water equivalent (SWE, mm) for all RCMs as labeled. RegCM4 simulations are included here to show unphysical SWE values as discussed in text.

Median Day of Seasonal Max SWE Historical

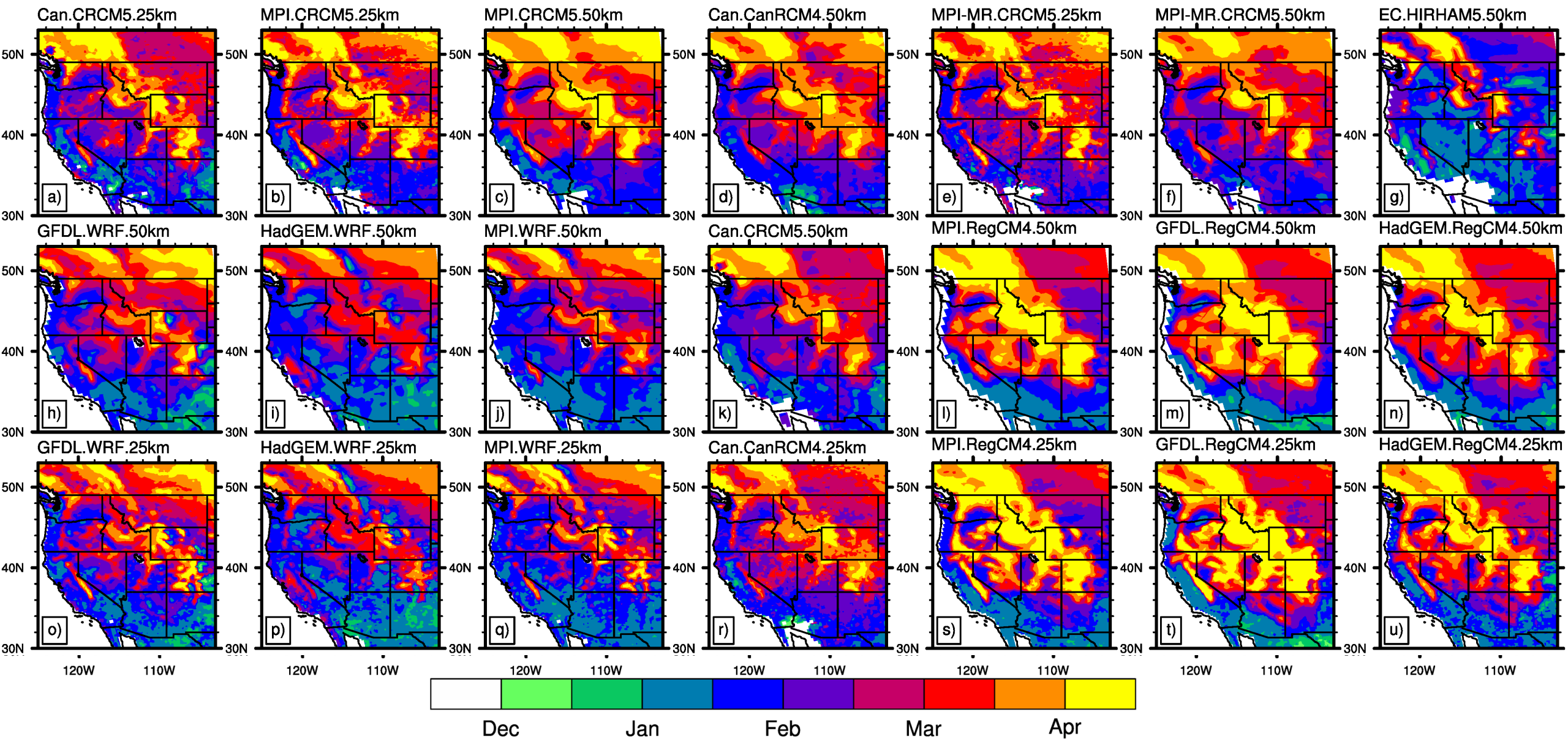


Figure SM6. As in Fig. SM5 except for the date (in half-months, as shaded) in which the median day of maximum historical seasonal SWE occurs.

CORDEX RCP8.5-Hist (2070_2099-1976_2005) Precipitation Climate in OND (mm)

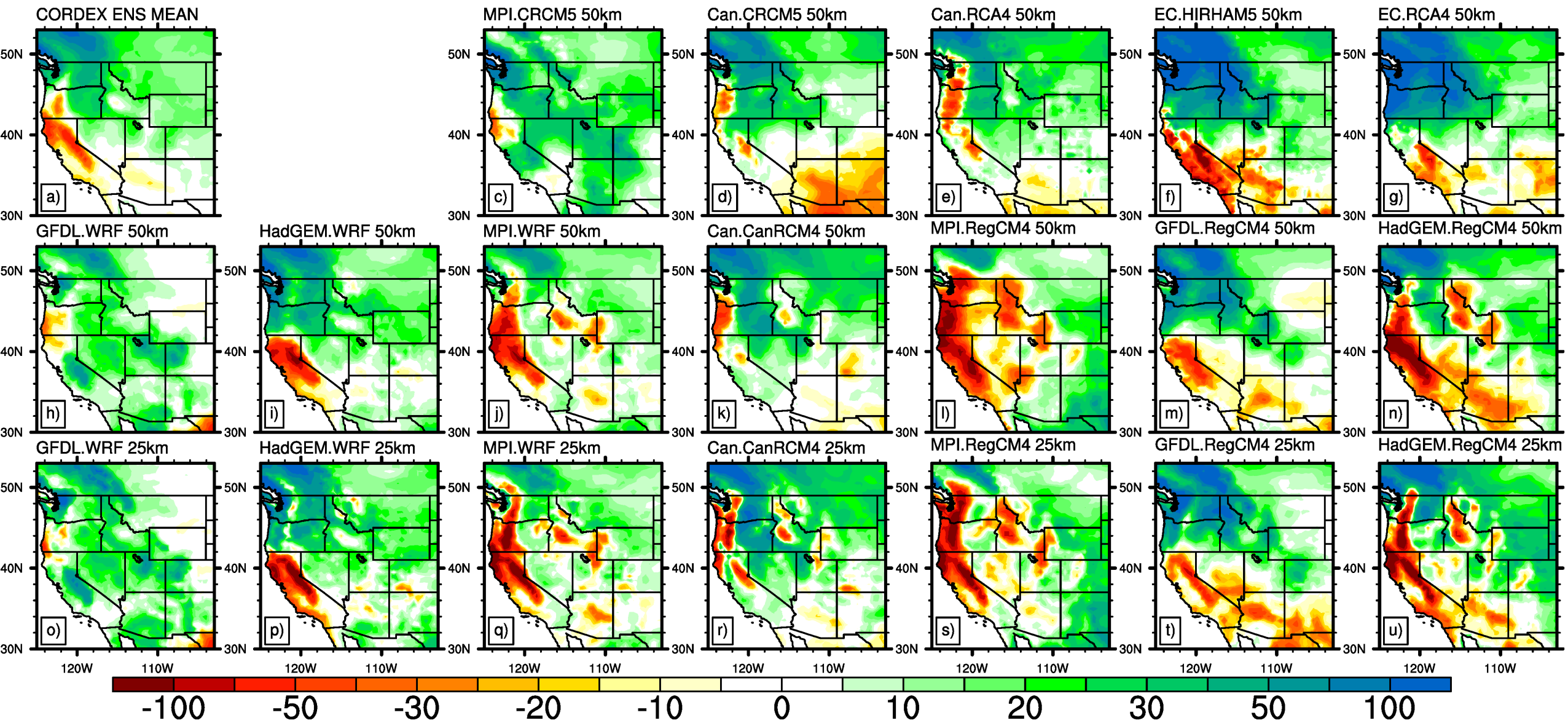


Figure SM7. Future (2070 – 2099) - Historical (1976 – 2005) projected change in mean OND precipitation (mm, shaded) for each NA-CORDEX model listed in Table 1, as labeled.

CORDEX RCP8.5-Hist (2070_2099-1976_2005) Precipitation Climate in JFM(mm)

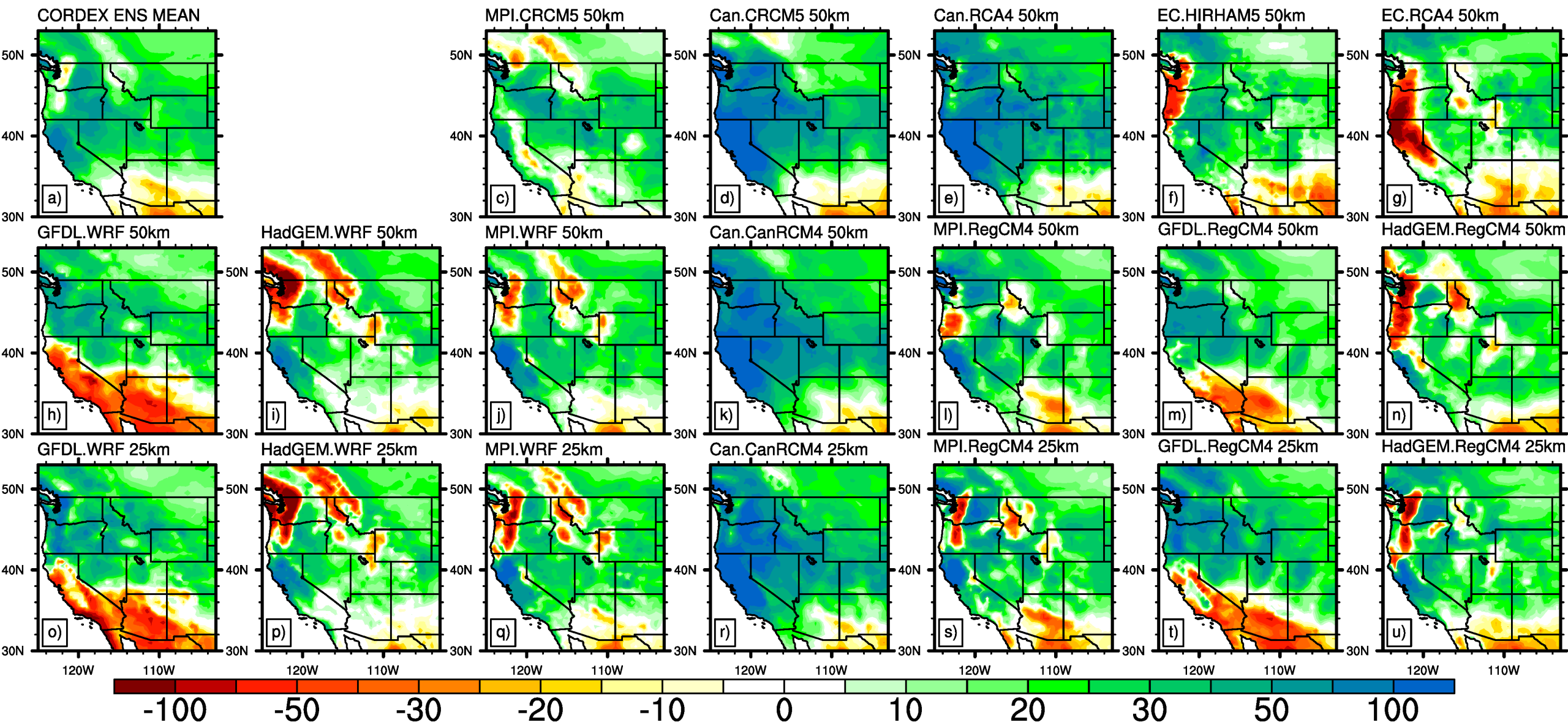


Figure SM8. As in Fig. SM7 except for JFM.

Precipitation Climate RCP8.5-Historical (mm)

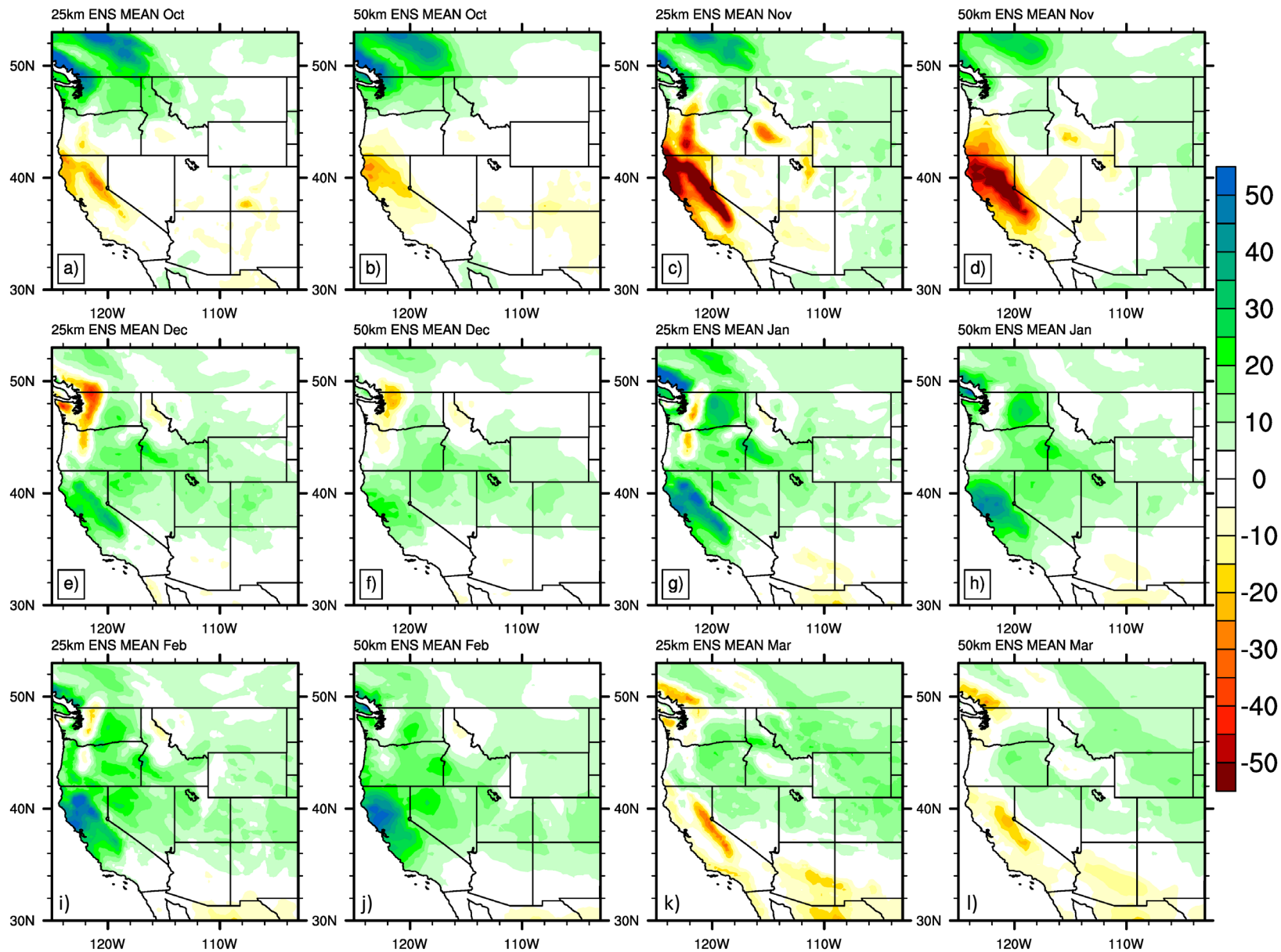


Figure SM9. a) Future (2070 – 2099) - Historical (1976 – 2005) projected change in October mean precipitation (mm, shaded) for the ensemble mean of all 25-km simulations; b) as in a) except for the 50-km simulation ensemble mean; c) as in a) except for November; d) as in b) except for November; d) as in a) except for December; f) as in b) except for December; g) as in a) except for January; h) as in b) except for January; i) as in a) except for February; j) as in b) except for February; k) as in a) except for March; l) as in b) except for March.

CORDEX Ensemble Spread (RCP8.5)

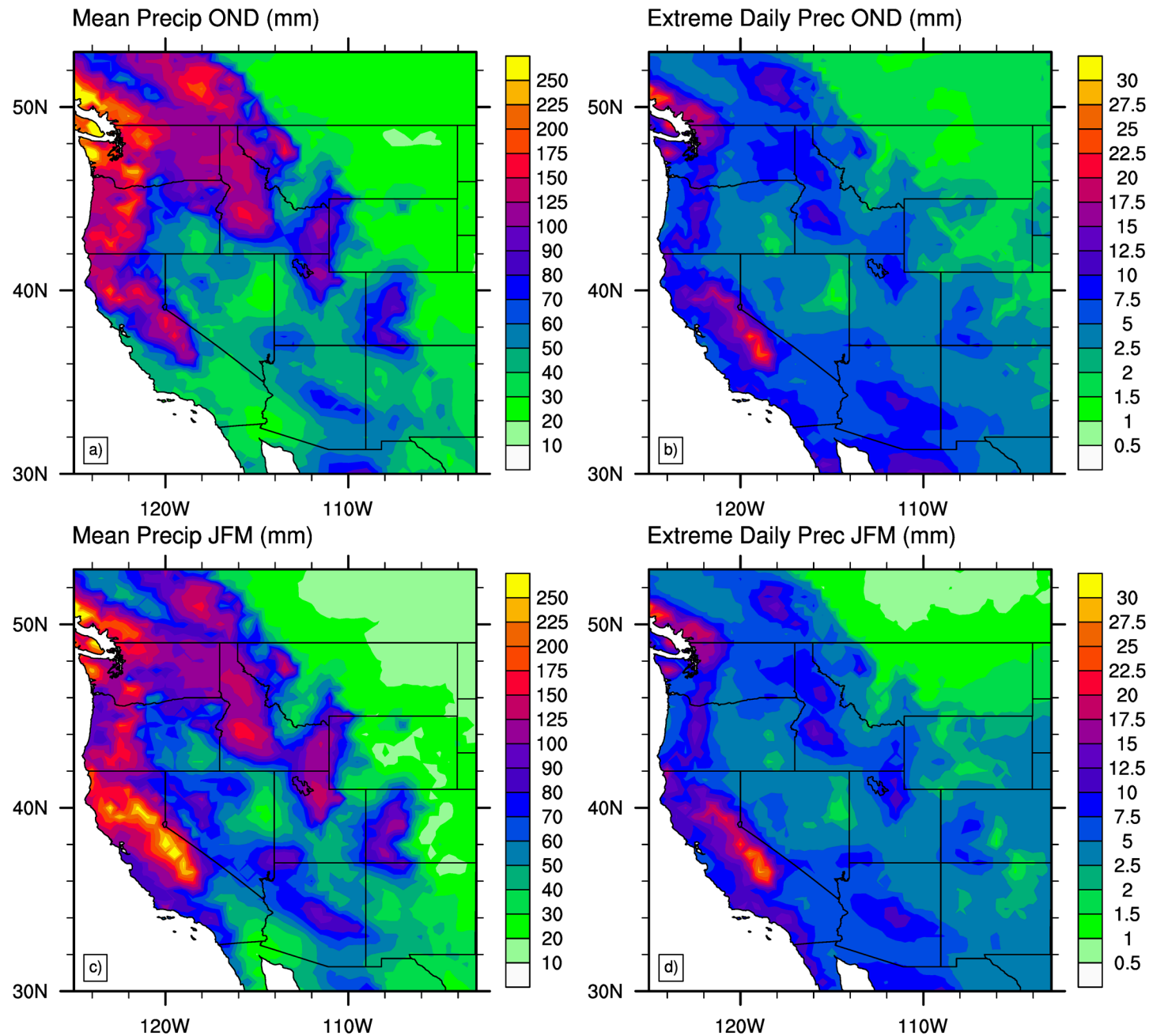


Figure SM10. a) Standard deviation of all NA-CORDEX individual model members in future (2070 – 2099) mean monthly OND precipitation (mm, as shaded); b) as in a) except for 99th percentile daily precipitation; c) as in a) except for JFM; d) as in b) except for JFM.

CORDEX RCP8.5-Hist (2070_2099-1975_2005) 99th Percentile of Daily Precipitation in OND (mm)

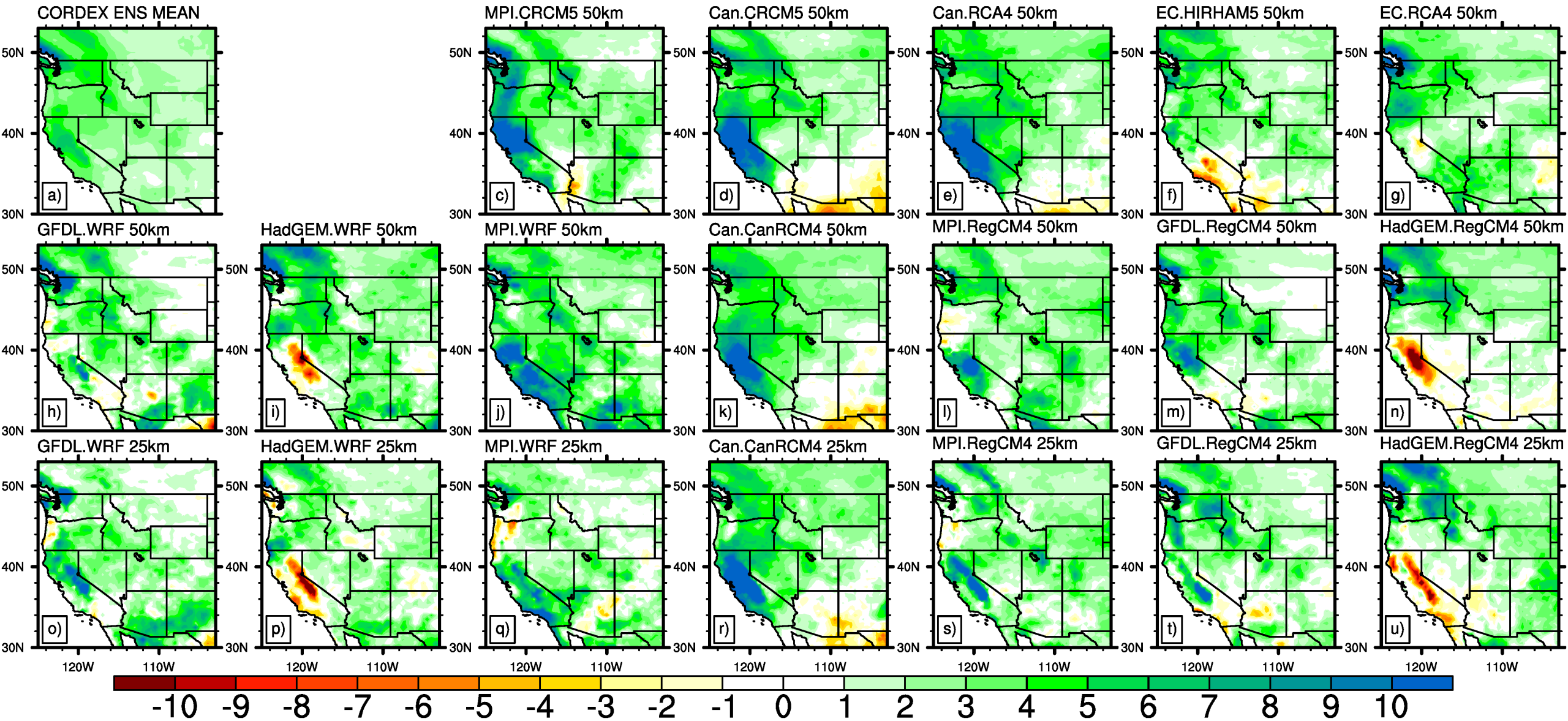


Figure SM11. As in Fig. SM7 except for 99th percentile daily precipitation.

CORDEX RCP8.5-Hist (2070_2099-1975_2005) 99th Percentile of Daily Precipitation in JFM (mm)

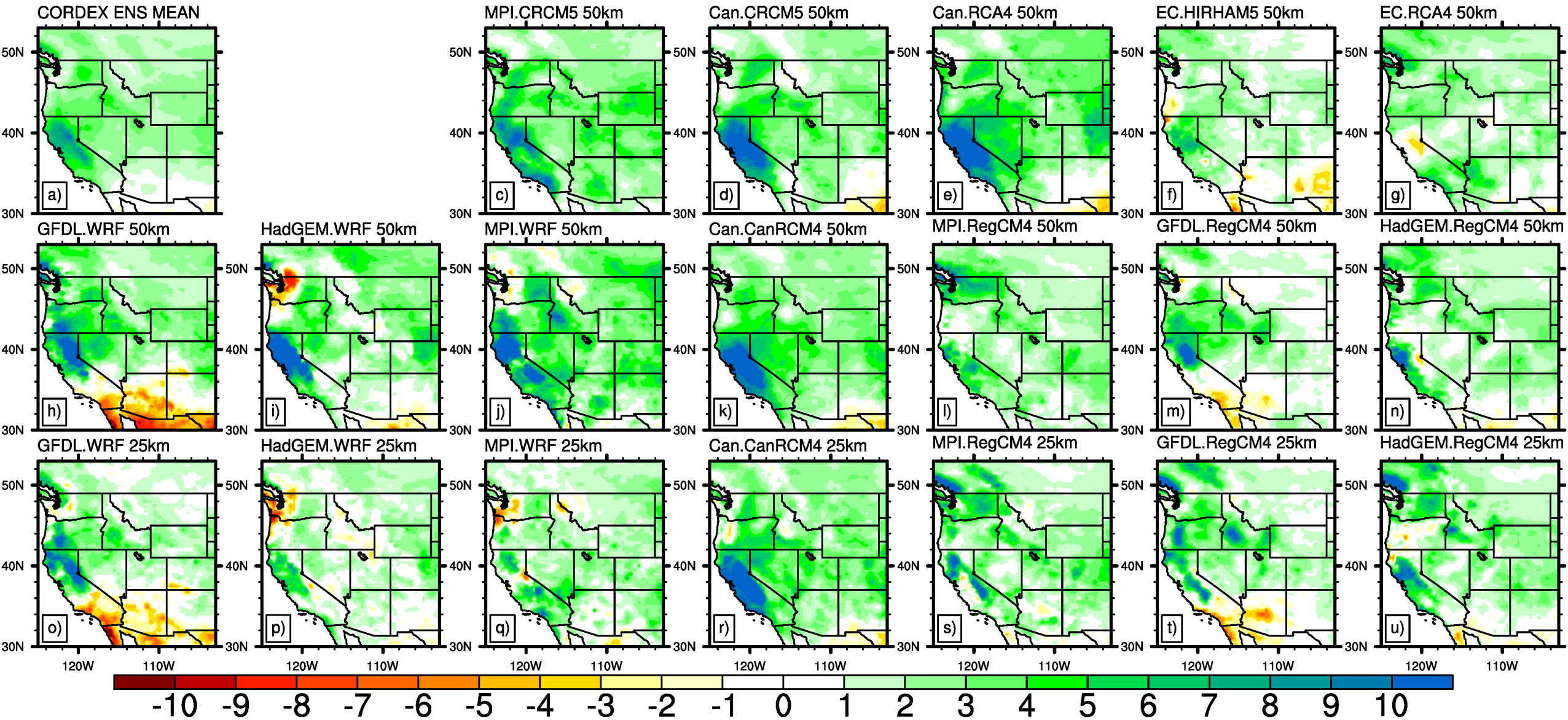
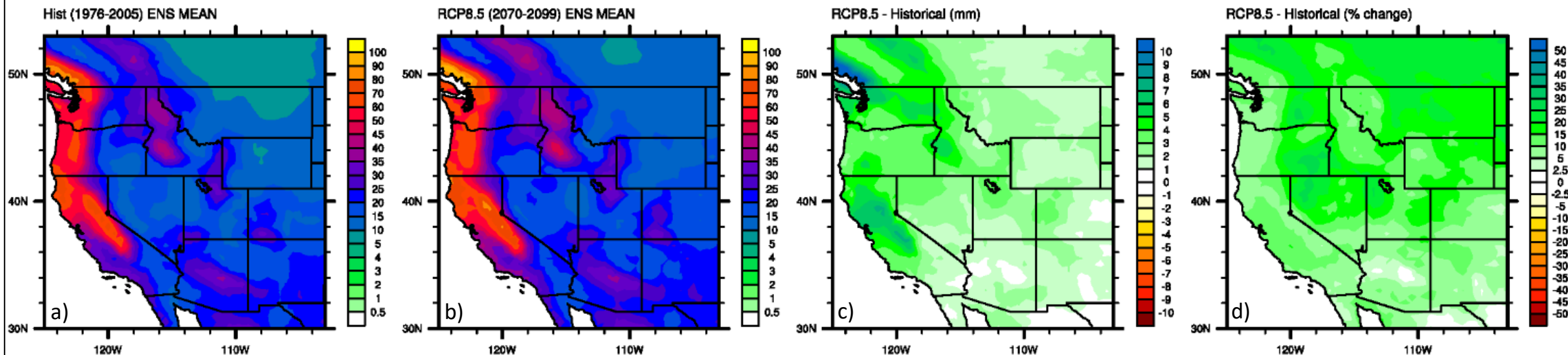


Figure SM12. As in Fig. SM11 except for JFM.

99th Percentile of Daily Precipitation in OND (mm)



99th Percentile of Daily Precipitation in JFM (mm)

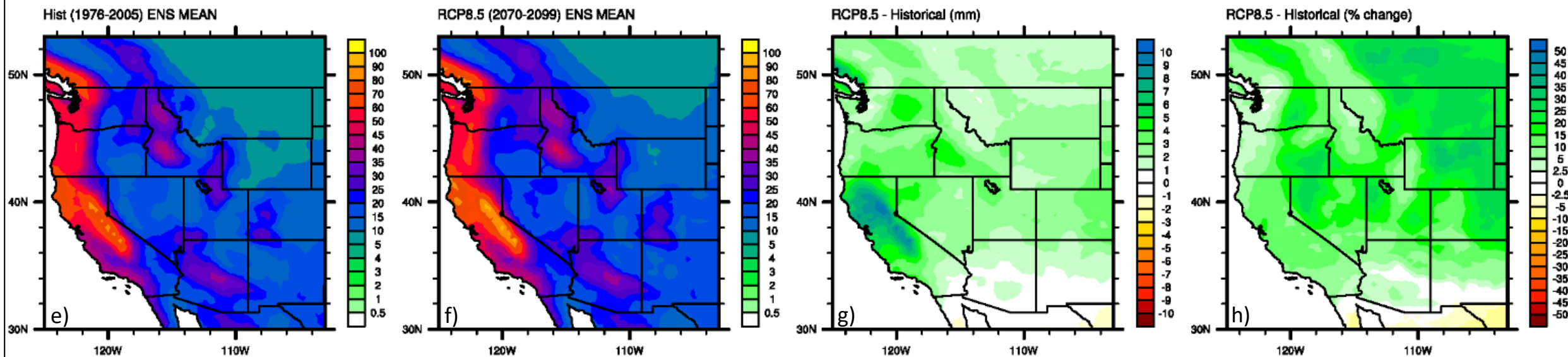


Figure SM13. a) Full NA-CORDEX ensemble mean of 99th percentile daily precipitation (mm, as shaded) in historical (1976 – 2005) period; b) as in a) except for future period (2070 – 2099); c) Future (2070 – 2099) - Historical (1976 – 2005) projected change in OND 99th percentile daily precipitation (mm, shaded) for the ensemble mean for full NA-CORDEX ensemble; d) as in c) except for percentage change; e) – h) as in a) – d) except for JFM.

Median Seasonal Max SWE RCP8.5(2070-2099)

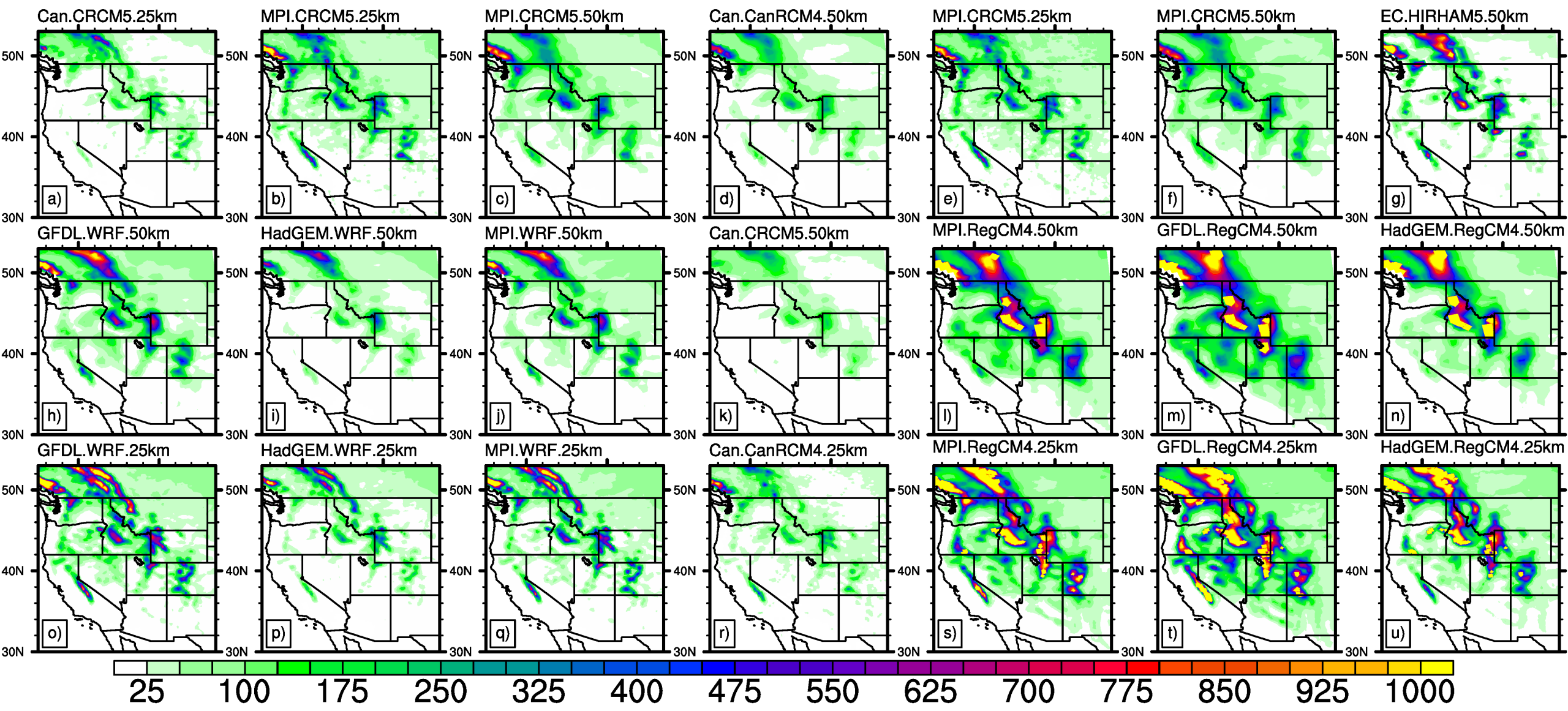


Figure SM14. As in Fig. SM5 except for future projected SWE.

Median Seasonal Max SWE RCP8.5-Historical (mm)

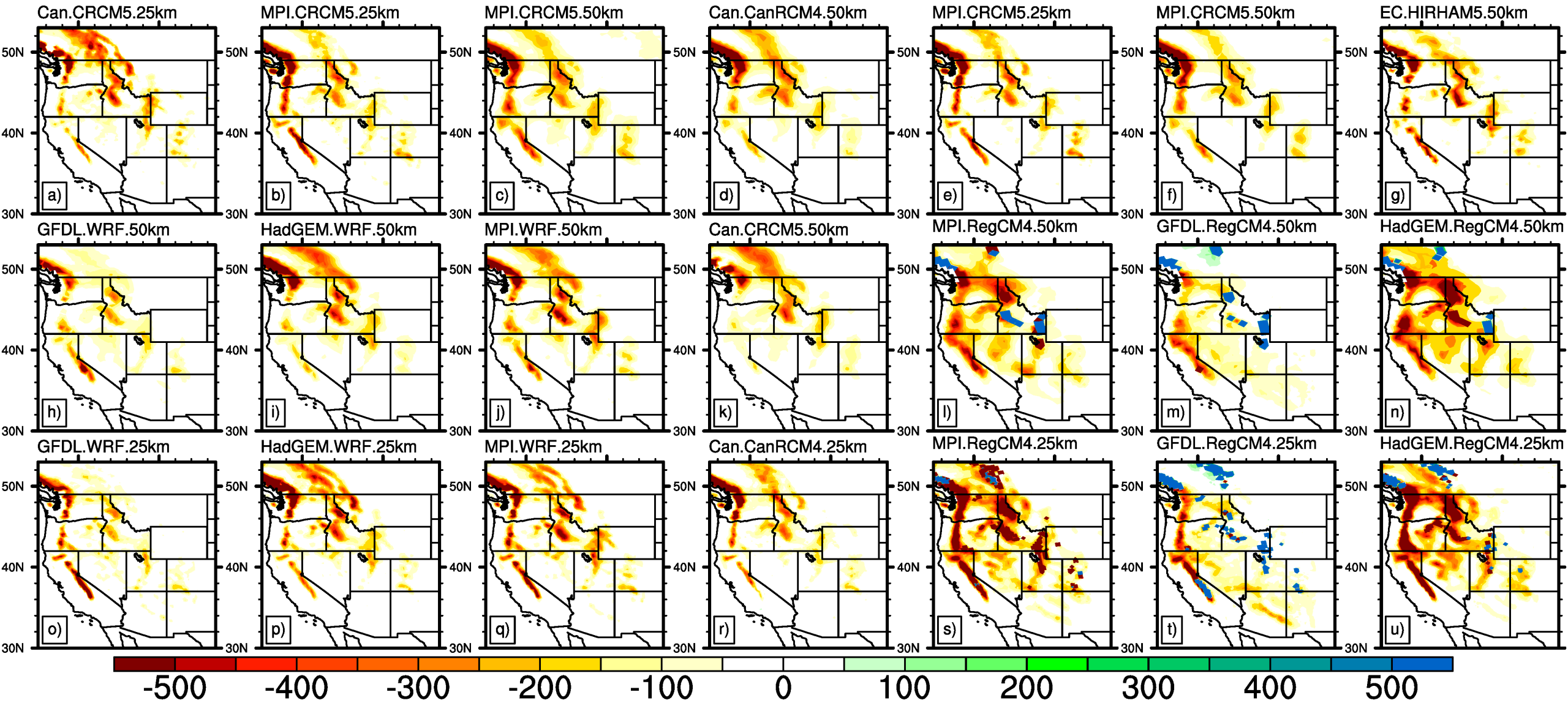


Figure SM15. Future (2070 – 2099) - Historical (1976 – 2005) projected change in median seasonal max SWE (mm, shaded) for each NA-CORDEX model listed in Table 1, as labeled.

Ratio of Annual Snowfall to Annual Precipitation (Ensemble Mean)

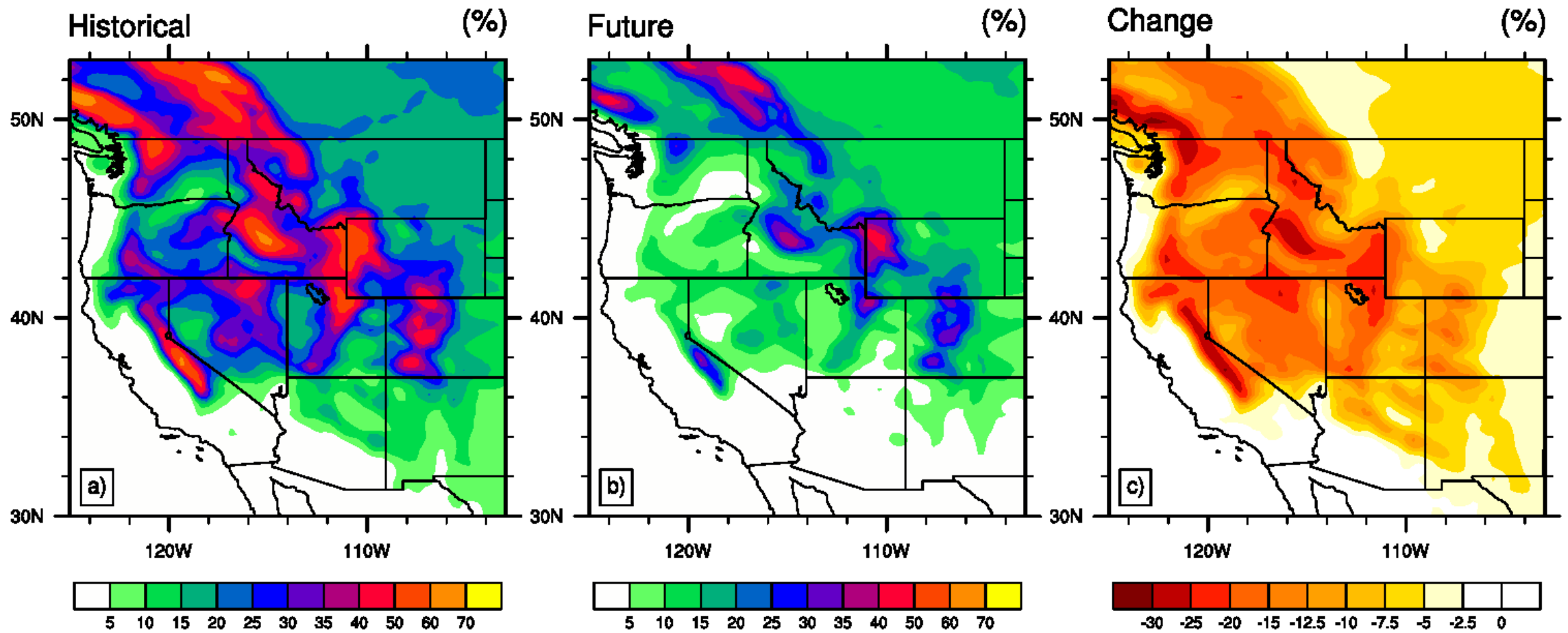


Figure SM16. a) Ensemble mean of all models shown in Fig. 15 for historical ratio of annual snowfall to annual total precipitation, b) as in a) except for in future RCP8.5 projections; c) Ensemble mean Future – Historical projected change in the ratio of annual snowfall to annual total precipitation.