Tropical Convection and Western US subseasonal predictions

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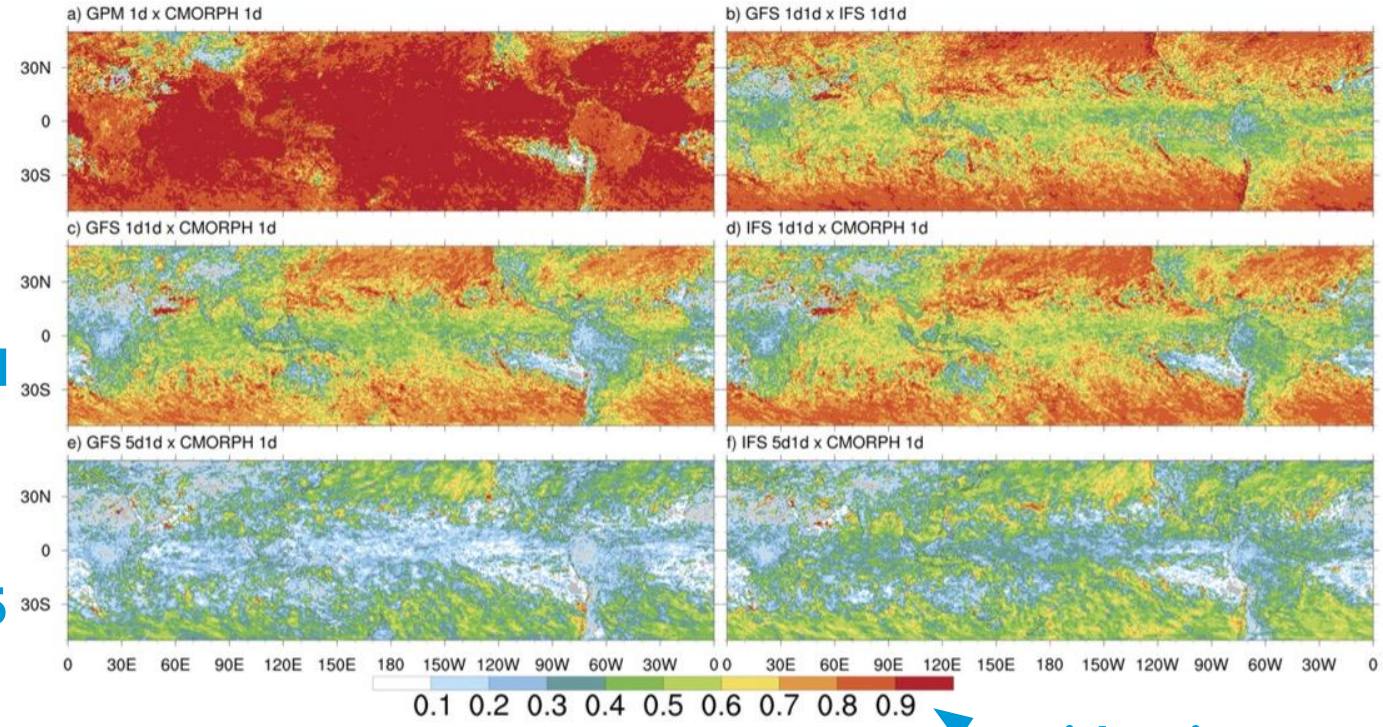
GFS forecasts of the tropics underperform in comparison to ECMWF



GFS Day 1

ECMWF Day 1

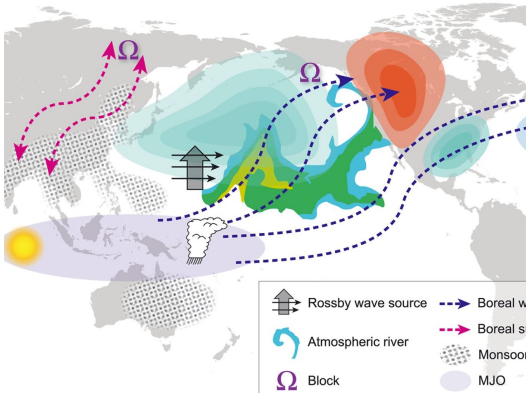
GFS Day 5

ECMWF Day 5

grid point correlations

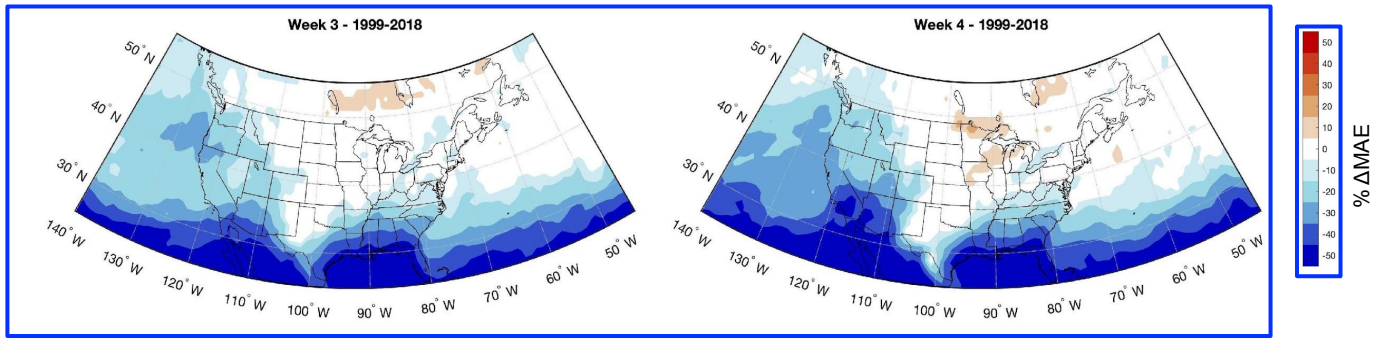
Figure from Dias et al, 2018: Equatorial Waves and the Skill of NCEP and ECMWF Numerical Weather Prediction Systems (MWR)

Better forecasts of the tropics, improves forecasts world-wide



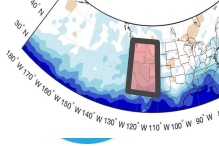
- Nudging experiments suggest that weeks 3-4 forecasts over much of the N.H would be 2-4 x more skillful, if the tropics predictions were “perfect”; Including improvements in precipitation predictions over the Western U.S.

blue shading denotes regions where precipitation errors are reduced when “removing” errors in the tropics



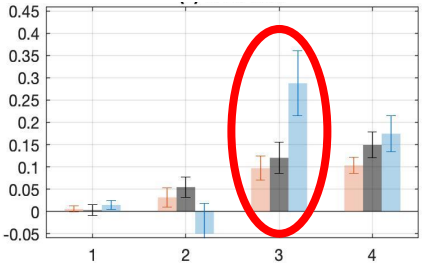
Dias, J., Tulich, S. N., Gehne, M., & Kiladis, G. N. (2021). Tropical Origins of Weeks 2–4 Forecast Errors during the Northern Hemisphere Cool Season, Monthly Weather Review, 149(9), 2975-2991.

The MJO modulates Western US weeks 3/4 predictions

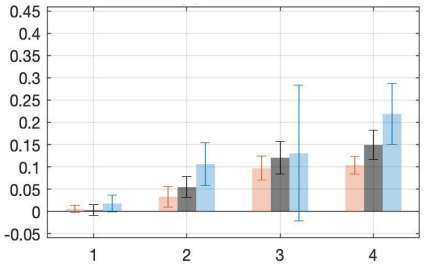


△ PRCP APC (WTR-free reforecasts)

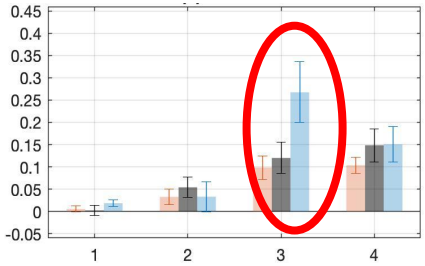
MJO Phase 1



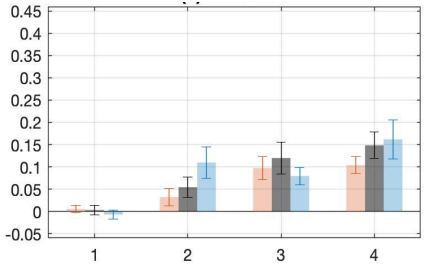
MJO Phase 3



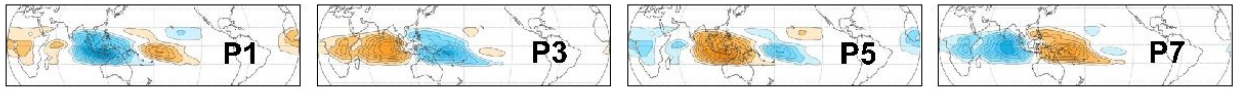
MJO Phase 5



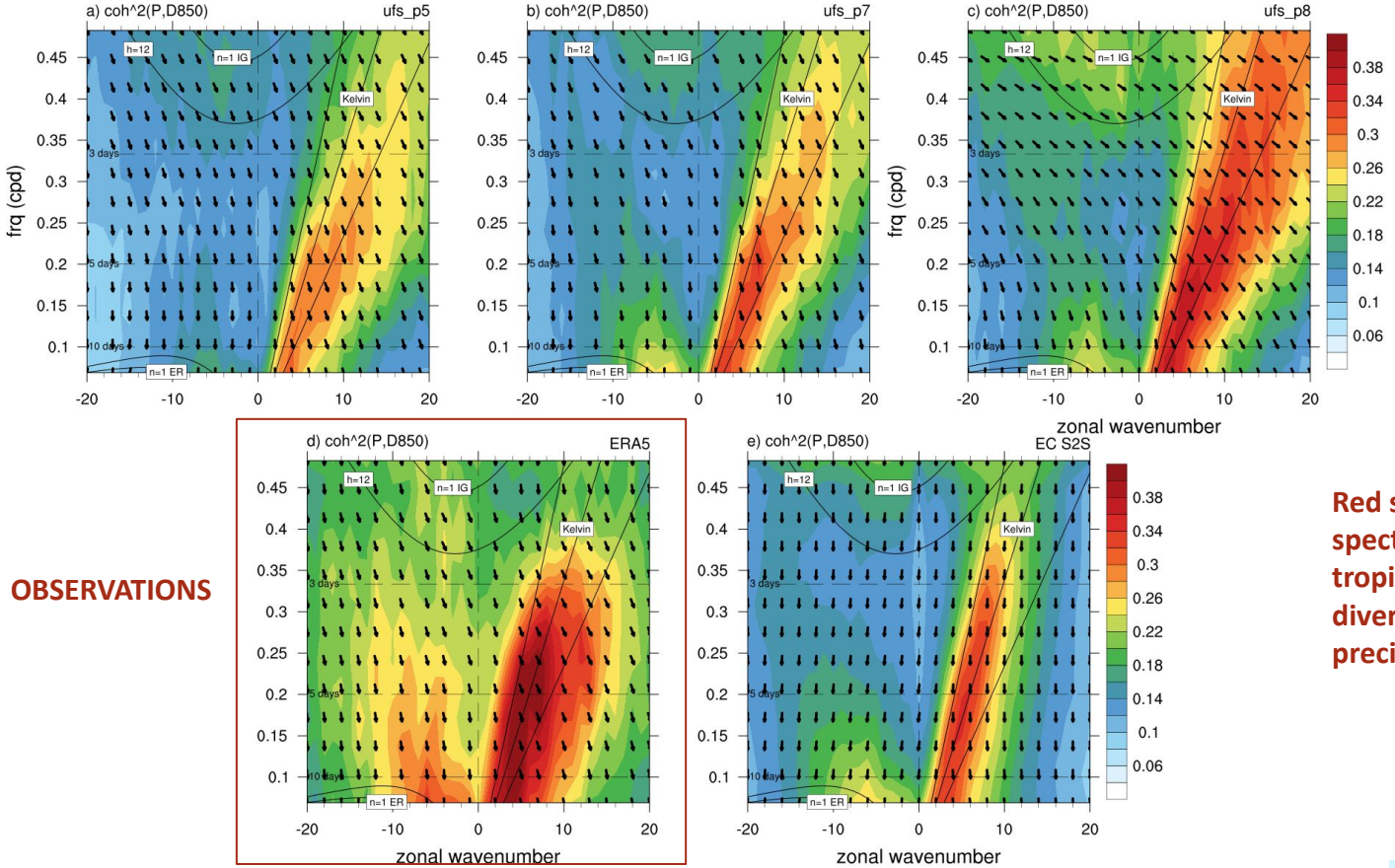
MJO Phase 7



With tropical nudging, skill of Week 3 UFS precipitation predictions over Western USA are improved when MJO is active at initialization time and in phases 1 and 5



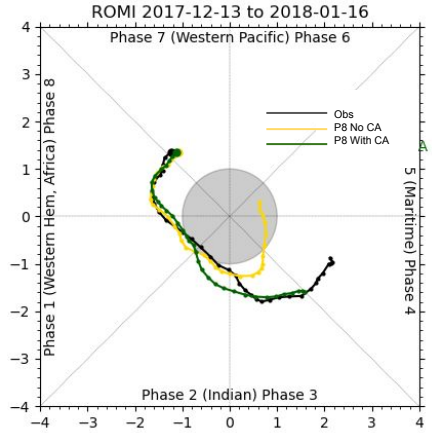
Tropical Convection has improved in the coupled UFS prototypes



OBSERVATIONS

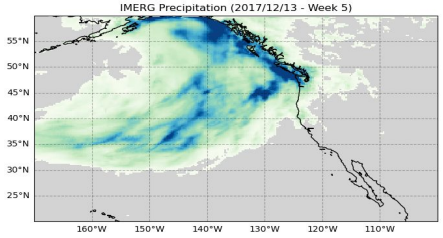
Red shading denotes spectral regions where tropical low level divergence and precipitation co-vary

UFS physics experiments can improve the MJO

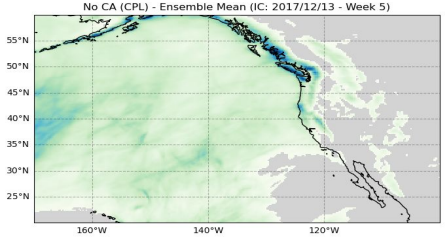


Initiated in phase 7, the ensemble mean **week 5** integrated vapour transport is enhanced, and precip is improved along the US/Canada west coast.

OBS (IMERG)

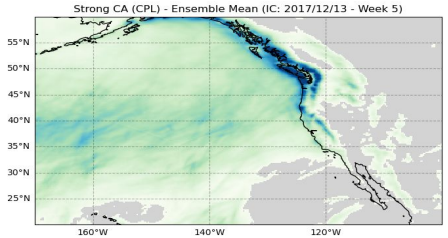


Without CA



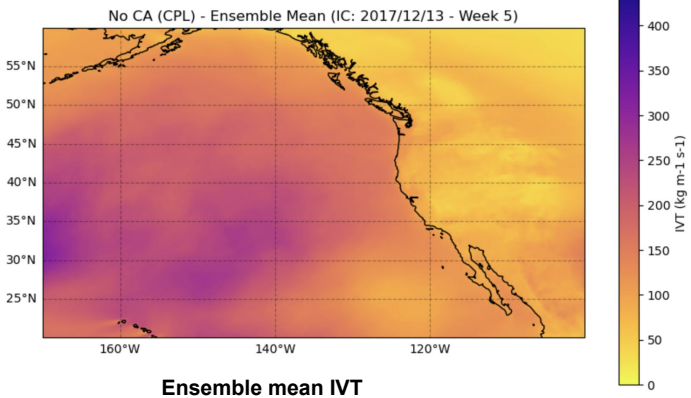
Ensemble mean precip

With CA



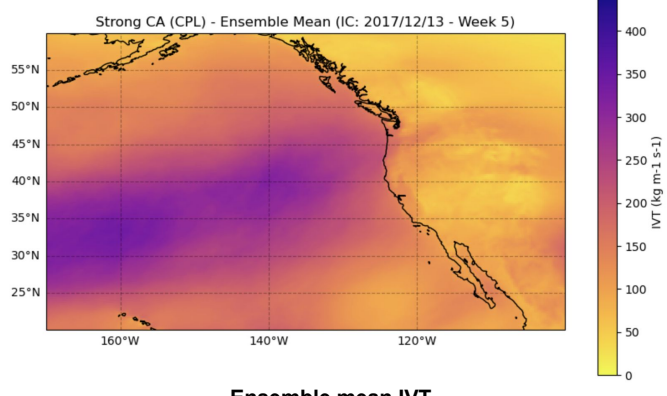
Ensemble mean precip

Without CA



Ensemble mean IVT

With CA



Ensemble mean IVT