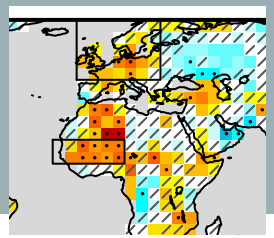
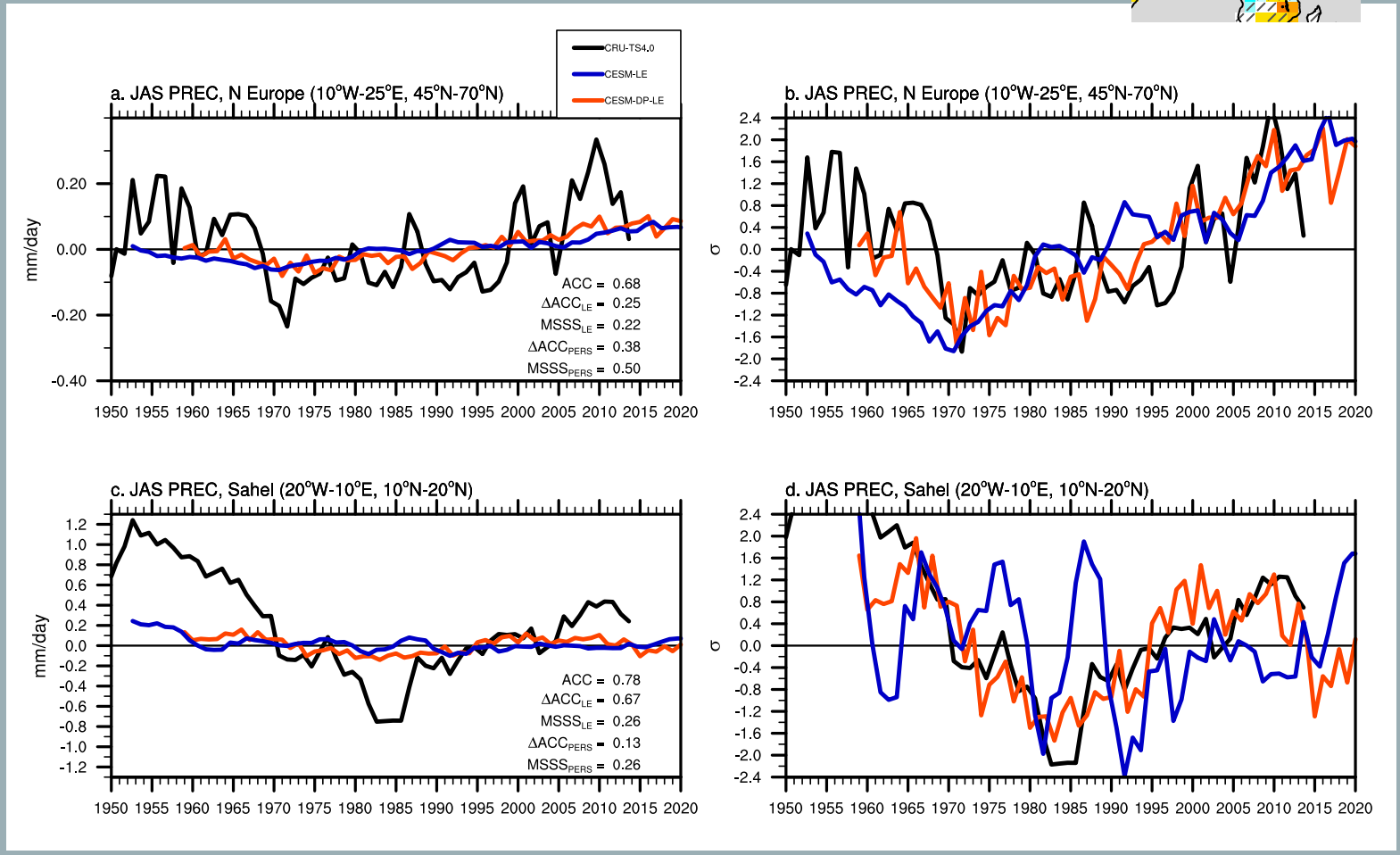
CESM-DPLE: Boreal Summer (JAS) regional Precip



DPLE : LY3-7

- N Europe*:



- Sahel**:

Yeager et al. (2018)

* Sutton and Dong, 2012: Atlantic Ocean influence on a shift in European climate in the 1990s, *Nat Geosci*, 5, 788-792.
Dunstone et al., 2018: Skilful Seasonal Predictions of Summer European Rainfall, *Geophys Res Lett*, 45, 3246-3254.

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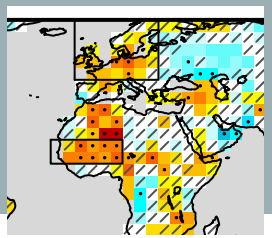

DPLE : LY3-7

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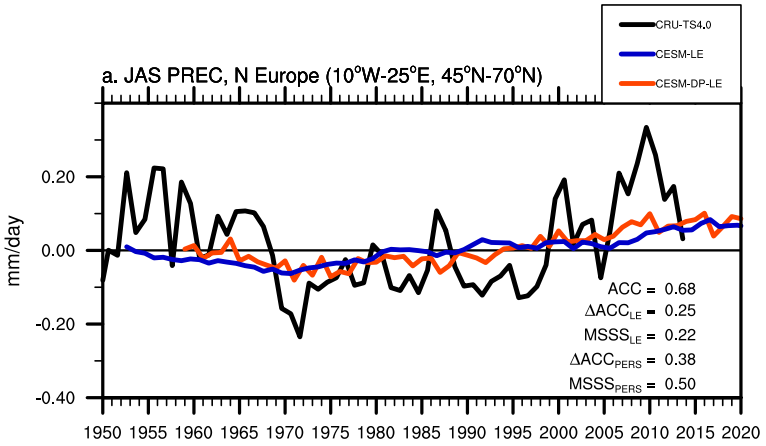
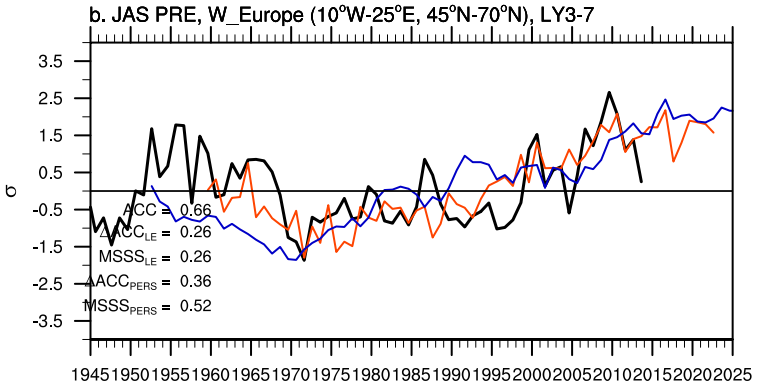
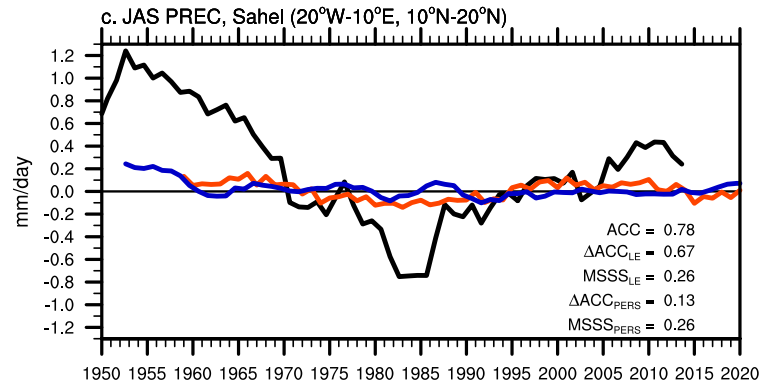
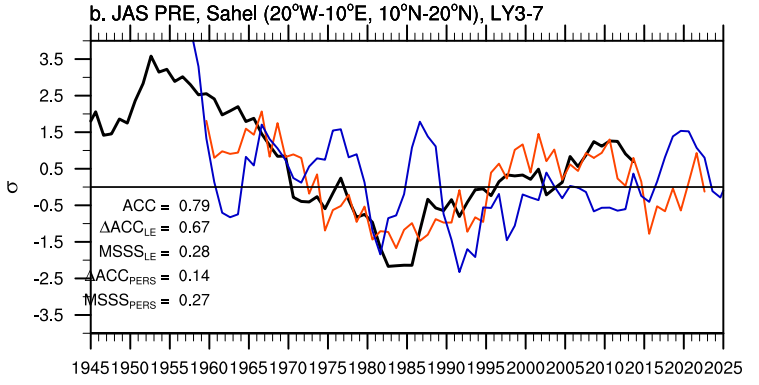




- Sahel**:





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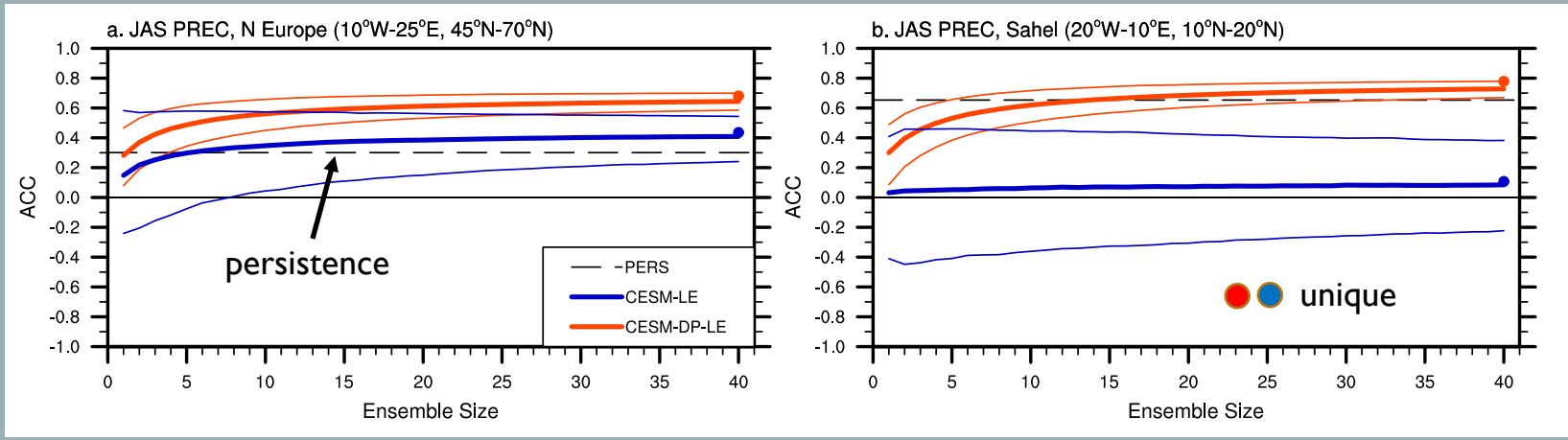
Skill dependence on ensemble size

- Bootstrapped skill score PDFs (w/ replacement): 5th, 50th, 95th percentiles
- Steady increase in DP skill (decrease in uncertainty) with ensemble size (ENS). Modest improvements for ENS>20.
- ENS~30-35 needed to beat persistence forecast of Sahel summer precipitation with 95% confidence.
- For given ENS, much greater uncertainty for UI skill than for initialized DP skill.

N Europe: **DPLE : LY3-7** Sahel:

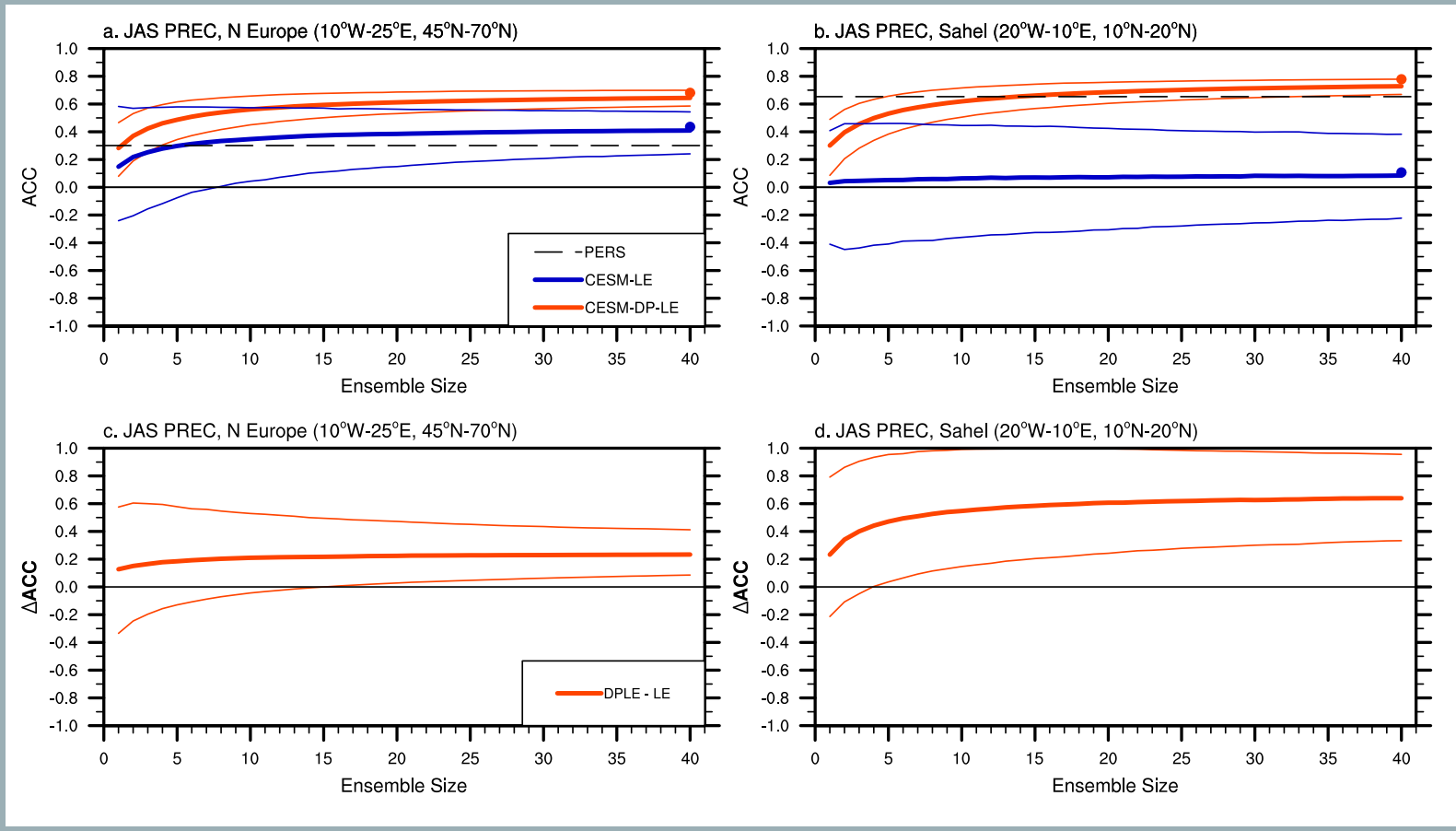


Yeager et al. (2018)

Skill dependence on ensemble size

- ENS>15 needed to outperform UI forecasts of N Europe summer precipitation with 95% confidence. External forcing contributes significantly to skill in this region.
- Benefits of initialization for Sahel will likely be seen with small ENS (~5), BUT...
- The magnitude of skill improvement for Sahel is highly uncertain, given the large uncertainty in externally-forced signal.

N Europe: **DPLE : LY3-7** Sahel:



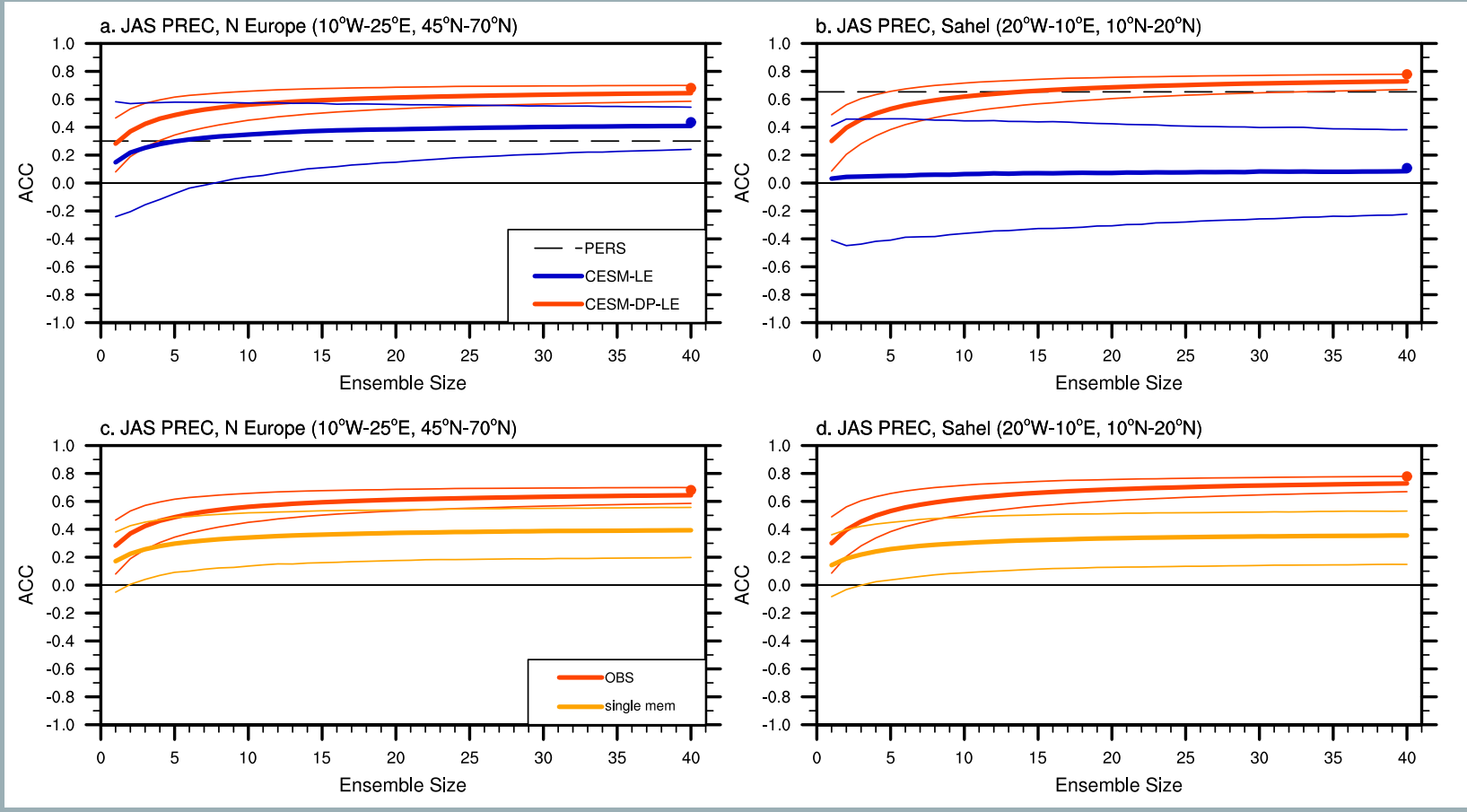
➔ Skill improvement over uninitialized (UI) ensemble

Yeager et al. (2018)

Unrealistically low signal-to-noise

- DPLE exhibits the "signal-to-noise" paradox noted by: Scaife et al. (2014), Eade et al. (2014), Dunstone et al. (2016)
- Model "underconfidence" implied by RPC (ratio of predictable components) = 1.64 (2.05) for LY3-7 predictions of JAS precipitation over N Europe (Sahel).

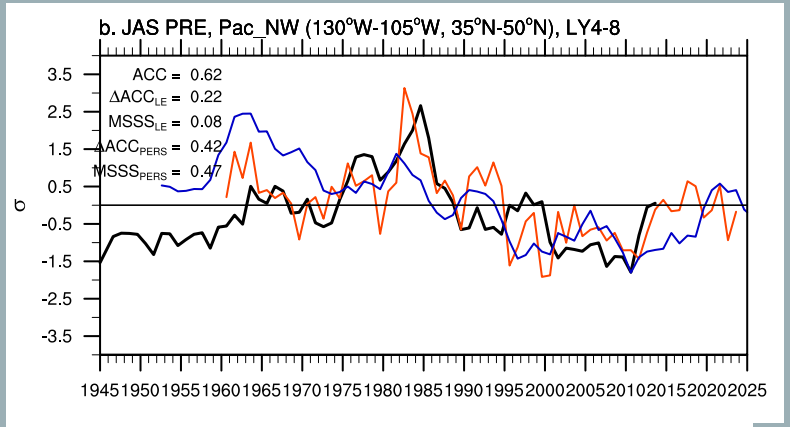
N Europe: **DPLE : LY3-7** Sahel:

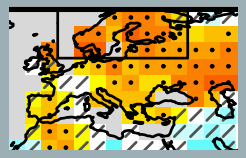


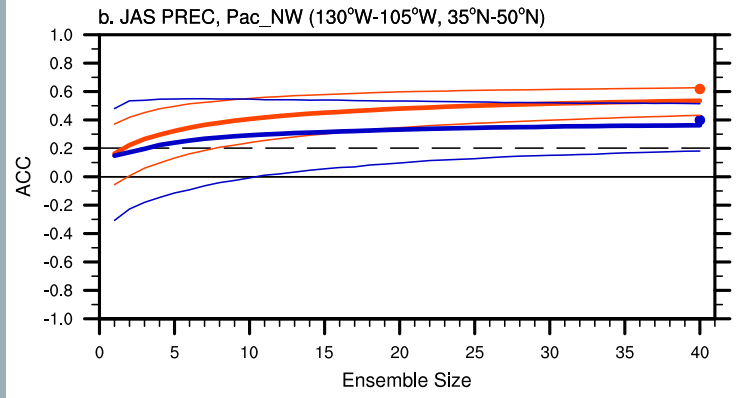
Yeager et al. (2018)

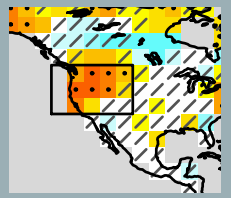
Other examples of high regional skill

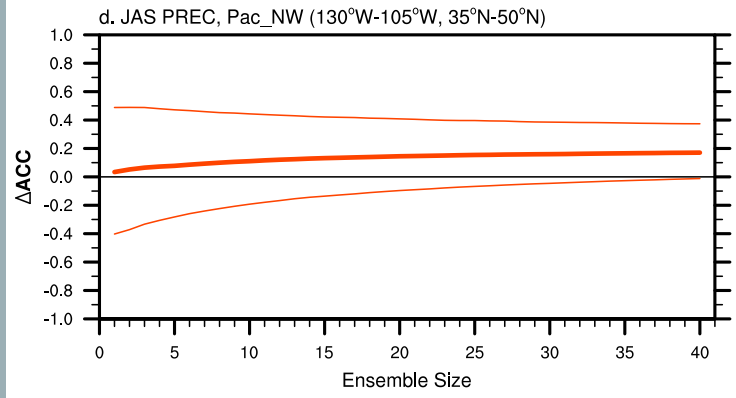
Pacific NW: JAS LY4-8



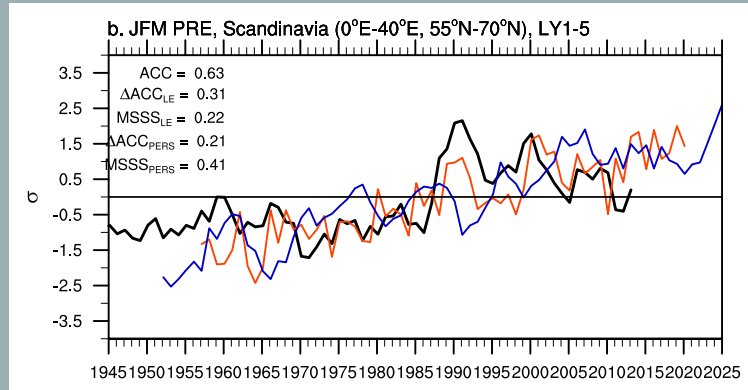


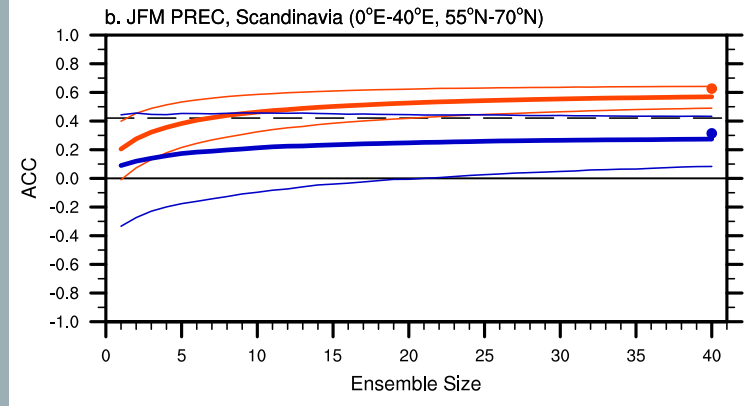


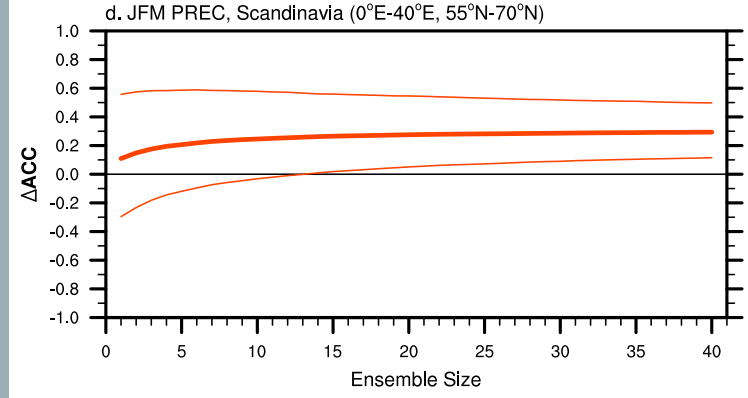




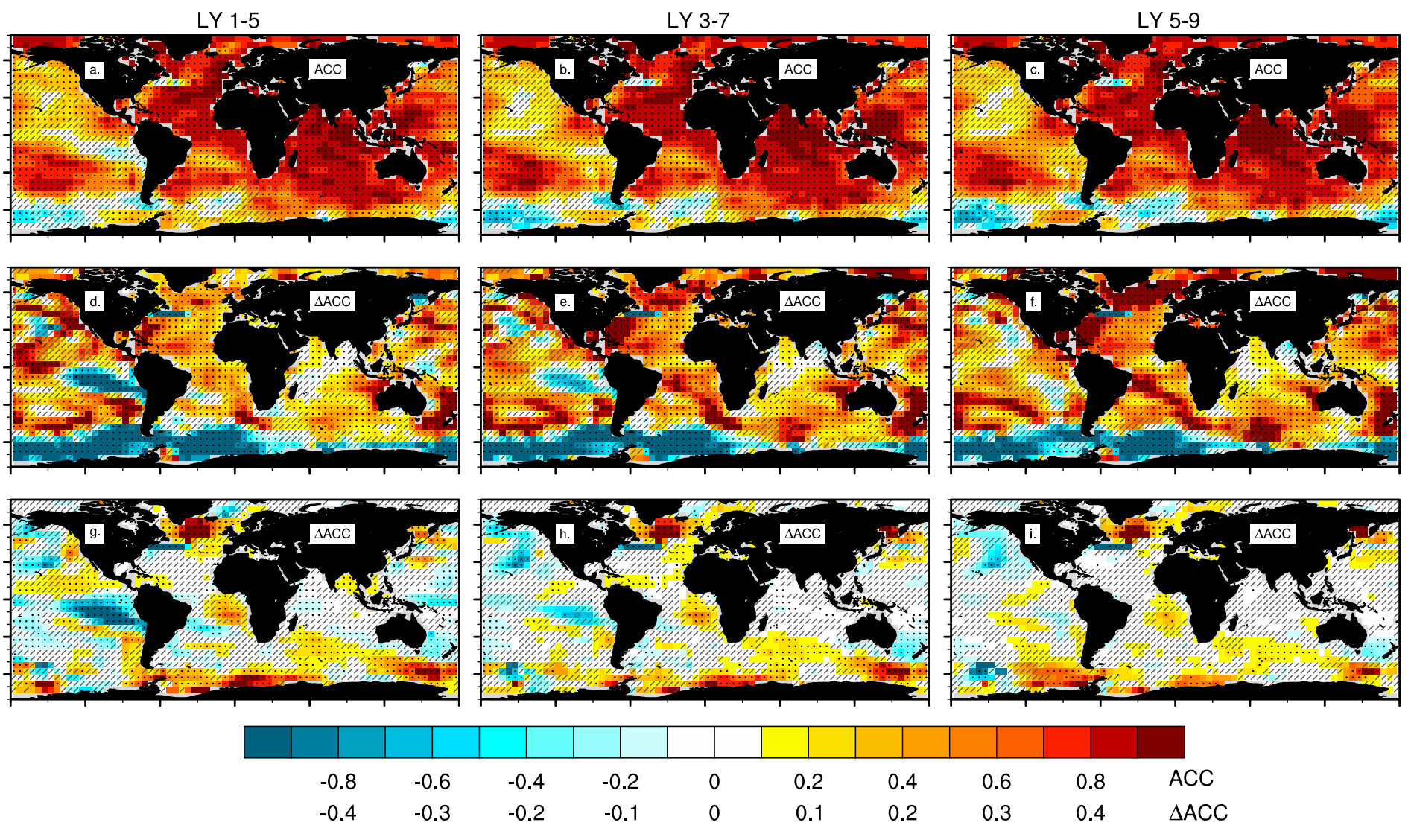
Scandinavia: JFM LY1-5







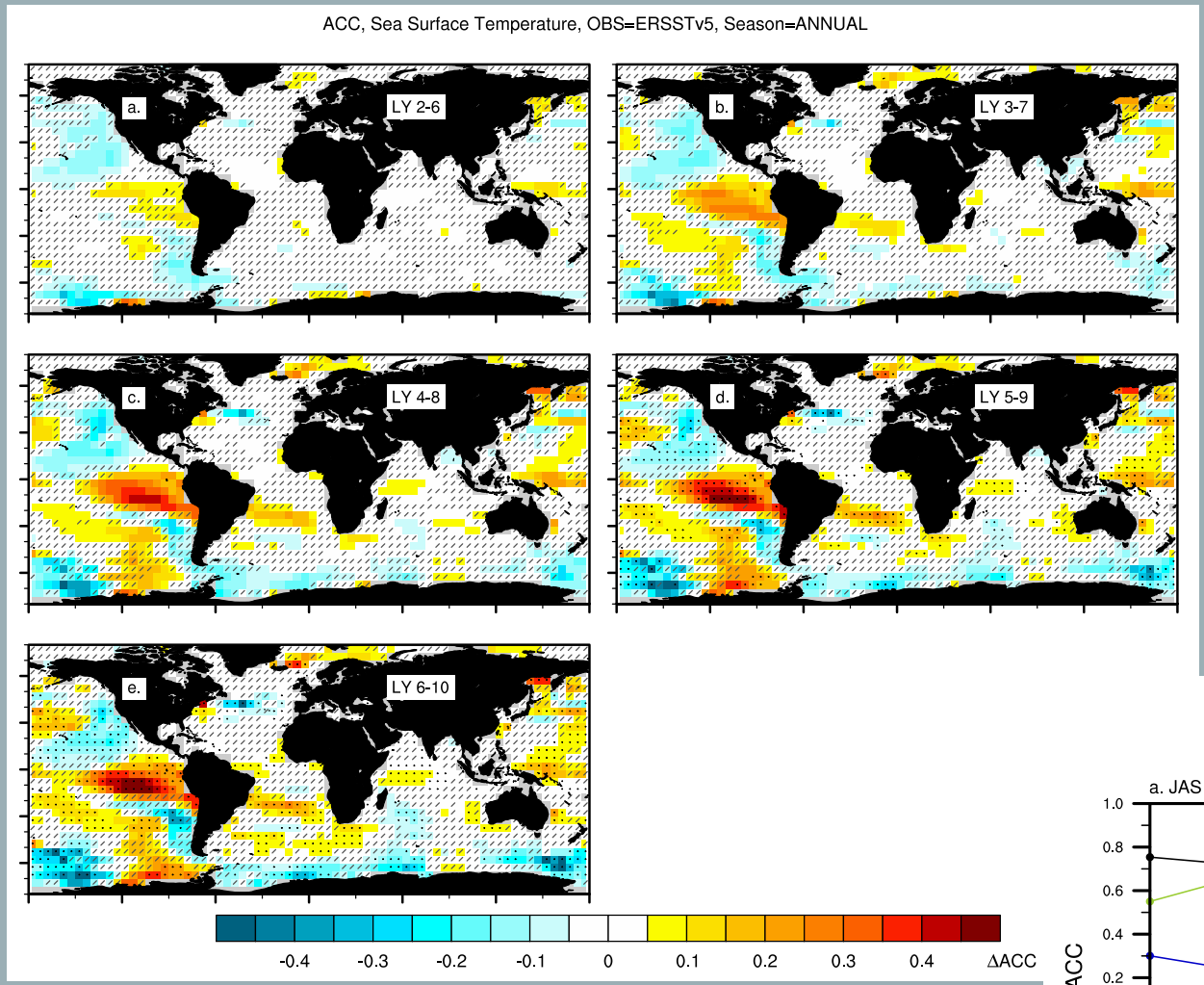
Predicted SST drives precipitation signal



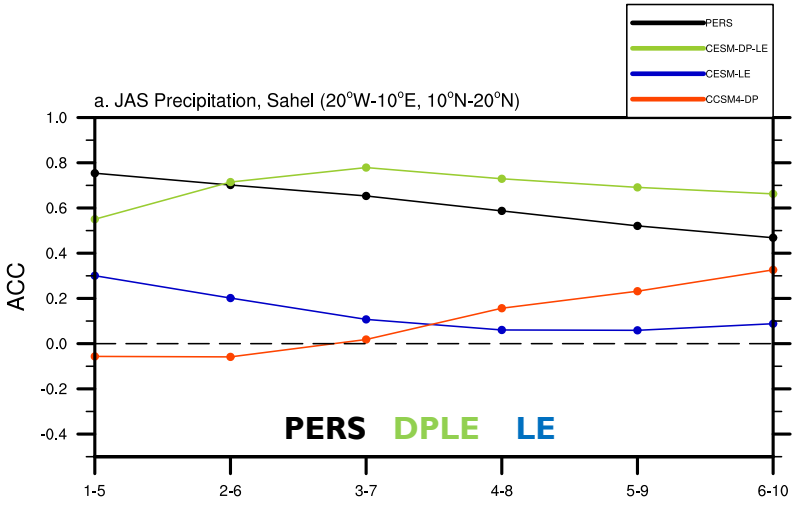
Yeager et al. (2018)

Initialization shock & lead-time dependence

DPLE SST ΔACC, difference from LY1-5 ACC:



Yeager et al. (2018)



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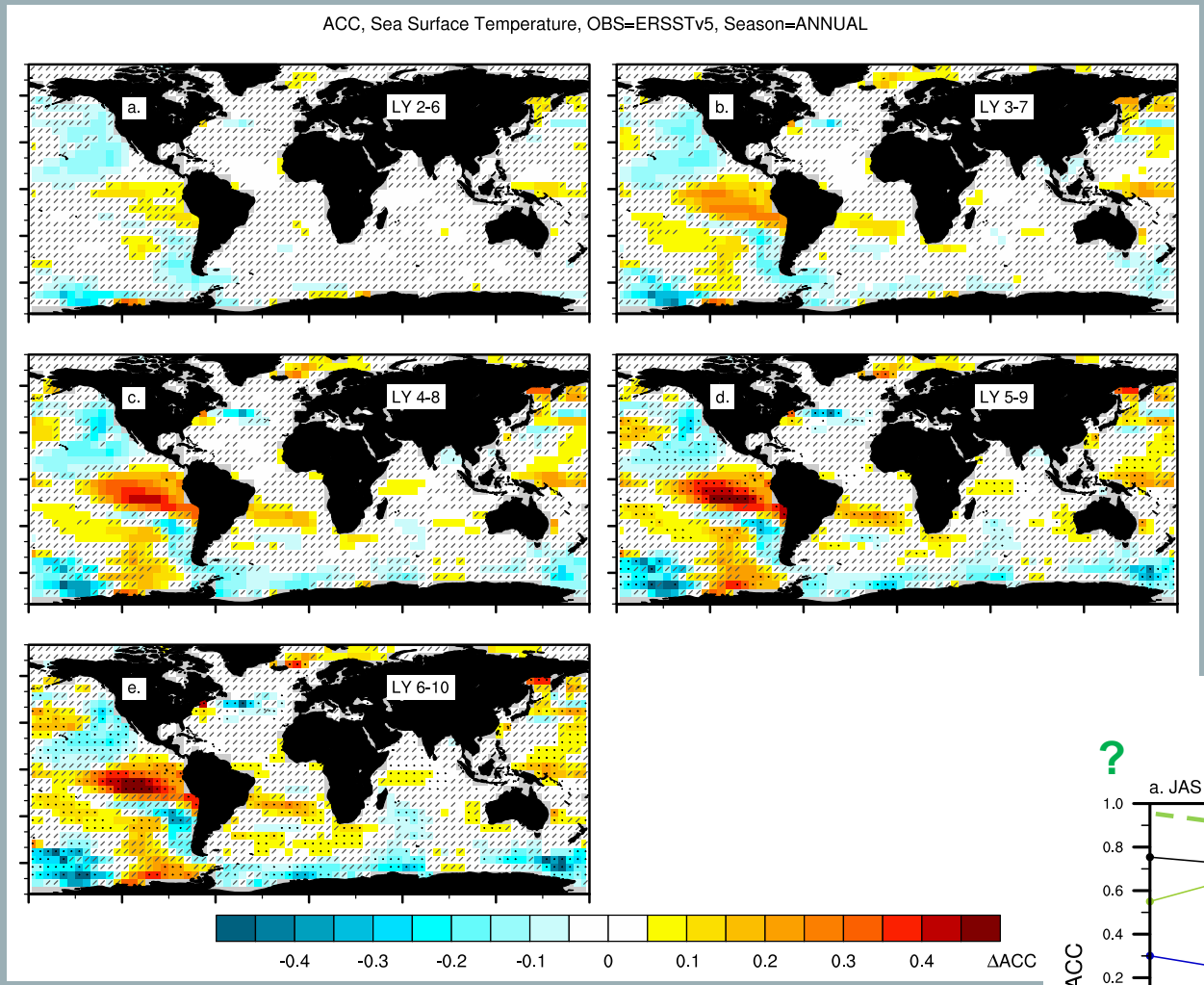
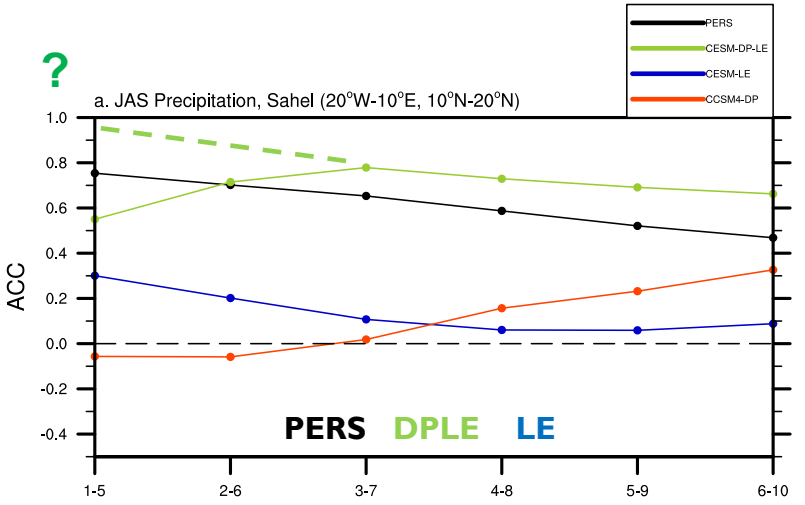
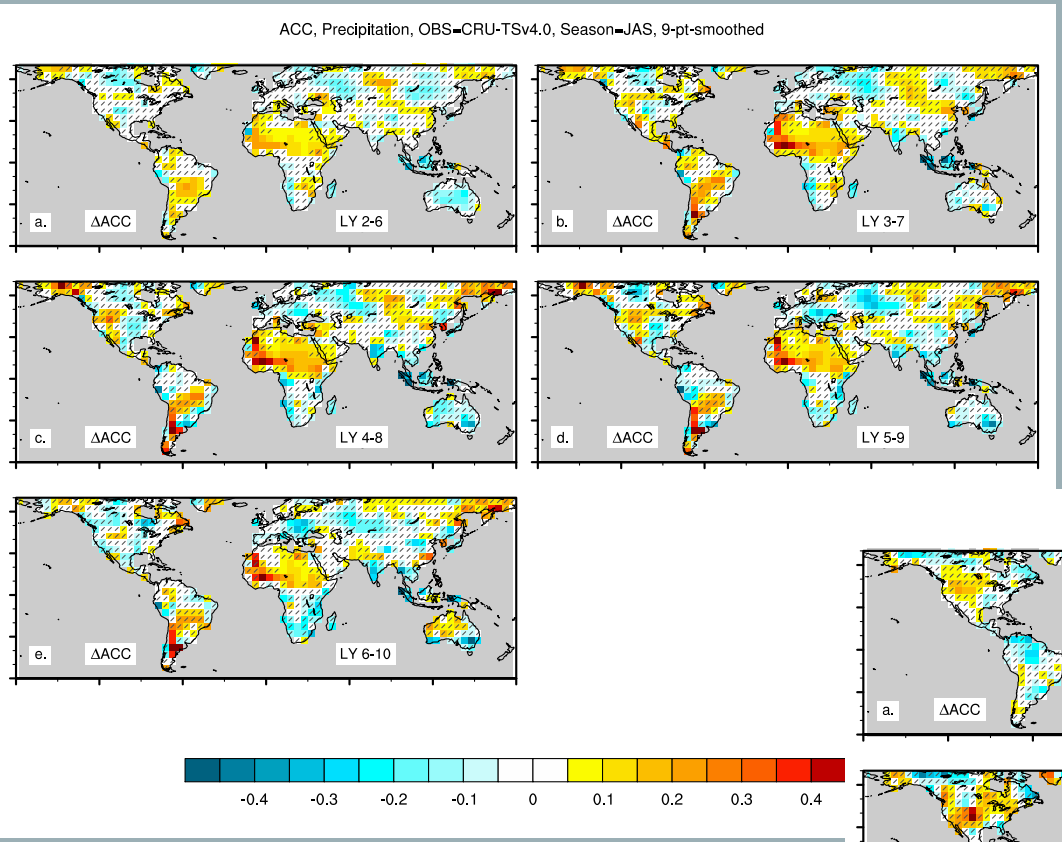


Yeager et al. (2018)

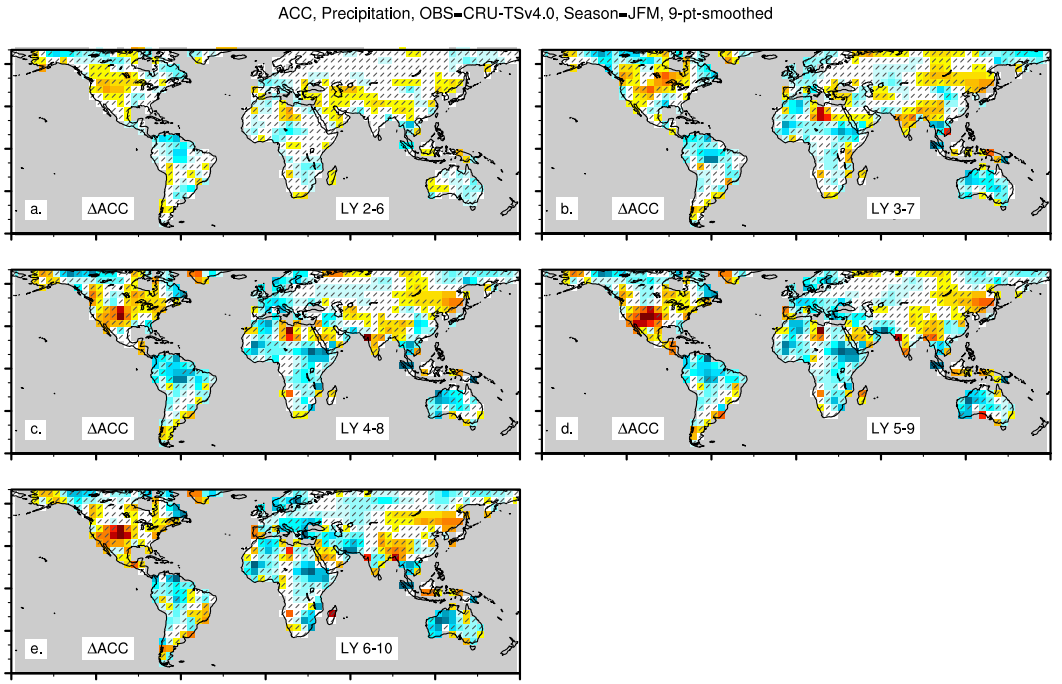


Lead-time dependence

ΔACC, difference from LY1-5 ACC :



← JAS PREC



JFM PREC →

- Suggests that DPLE precipitation skill is a lower bound that could be improved by reducing initialization shock in the Tropical Pacific