

Sensitivity to ensemble size

DPLE LY3-7 skill: ENS=40 vs ENS=5

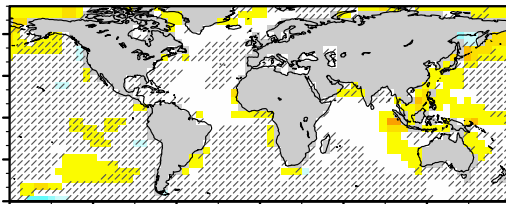
JAS →

SST

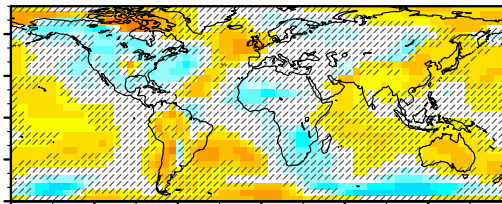
SLP

PREC

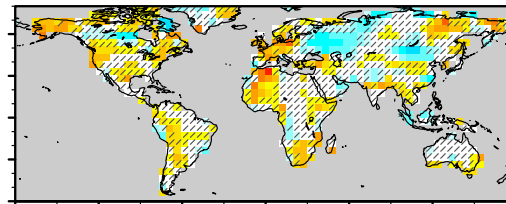
a. JAS SST, ΔACC



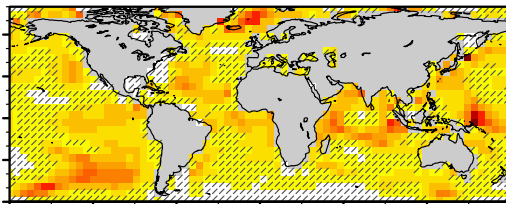
b. JAS SLP, ΔACC



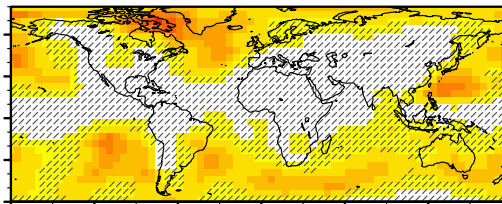
c. JAS PRE, ΔACC



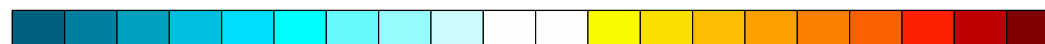
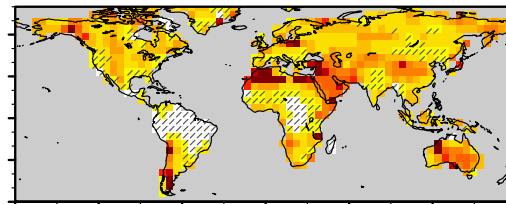
d. JAS SST, MSSS



e. JAS SLP, MSSS



f. JAS PRE, MSSS



-0.4 -0.3

-2 -0.75

-0.2 -0.1

-0.34 -0.13

0

0

0.1

0.1

0.2

0.2

0.3

0.3

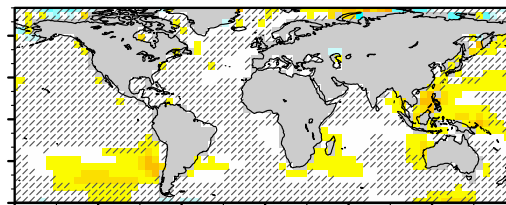
0.4

0.4

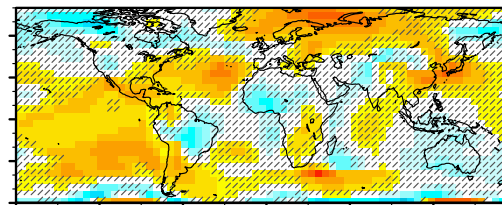
ΔACC

MSSS

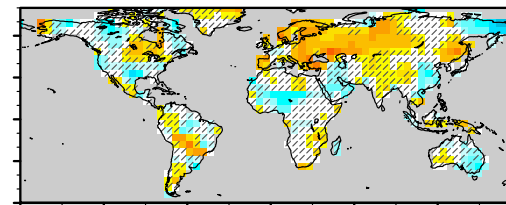
a. JFM SST, ΔACC



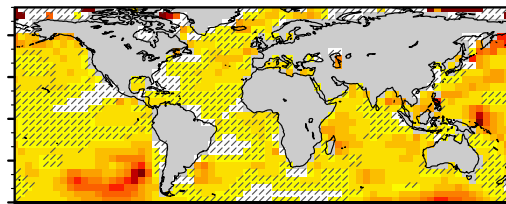
b. JFM SLP, ΔACC



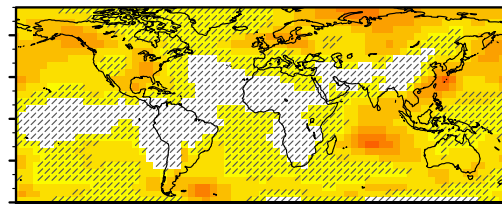
c. JFM PRE, ΔACC



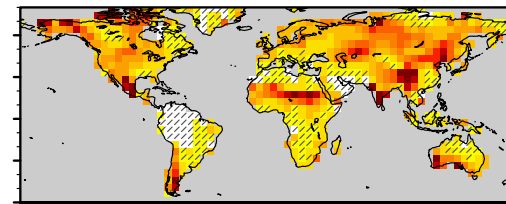
d. JFM SST, MSSS



e. JFM SLP, MSSS



f. JFM PRE, MSSS



-0.4 -0.3

-2 -0.75

-0.2 -0.1

-0.34 -0.13

0

0

0.1

0.1

0.2

0.2

0.3

0.3

0.4

0.4

ΔACC

MSSS

JFM →

Sensitivity to ensemble size

DPLE LY3-7 skill: ENS=40 vs ENS=10

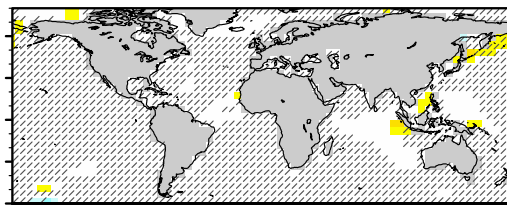
JAS →

SST

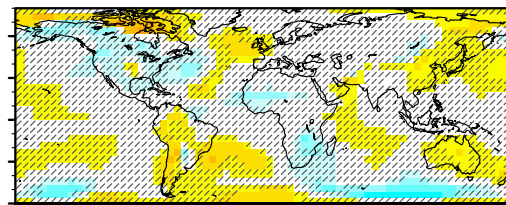
SLP

PREC

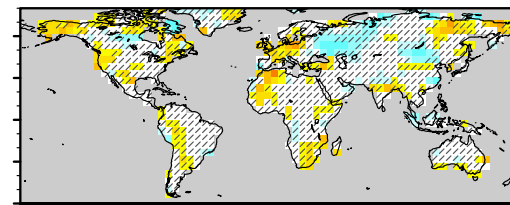
a. JAS SST, Δ ACC



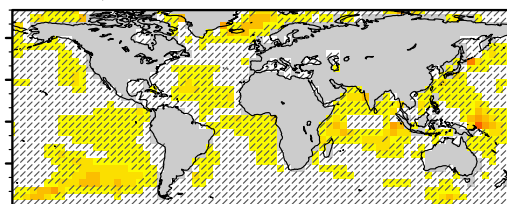
b. JAS SLP, Δ ACC



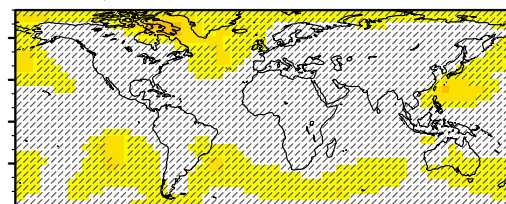
c. JAS PRE, Δ ACC



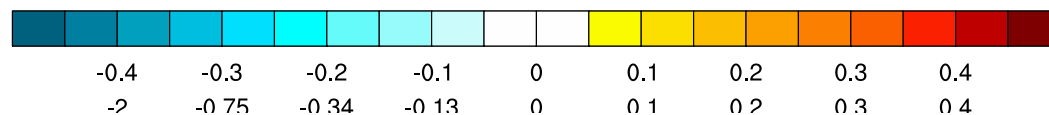
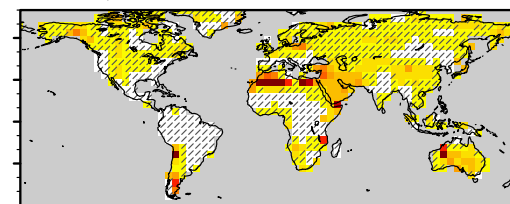
d. JAS SST, MSSS



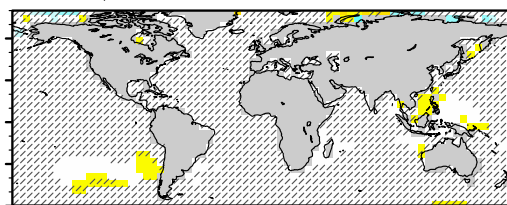
e. JAS SLP, MSSS



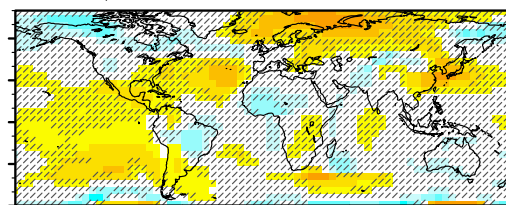
f. JAS PRE, MSSS



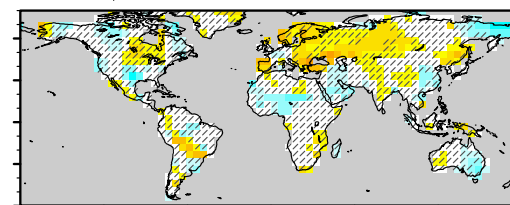
a. JFM SST, Δ ACC



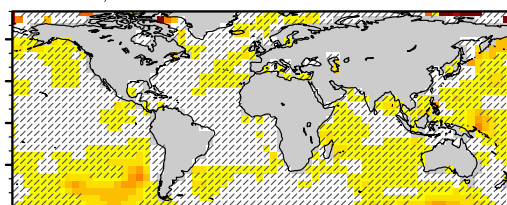
b. JFM SLP, Δ ACC



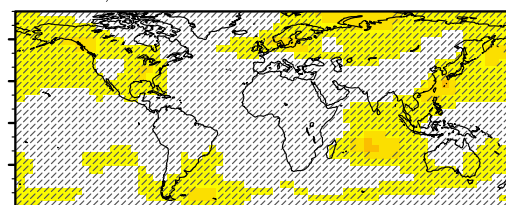
c. JFM PRE, Δ ACC



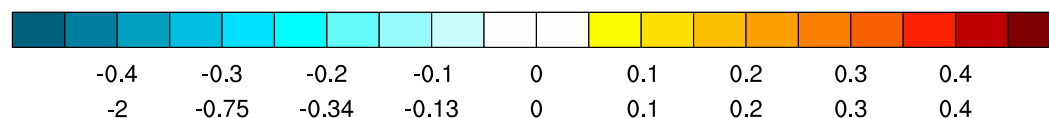
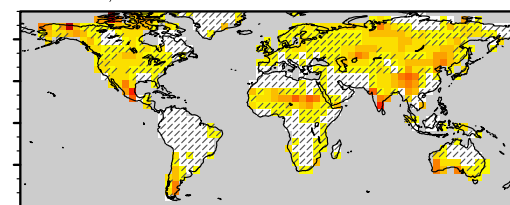
d. JFM SST, MSSS



e. JFM SLP, MSSS



f. JFM PRE, MSSS



JFM →

Sensitivity to ensemble size

DPLE LY3-7 skill: ENS=40 vs ENS=20

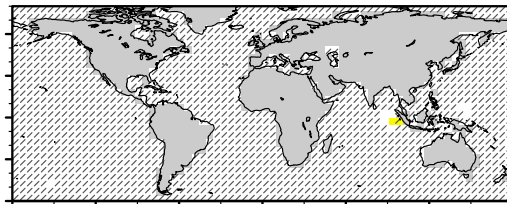
JAS →

SST

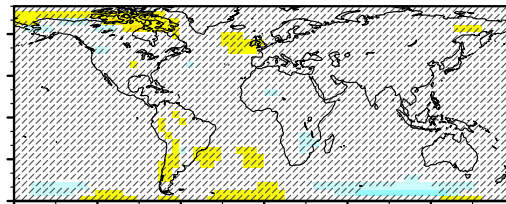
SLP

PREC

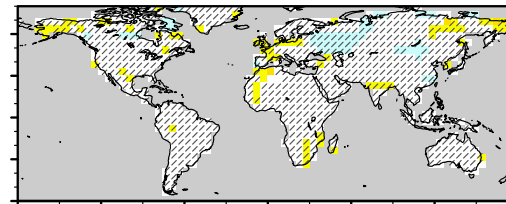
a. JAS SST, ΔACC



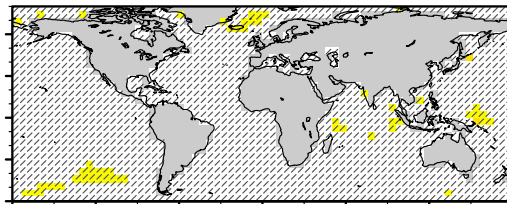
b. JAS SLP, ΔACC



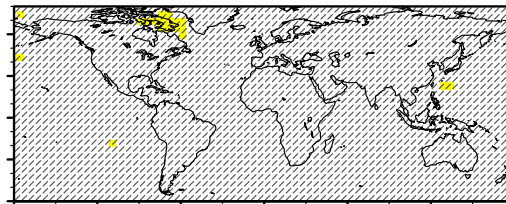
c. JAS PRE, ΔACC



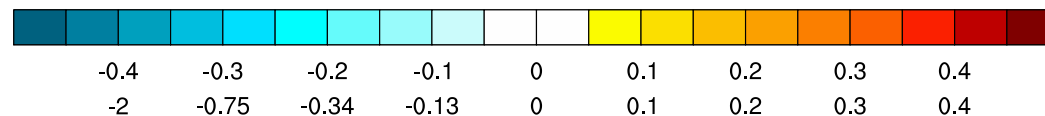
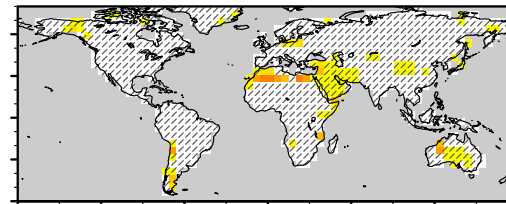
d. JAS SST, MSSS



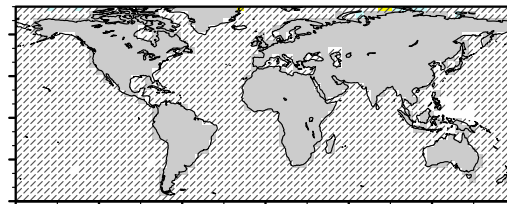
e. JAS SLP, MSSS



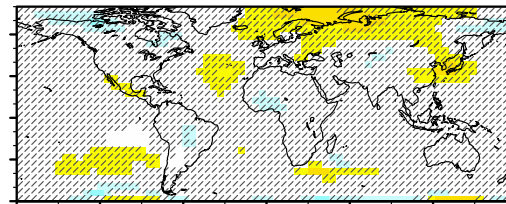
f. JAS PRE, MSSS



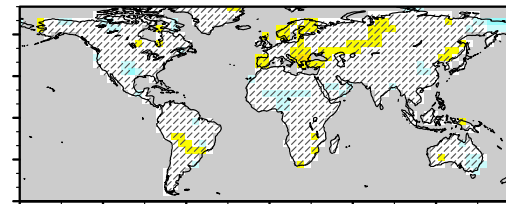
a. JFM SST, ΔACC



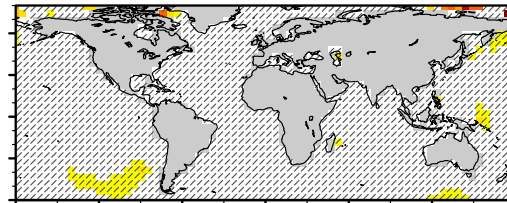
b. JFM SLP, ΔACC



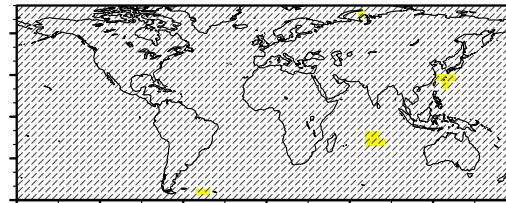
c. JFM PRE, ΔACC



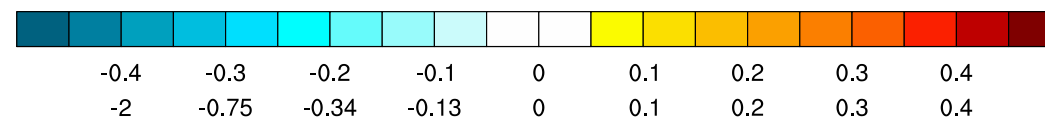
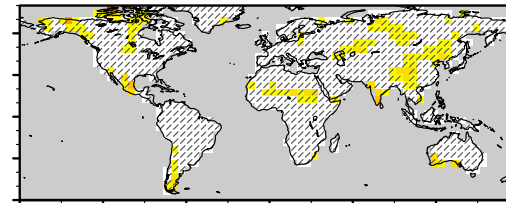
d. JFM SST, MSSS



e. JFM SLP, MSSS



f. JFM PRE, MSSS

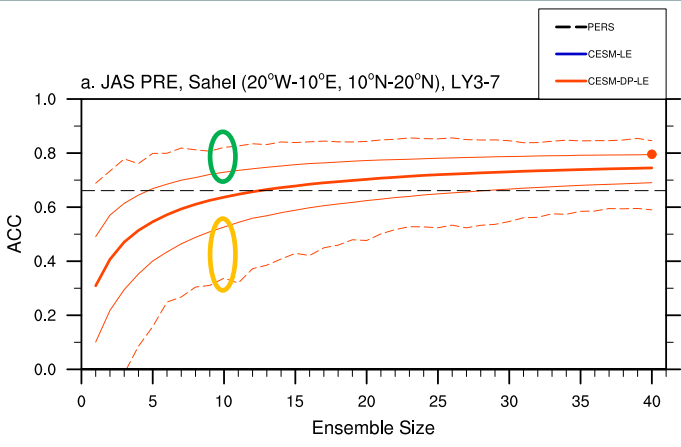


JFM →

What explains skill uncertainty?

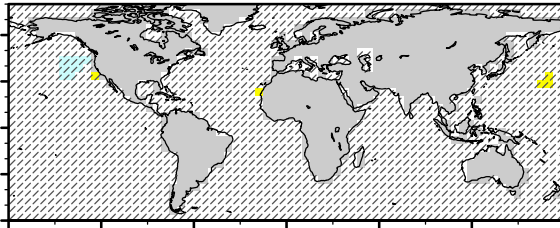
DPLE LY3-7 JAS Sahel PRE skill

- Spread in skill entirely attributable to spread in atmospheric evolution (no clear SST driver of spread) – related to signal-to-noise paradox?

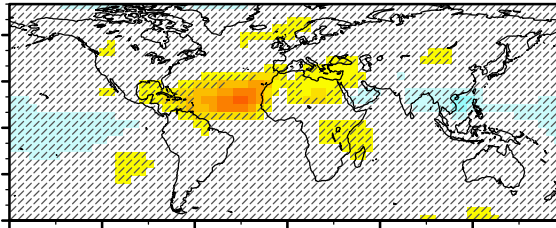


quantile=0.05, ens=10, LY3-7, PREC.Sahel.JAS.3-7.corr_vs_esize.wreplace.nmbase40.nc

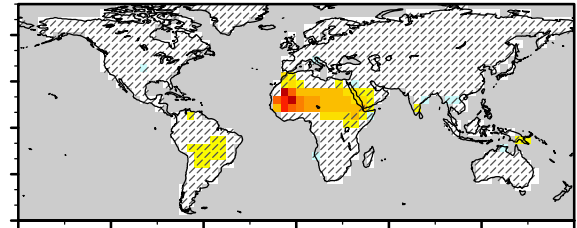
a. JAS SST, Δ ACC



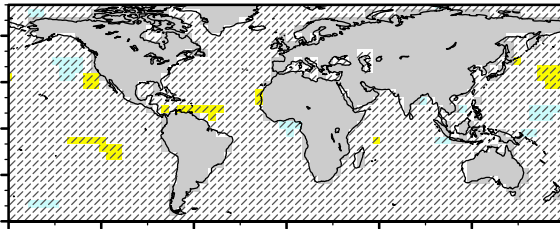
b. JAS SLP, Δ ACC



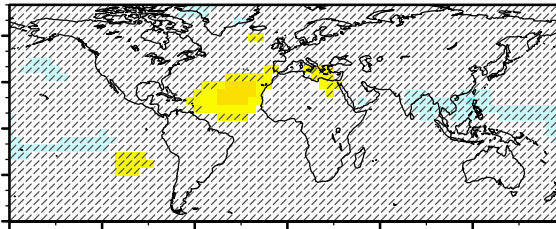
c. JAS PRE, Δ ACC



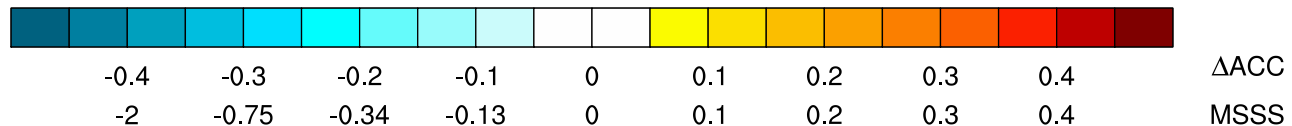
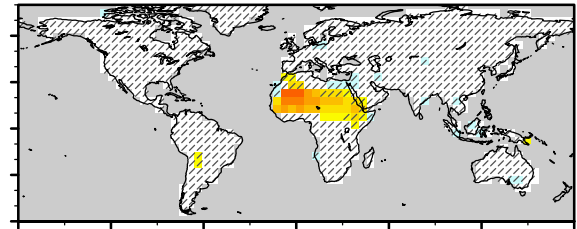
d. JAS SST, MSSS



e. JAS SAT, MSSS

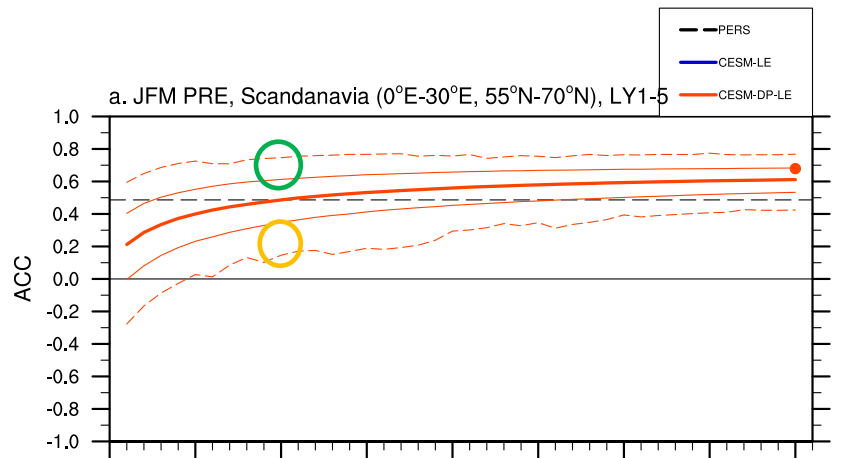


f. JAS PRE, MSSS



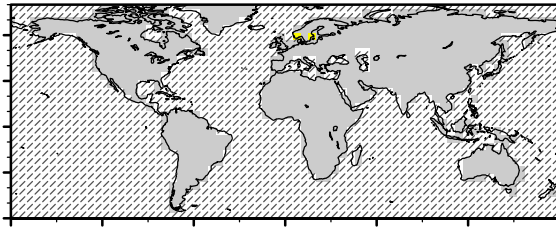
What explains skill uncertainty?

DPLE LY1-5 JFM Scandinavia PRE skill

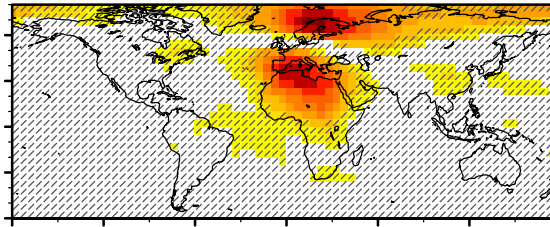


- Spread in skill entirely attributable to spread in atmospheric evolution (no clear SST driver of spread) – related to signal-to-noise paradox?

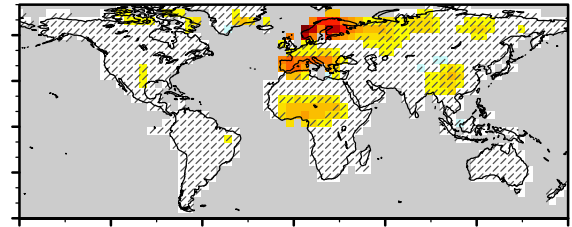
a. JFM SST, Δ ACC



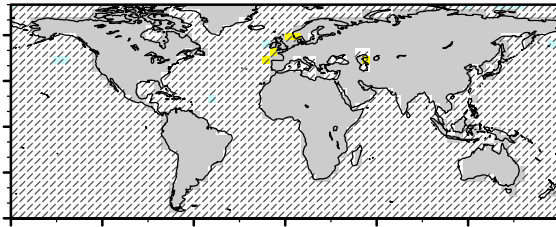
b. JFM SLP, Δ ACC



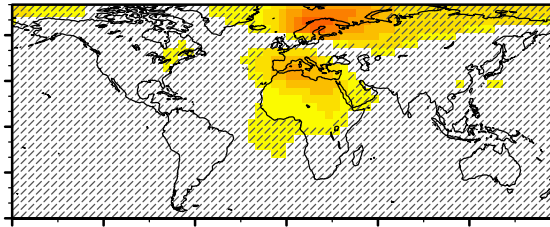
c. JFM PRE, Δ ACC



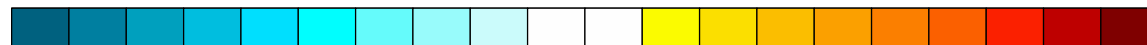
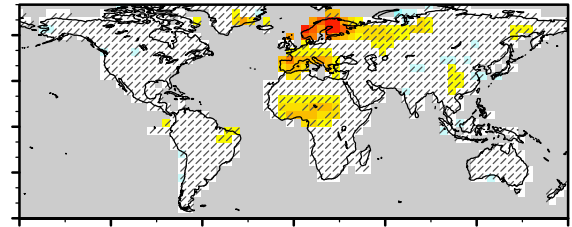
d. JFM SST, MSSS



e. JFM SAT, MSSS



f. JFM PRE, MSSS



-0.4

-0.3

-0.2

-0.1

0

0.1

0.2

0.3

0.4

Δ ACC

-2

-0.75

-0.34

-0.13

0

0.1

0.2

0.3

0.4

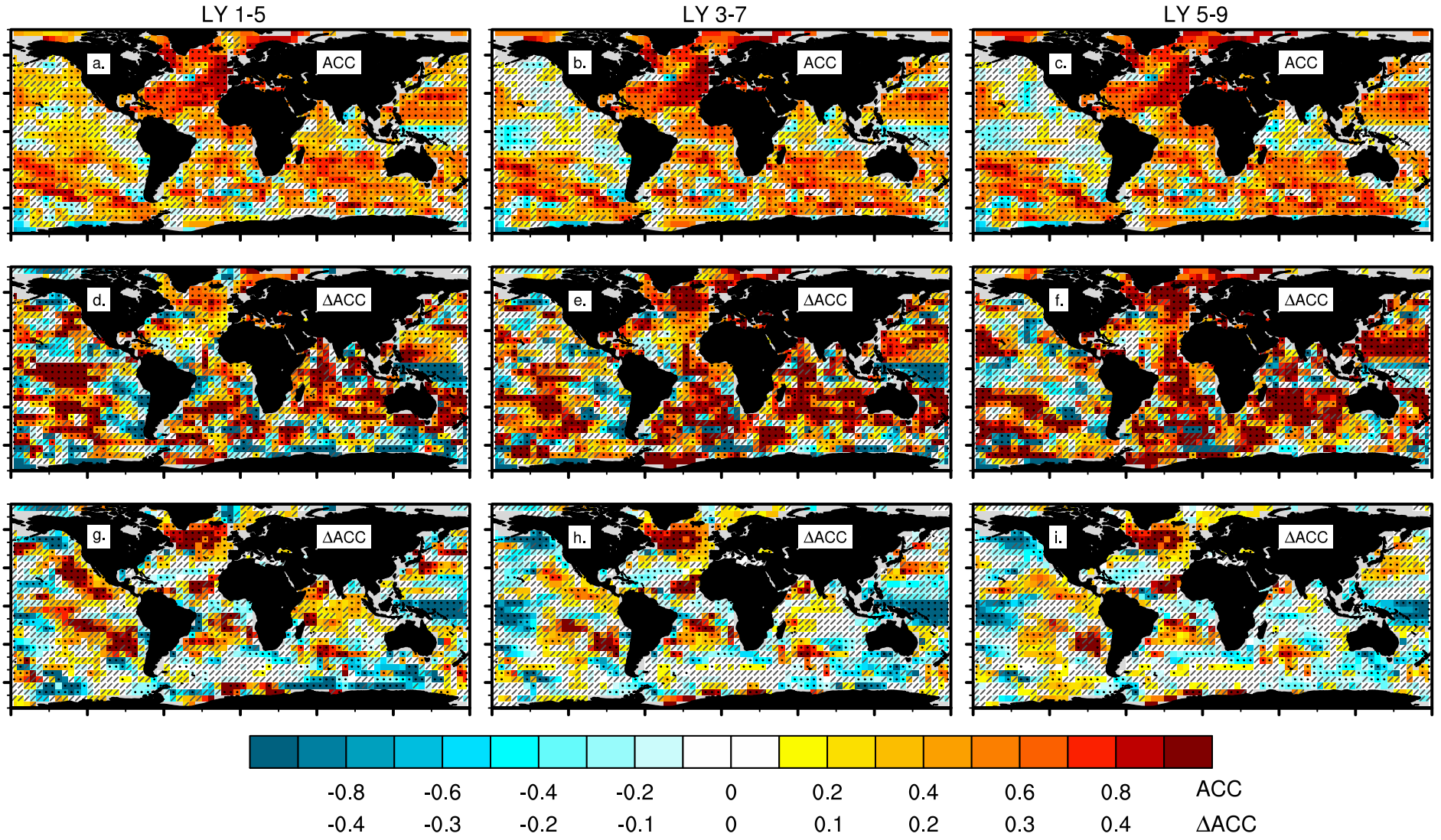
MSSS

Some of the lessons learned (so far) from CESM-DPLE:

- Decadal skill for (land) precipitation is complex and varies considerably with: region, season, lead time, ensemble size, inclusion (or not) of trend, degree of spatial filtering, etc. BUT, there are grounds for optimism and indications that max skill has not yet been achieved.
- High, robust skill for: JAS: **Sahel**, Europe JFM: N Europe, Eurasia
- Promising results for: Africa, S Asia, N and S America, Australia.
- Initialization shock can result in SST forcing that improves with lead time in some key regions
→ potential PRECIP skill is likely not being fully realized. Suggests the need to run beyond LY 5 as skill is not necessarily maximized at short leads.
- Low model signal-to-noise can be overcome (to some extent) with larger ensembles, but points to the need for model development to realize higher real world predictability. Diminishing returns for ENS>20 for decadal predictions of seasonal precipitation. Large uncertainties in externally-forced signal call into question the validity of skill improvement assessments using small UI ensembles.
- Precipitation skill uncertainty is almost entirely attributable to uncertainty in atmospheric response, not SST driving.
- Data publically available at <http://www.cesm.ucar.edu/projects/community-projects/DPLE/>

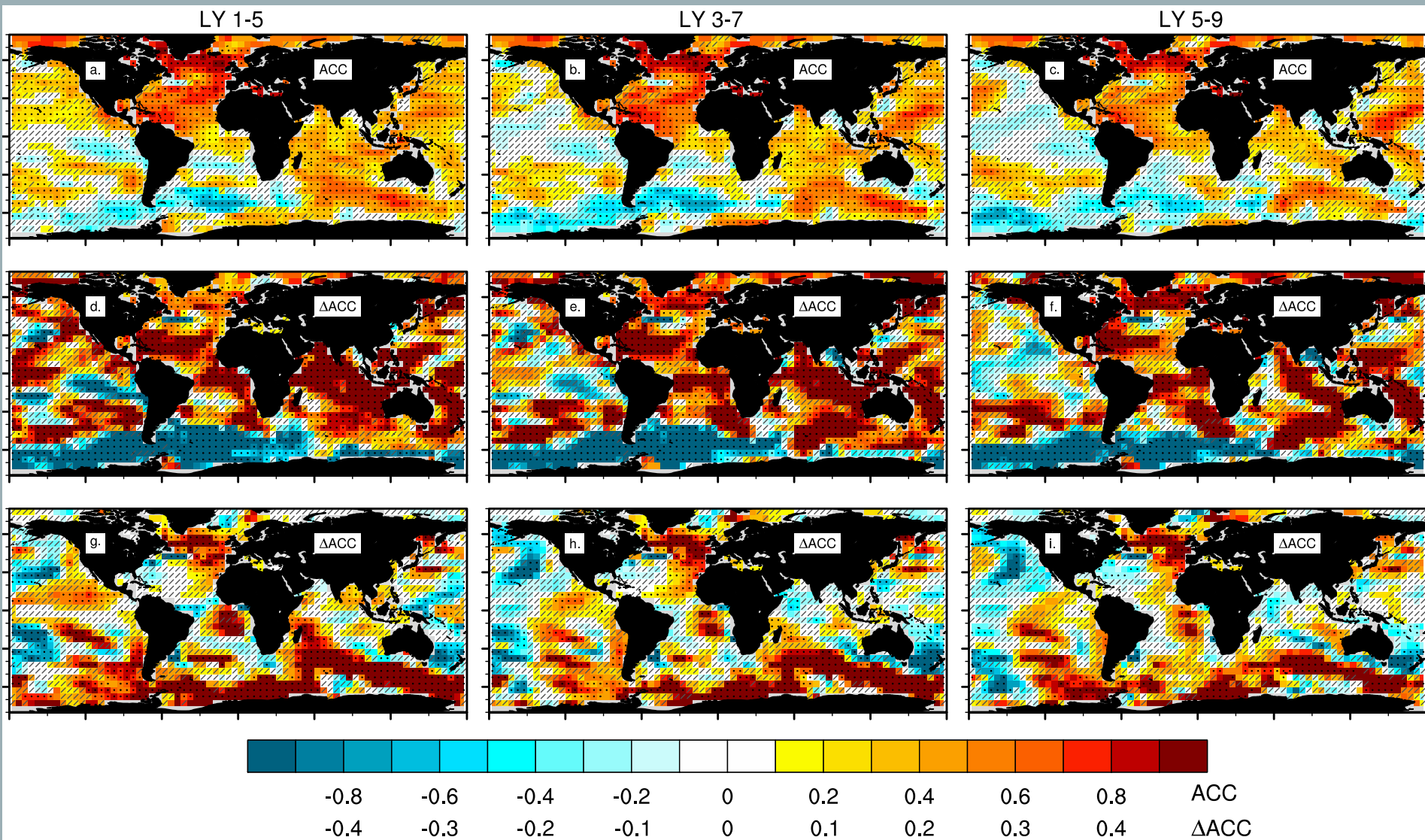
CESM-DPLE: 0-295m Ocean Temperature

ACC, T295, OBS=EN4.2.1, Season=ANNUAL, (LY 1-5: 1957.5-2014.5)



Understanding the Origins of Precipitation Skill

DPLE : Sea Surface Temperature (detrended)

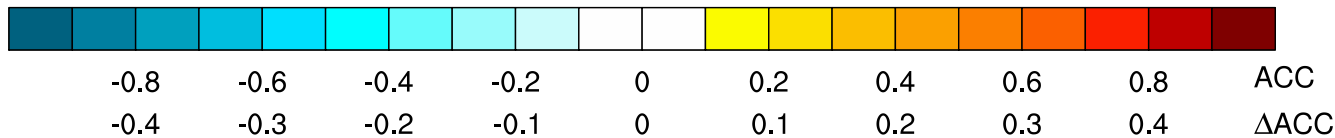
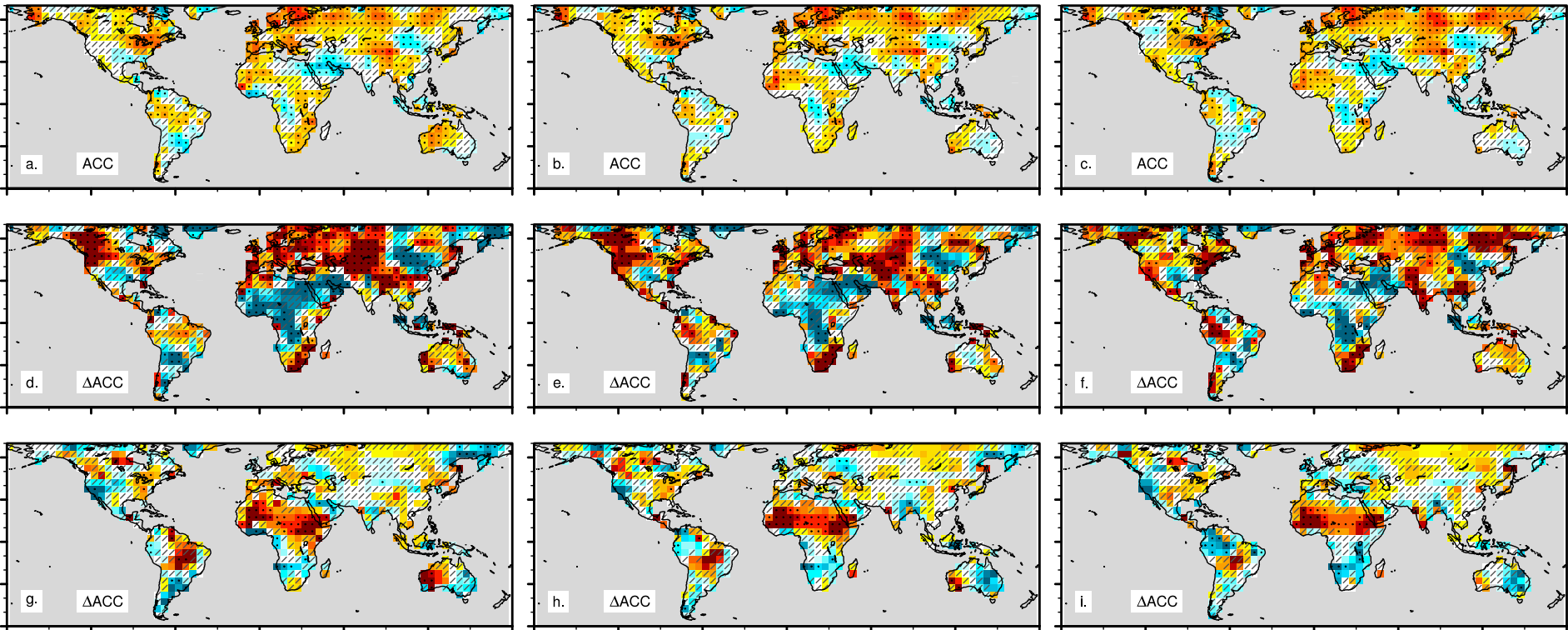


ACC, Precipitation, OBS=CRU-TS4.0, Season=ANNUAL, 9-pt-smoothed, (LY 1-5: 1957.5-2013.5)

LY 1-5

LY 3-7

LY 5-9



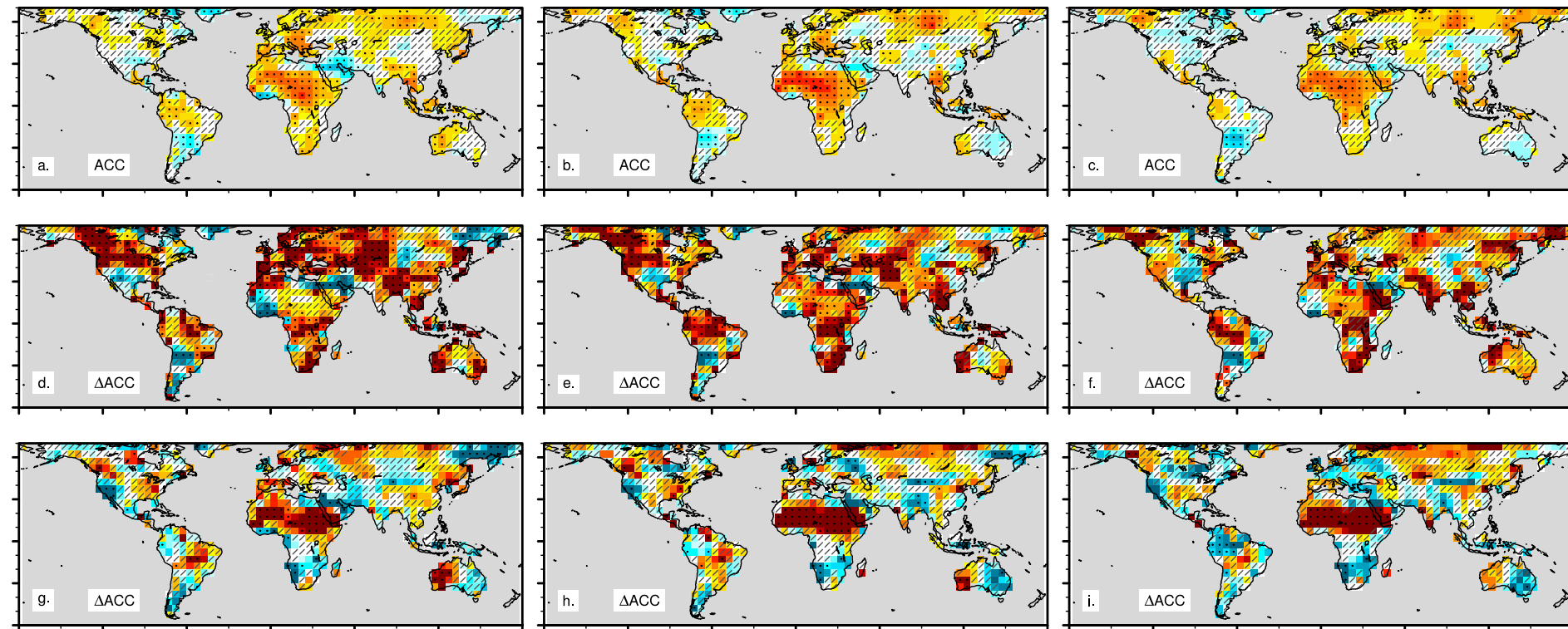
CESM-DPLE: Annual Precip (detrended)

ACC, Precipitation, OBS=CRU-TS4.0, Season=ANNUAL, 9-pt-smoothed, (LY 1-5: 1957.5-2013.5), detrended

LY 1-5

LY 3-7

LY 5-9



-0.8 -0.6 -0.4 -0.2 0 0.2 0.4 0.6 0.8 ACC
-0.4 -0.3 -0.2 -0.1 0 0.1 0.2 0.3 0.4 ΔACC