Impacts of Land-Surface Initialization on ACCESS Intraseasonal and Seasonal Forecasts
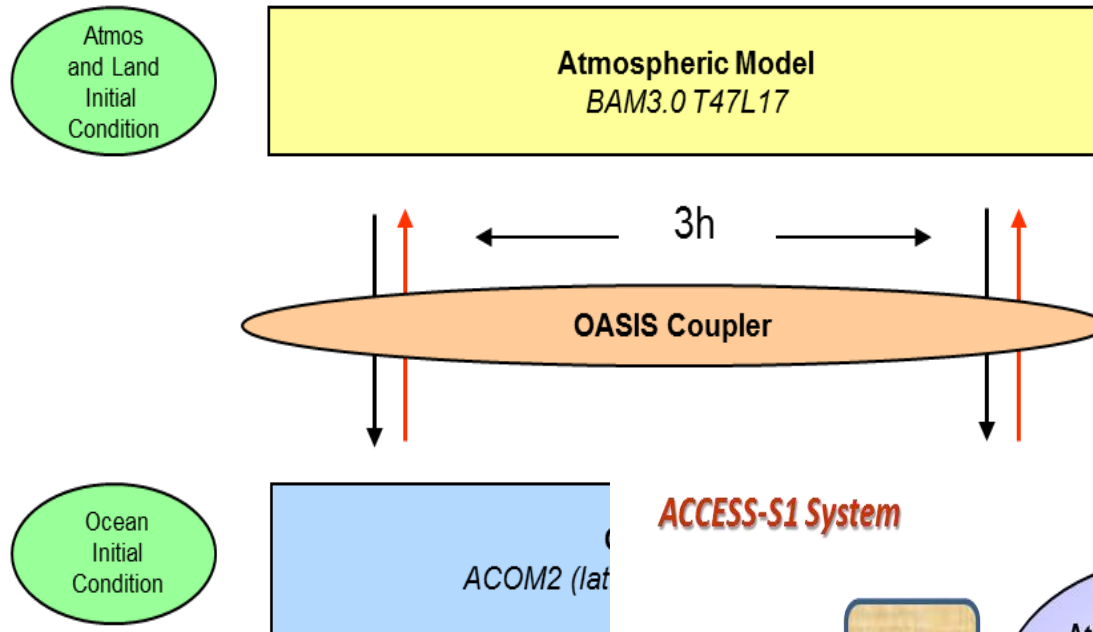
Huqiang (Hugh) Zhang
(h.zhang@bom.gov.au)

Australian Bureau of Meteorology

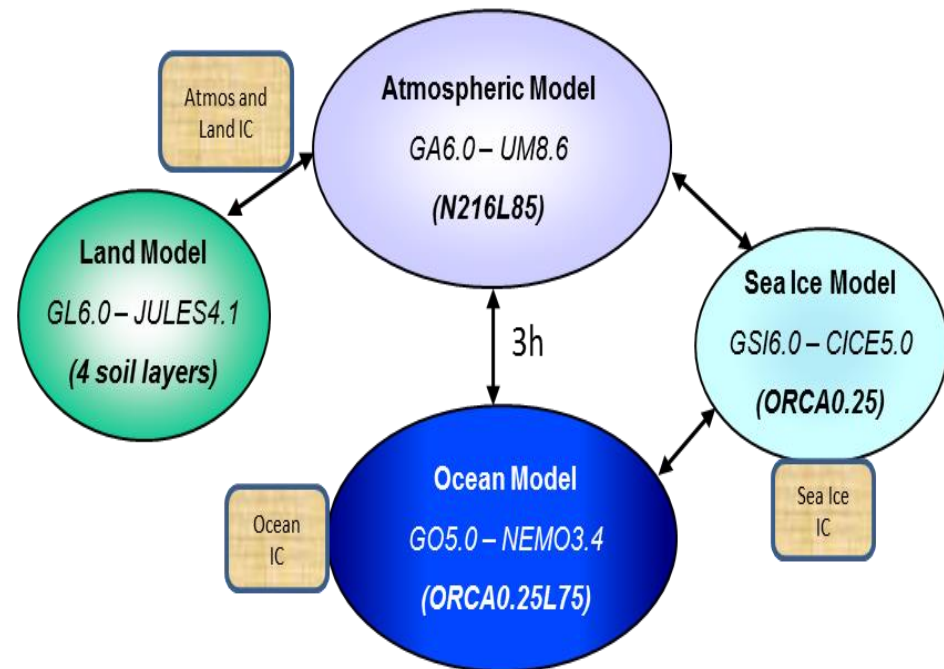**Co-authors:** *Maggie Zhao, Imtiaz Dharssi, and Lili Jin*

Reference: *Zhao M., Zhang H., and Dharssi I (2017) Impact of Land-surface Initialization on ACCESS-S1 and Comparison with POAMA, Bureau of Meteorology Research Report (submit to BRP)*

POAMA System

Atmos and Land Initial Condition

Atmospheric Model
BAM3.0 T47L17

3h

OASIS Coupler

Ocean Initial Condition

ACOM2 (lat

POAMA: old BoM model (bucket land model) & low resolution (~200km)

ACCESS-S1 System

Atmos and Land IC

Atmospheric Model
GA6.0 – UM8.6
(N216L85)

Land Model
GL6.0 – JULES4.1
(4 soil layers)

3h

Sea Ice Model
GSI6.0 – CICE5.0
(ORCA0.25)

Ocean Model
GO5.0 – NEMO3.4
(ORCA0.25L75)

Ocean IC

Sea Ice IC

ACCESS-S1: UK GC2-based (advanced physics) & higher resolution (~60km)

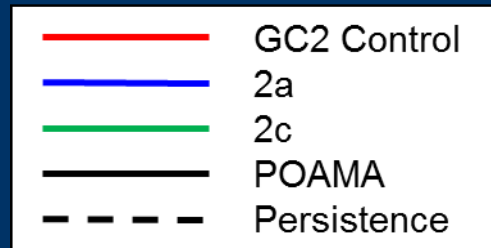# Improved mean climate
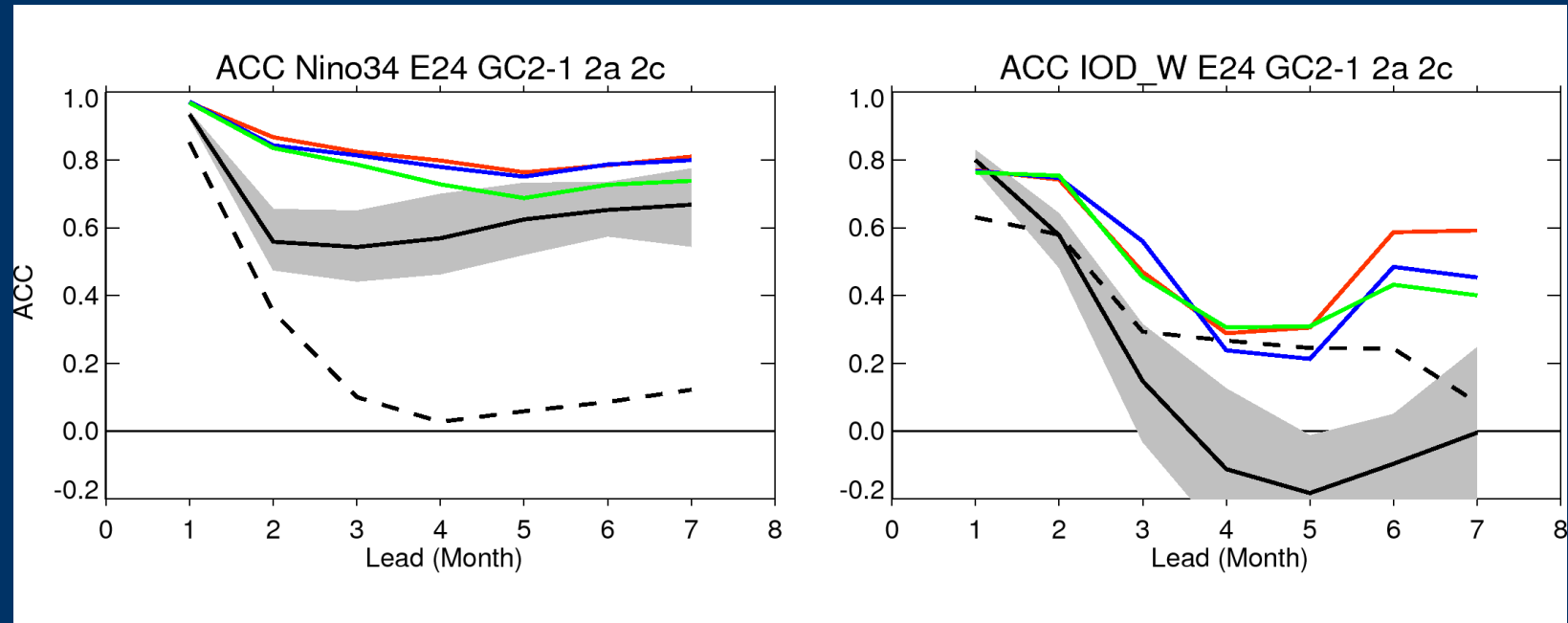

Obs   GC2   POAMA

Pr (JJA)

Tmax (JJA)
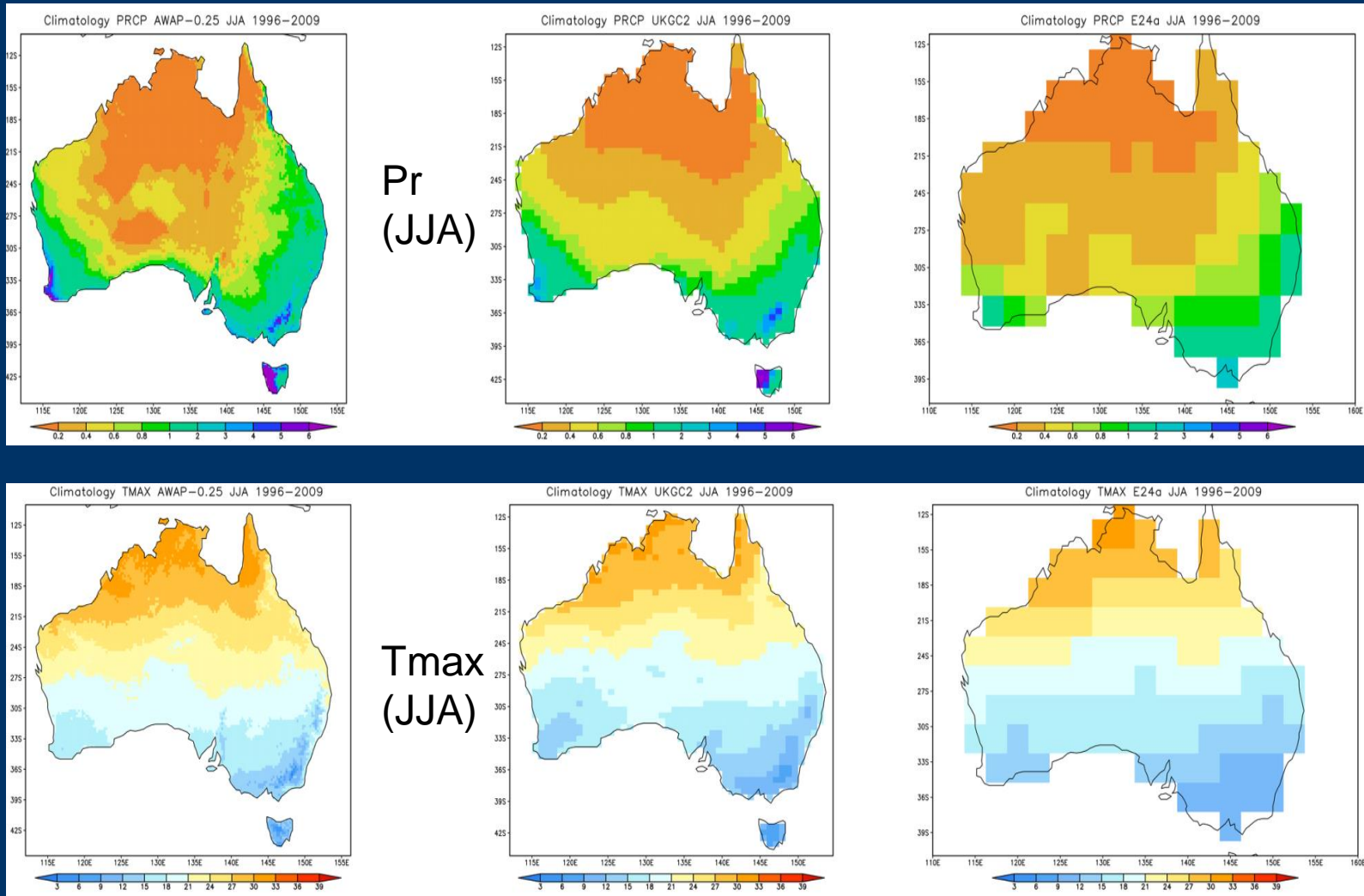
Source: Li Shi (ACCESS-S meeting 18/12/2015)

Improved ENSO prediction skill

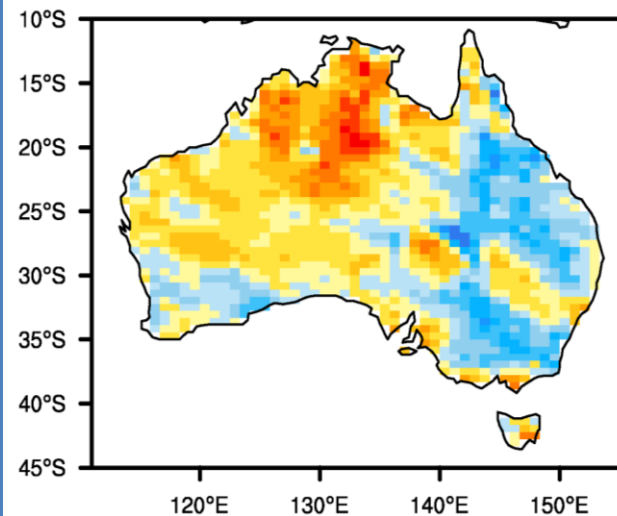Source: Guomin Wang (ACCESS-S meeting 18/12/2015)
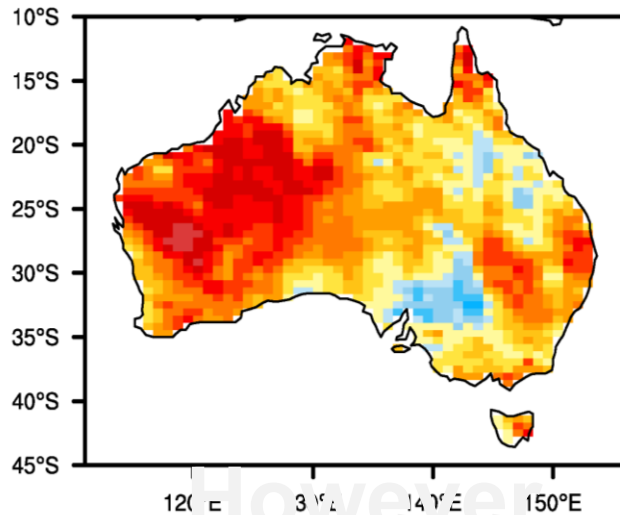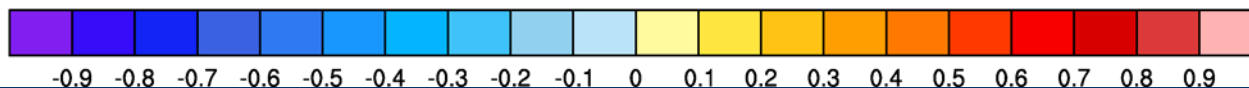
(b) ACCESS-S1,CTL
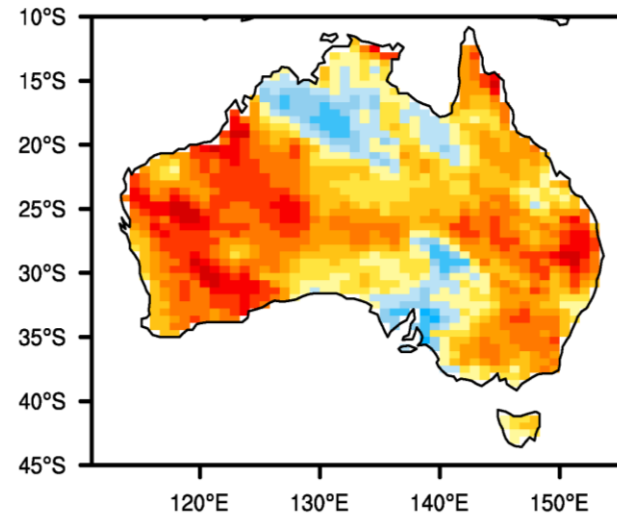
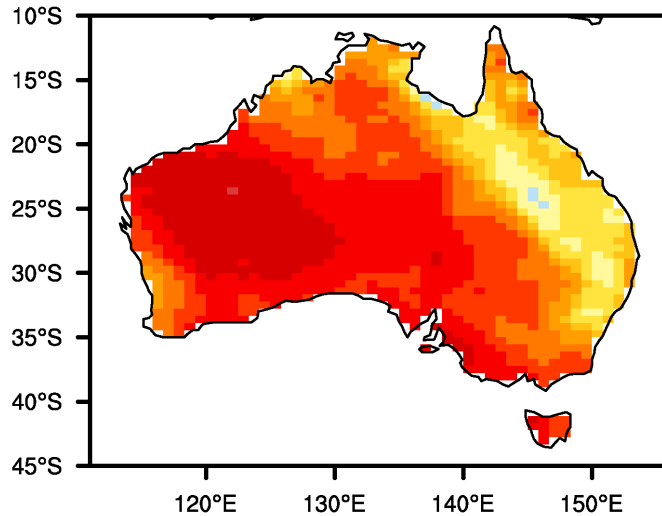(c) POAMA e24a

(f) Diff CTL-E24a

Precip hindcast skill (<u>anomaly correlations</u>) for 1st May start time
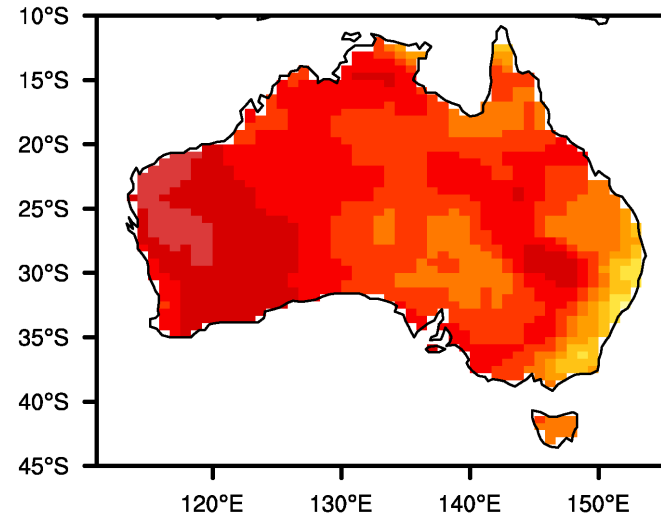
Hindcast period: 1990-2012

Lead time (LT) zero: starting 1st May and forecasting for May-Jun-Jul
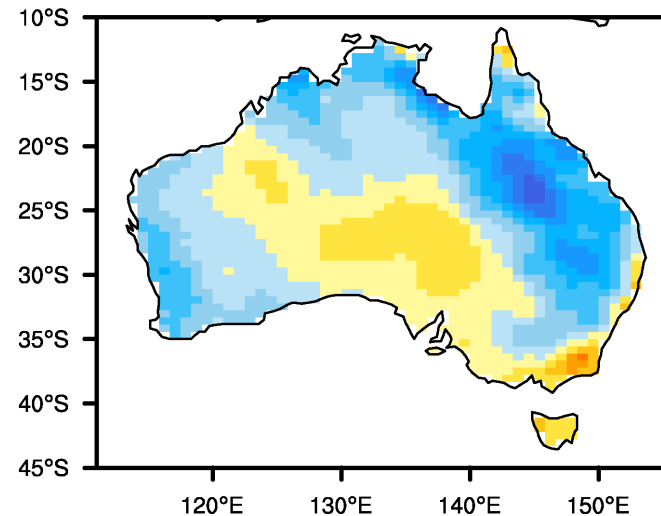
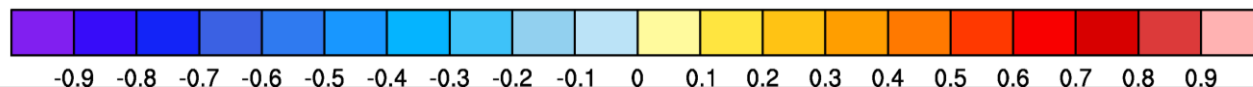(b) ACCESS-S1,CTL

(c) POAMA e24a

(f) Diff CTL-E24a

Monthly Tmax hindcast skill (anomaly correlations) for 1st May start time

Hindcast period: 1990-2012

Lead time (LT) zero: starting 1st May and forecasting for May-Jun-Jul

Focus of this study: contribution of land-surface initialisation to the lack of translation of good tropical SST forecast skill into surface hydro-climate forecasts

Experiments (1st May, 3-mon, 11 members, 1990-2012)

- **CTL**: standard ACCESS-S1 configuration (as GloSea5/GC2) with a climatological soil moisture;

- **LIC**: using interannually varying soil moisture from our JULES offline run (Era-interim forcing +GPCP rainfall correction);

- **LICC**: climatological soil moisture from our JULES offline run

LICC~CTL ➜ impacts due to different soil moisture climatology
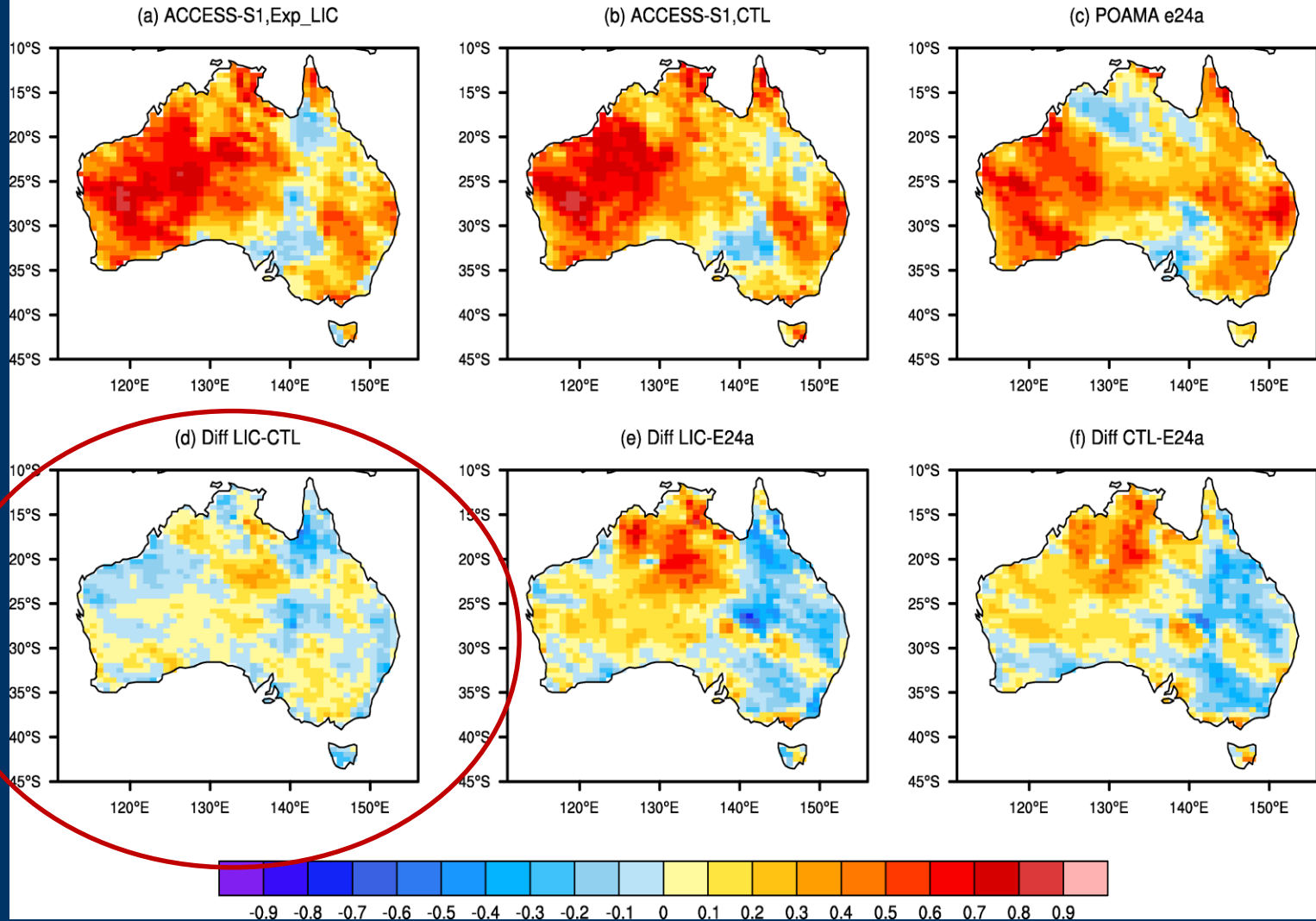LIC~LICC ➜ impacts due to varying soil moisture initial conditions
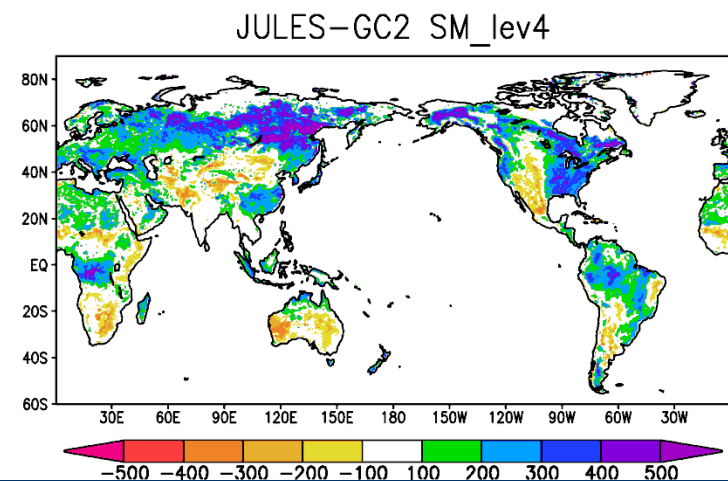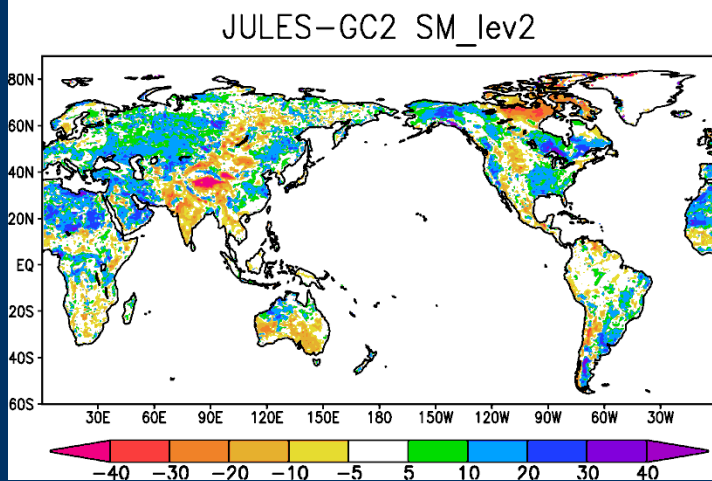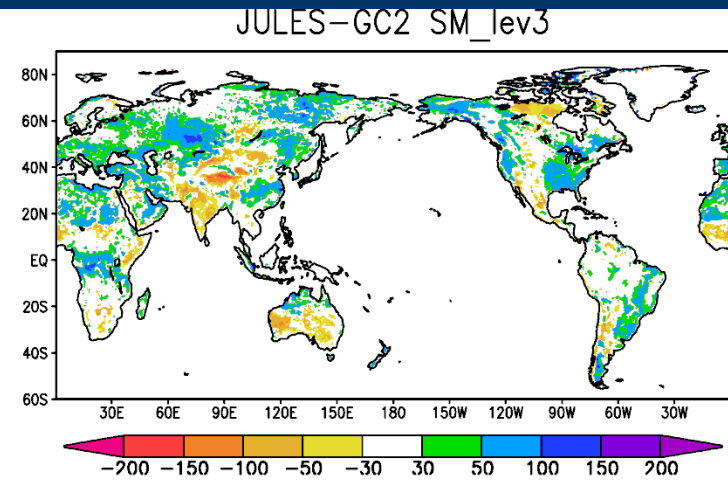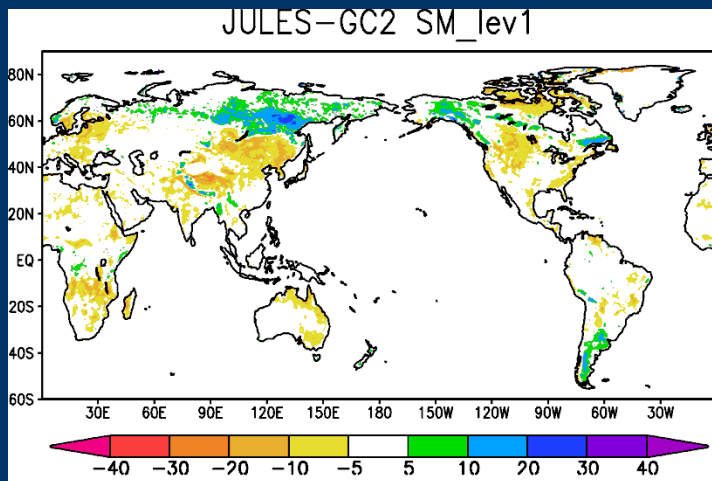
Differences of soil moisture conditions between JULES offline and GC2 at each soil layer
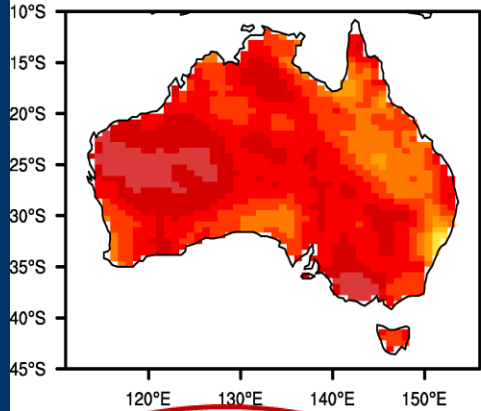
Seasonal forecast (MJJ) skill (anomaly correction) gain:

Prec ACC with AWAP: 1990-2012, MJJ

(a) ACCESS-S1,Exp_LIC
(b) ACCESS-S1,CTL
(c) POAMA e24a
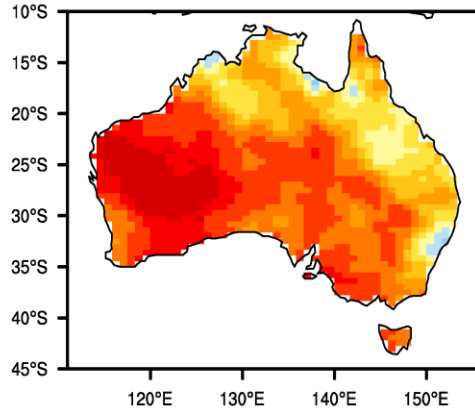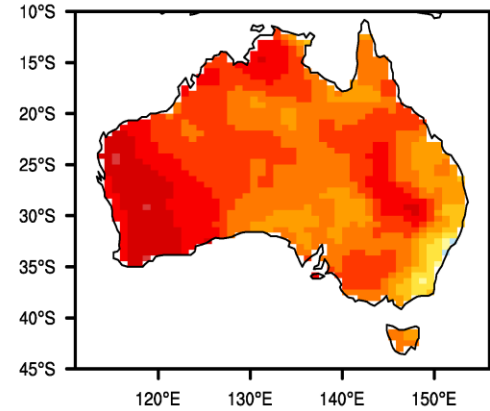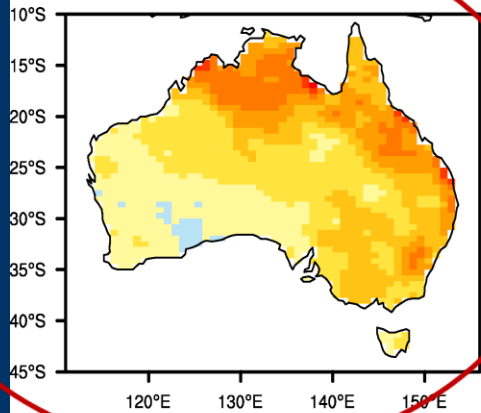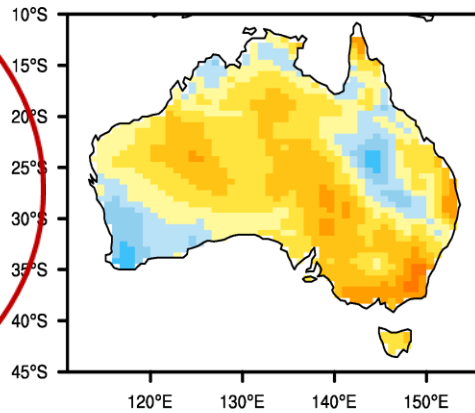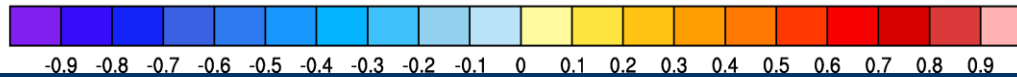(d) Diff LIC-CTL
(e) Diff LIC-E24a
(f) Diff CTL-E24a

Tmax ACC with AWAP: 1990-2012, MJJ
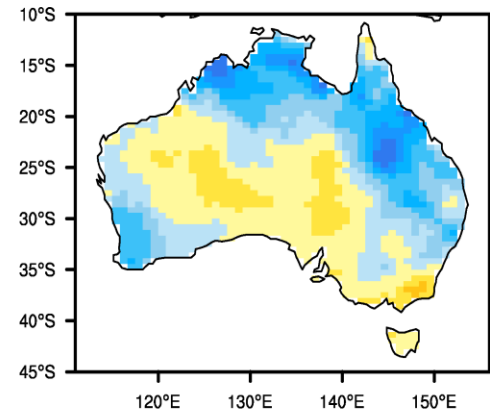
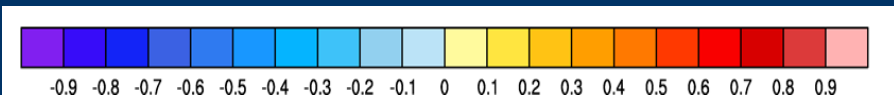(a) ACCESS-S1,Exp_LIC (b) ACCESS-S1,CTL (c) POAMA e24a
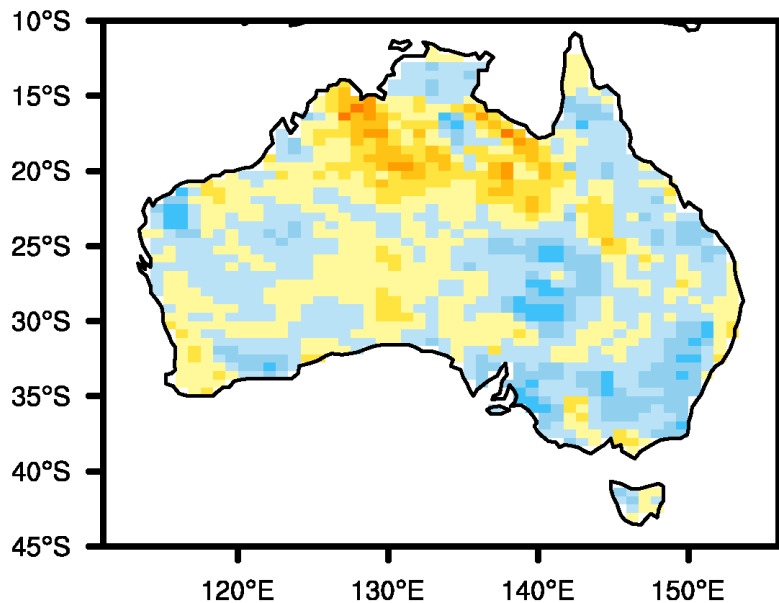
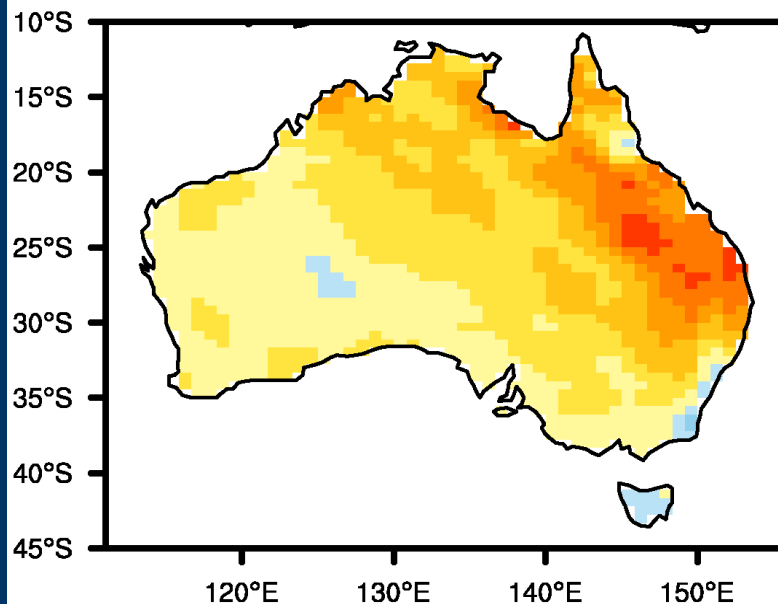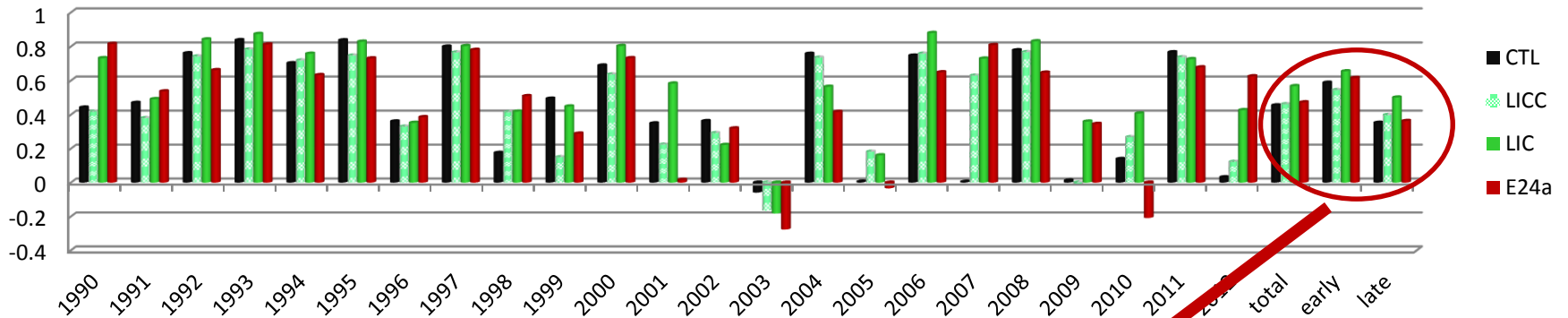(d) Diff LIC-CTL (e) Diff LIC-E24a (f) Diff CTL-E24a

(d) Diff LIC-LICC , Prec

LIC against LICC:

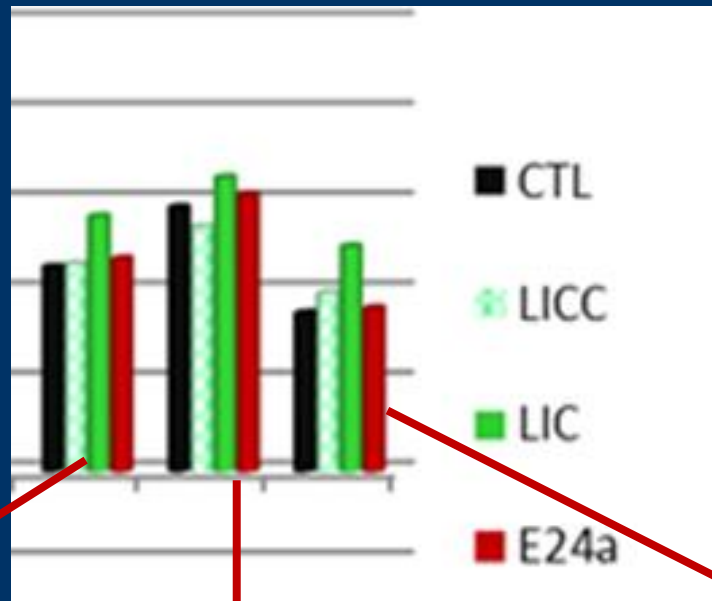climatological soil moisture ~ "realistic" soil moisture)

(g) Diff LIC-LICC , Tmax

Pattern Corr with AWAP Tmax_oz, 0501, lt0

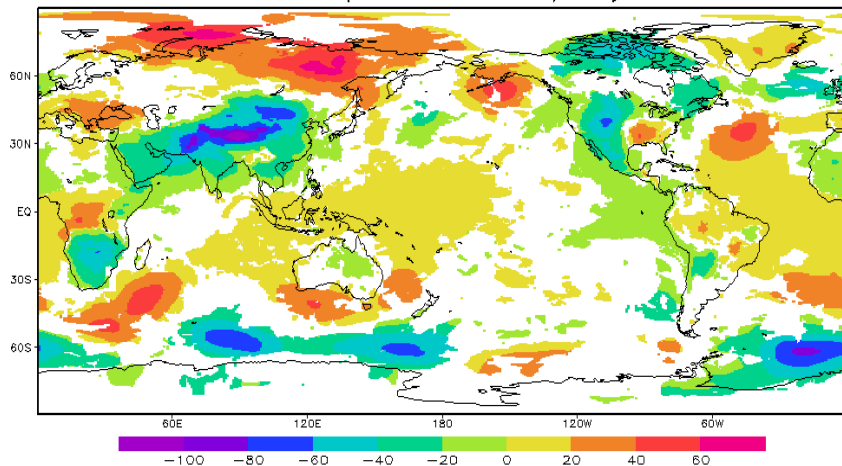Spatial correlation of May Tmax monthly anomalies over Australia

total period (1990-2012)
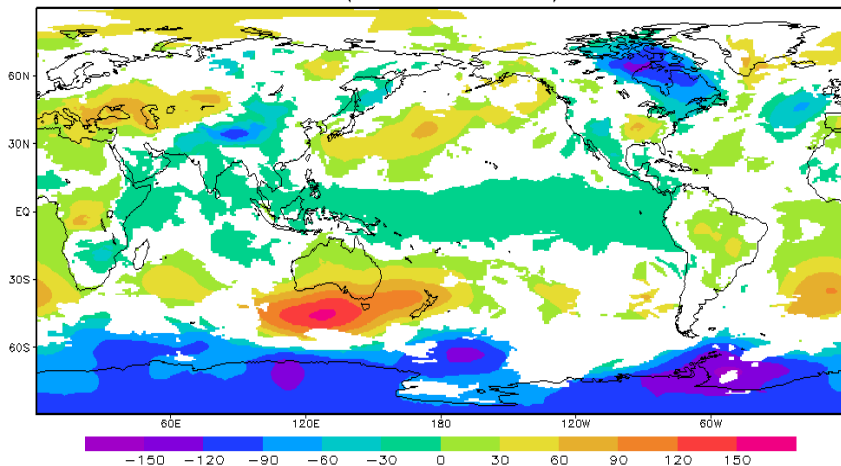
early period (1990-1999)
IPO warm phase

late period (2000-2012)
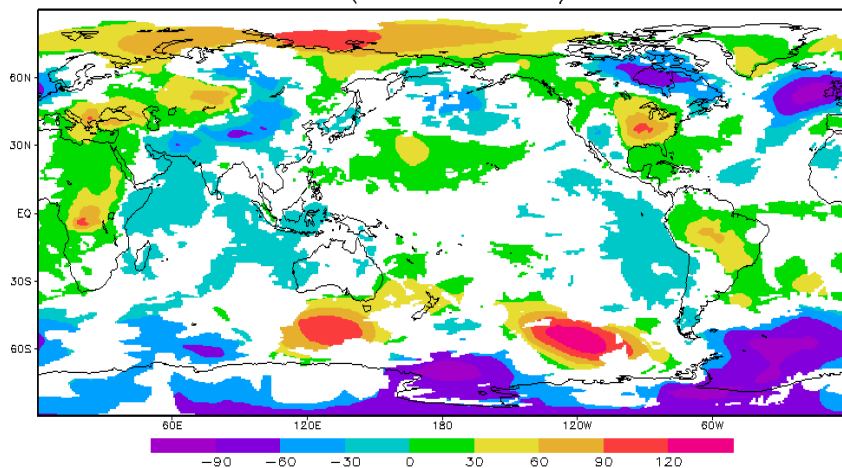**IPO cold phase**
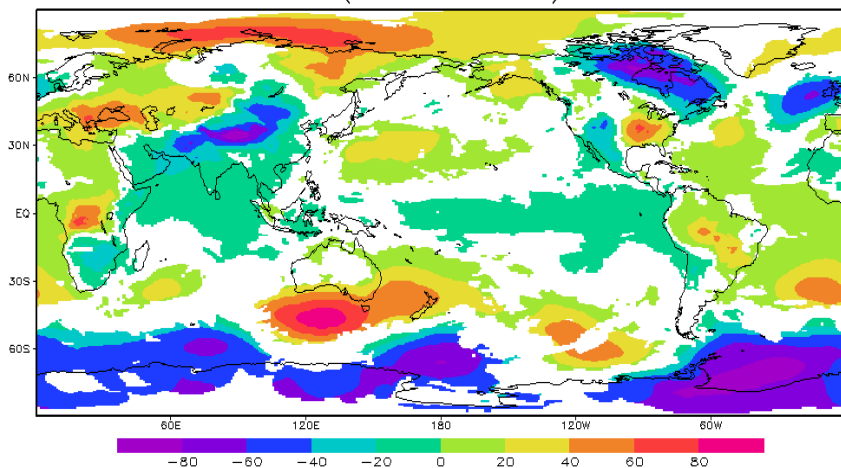
MSLP mean difference: LIC-CTL

Response in rainfall signal is supported by circulation responses

Summary:

- Impacts of land-surface initial conditions on ACCESS-S1 seasonal forecast skill demonstrated;

- Such impacts can be modulated by large-scale climate drivers such as IPO;

- Part of the model biases can also be caused by the land surface initialisation;

- Model skill improvement expected in ACCESS-S2 in which better LIC is being implemented.

- Model mean bias is reduced too.