

ACCESS-CABLE for NWP: *preliminary results from Transpose AMIP experiments*

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Acknowledgement:

CABLE team (in particular: Jhan Srbinovsky, Lauren Stevens technical assistance)

ACCESS/ESM team

CAWCR: Collaboration for Australian Weather and Climate Research

Current work progress & plan: *three-step approach*

1: Offline testing CABLE within JULES interface - global offline experiments (GSWPs): (*done*)

running CABLE offline with JULES-like namelist - this is to make sure no substantial changes are required for being used in the current Surface Analysis system for NWP

2: Setting up Transpose-AMIP experiments for testing GA6-CABLE climate configuration: (*nearly done*)

Running climate model in NWP mode – a quick and cheap way to test the setups, examine its NWP potential and identify issues

3: Real NWP tests: background testing runs starting from global then regional (*to begin*)

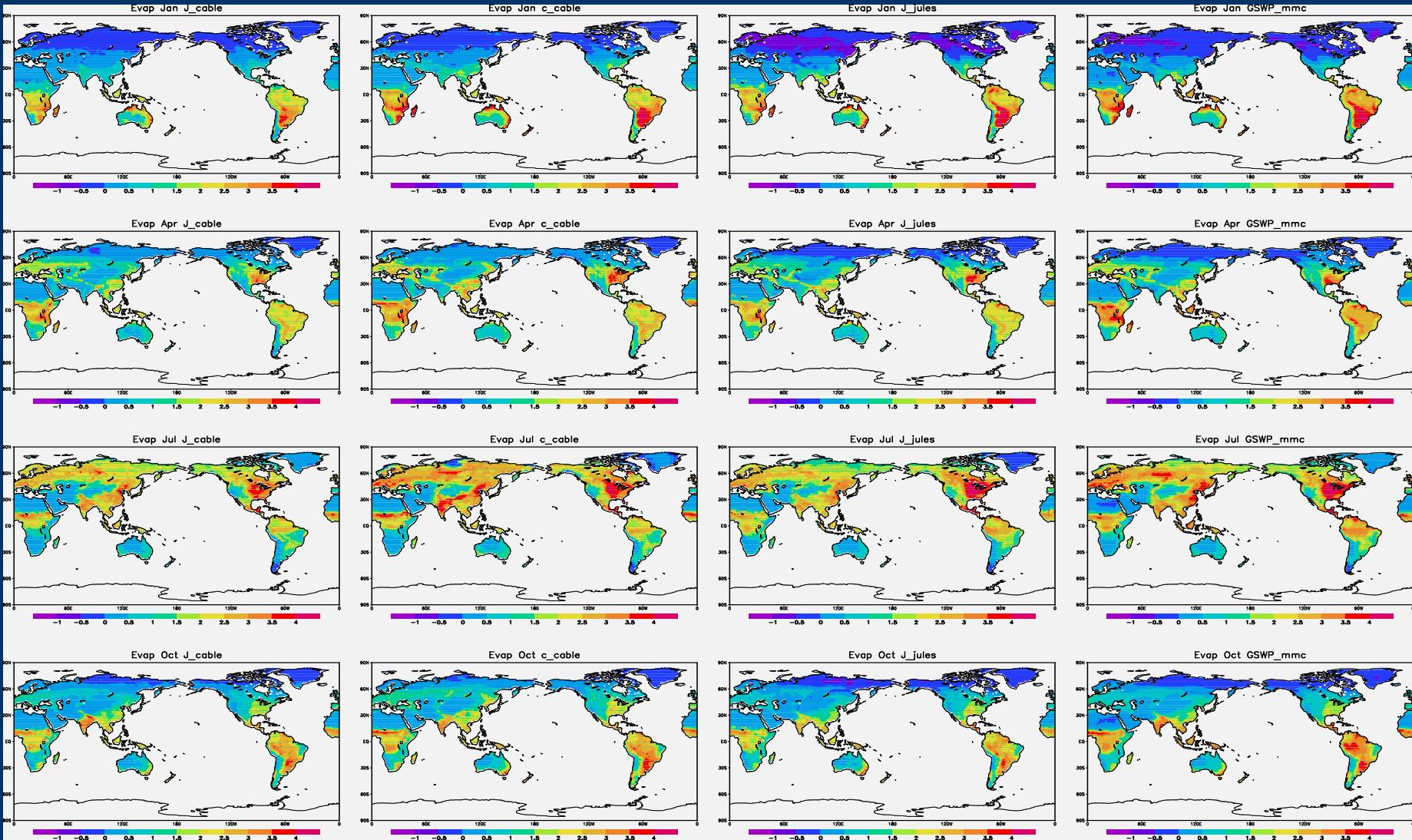
Global Offline Testing: 10-yr GSWP2 climatology of Evaporation

CABLE within JULES

CABLE own

JULES own

Other models (mmc)



Transpose-AMIP (see CAWCR tech reports by Greg Roff)

Standard local setups:

- 5-day NWP hindcasts (16 ensembles) for 15th Oct 2008, Jan/Apr/Jul 2009 (Year of Tropical Convection YOTC);
- Atmospheric initial conditions from the EC analysis for YOTC;
- SSTs prepared from ECMWF for YOTC;
- Land-surface from AMIP climatology

For the CABLE-NWP testing:

1: Standard GA6 N96L85 experiments ([here named as GA6-JULES](#)), with JULES climatology coming from GA6 N96L85 AMIP runs;

2: Testing GA6-CABLE N96L85 using a configuration handled from Jhan Srbinovsky in his GC2 setup ([here temporarily named as GA6-CABLE](#)), with CABLE climatology from its previous ACCESS1.3 (we do not have long AMIP run done yet)

3: Making Transpose-AMIP closer to NWP: super-imposing soil moisture and soil temperature anomalies derived from ERA-interim

A poor-man's simple surface initialisation test to make the TransAMIP experiments more like NWP :

Superimposing normalised anomalies from ERA-interim data for the start time of the TransAMIP runs

$$\frac{\theta^E - \theta_m^E}{\theta_s^E} = \frac{\theta^C - \theta_m^C}{\theta_s^C}$$

Note: superscript **E** for EC land model, **C** for CABLE; subscript **m** for mean and **s** for standard deviation

EC LS four soil layers: 0-7cm; 7-28cm; 28-100cm; 100-289cm

CABLE six soil layers: 0-2.2cm; 2.2-8cm; 8-23.4cm; 23.4-64.3cm; 64.3-172.5cm; 172.5-460cm

Simple vertically mapping according to the depth of the soil layers

Two forecasting cases:

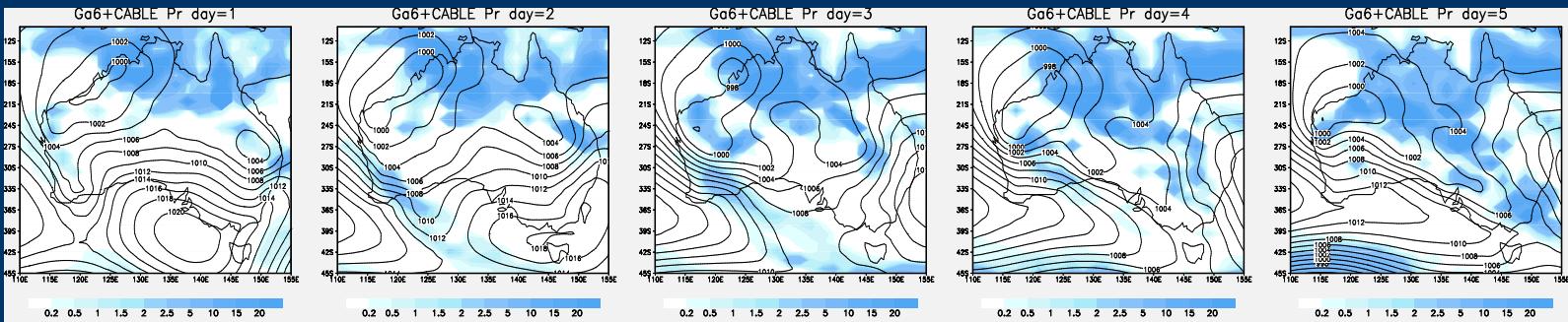
one for summer (2009-01-16 06UTZ) and one for winter (2009-07-16 06UTZ)

Two questions:

- Impacts of different land-surface models in GA6?
Comparing the standard runs using GA6-JULES and "GA6-CABLE"
- Impacts of simple surface initialisation on forecasts?
Comparing different surface initial conditions used in "GA6-CABLE"

CASE 2009-01-16

Fcst day1



day2

day3

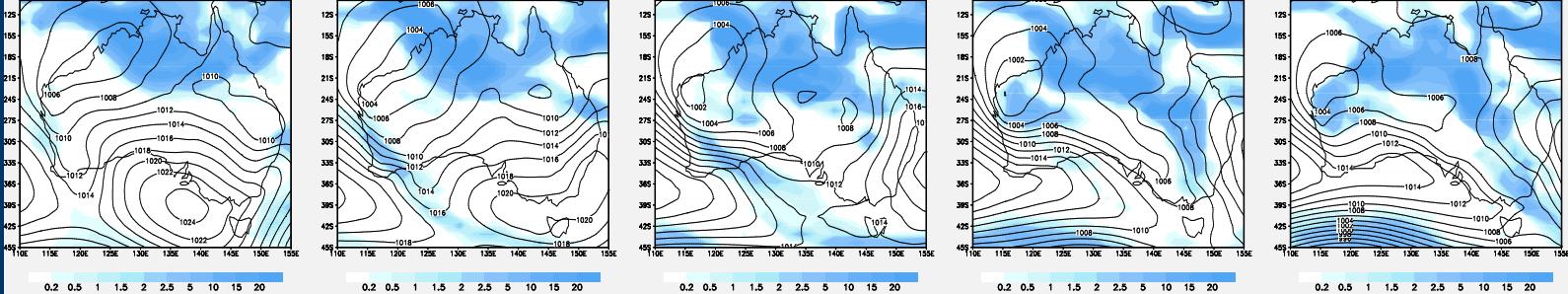
day4

day5

GA6+
CABLE

GA6+
JULES

GA6+JULES day=1



day2

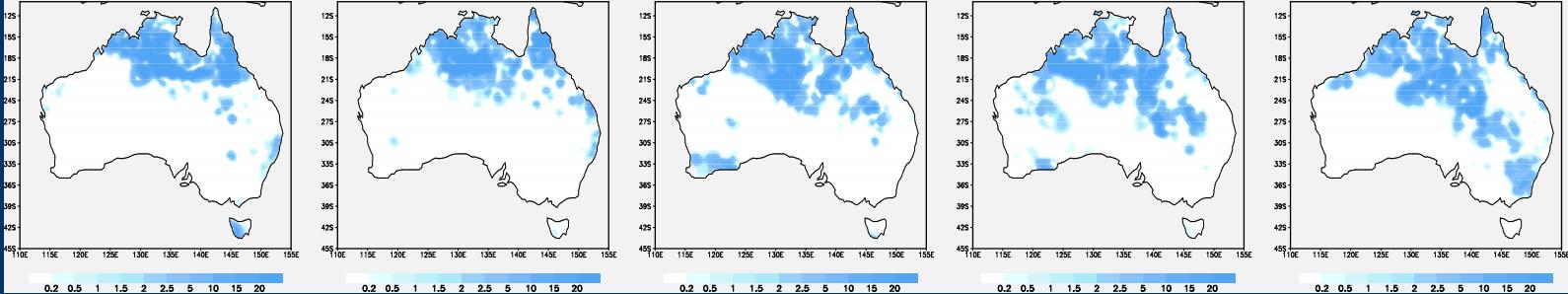
day3

day4

day5

Pr obs

Obs day=1



day2

day3

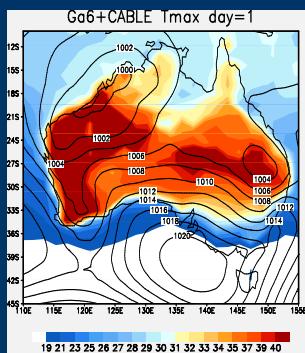
day4

day5

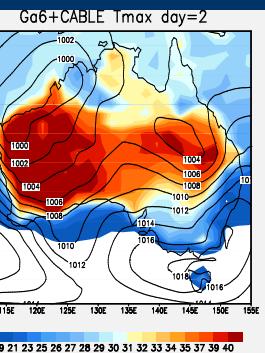
CASE 2009-01-16

GA6+
CABLE

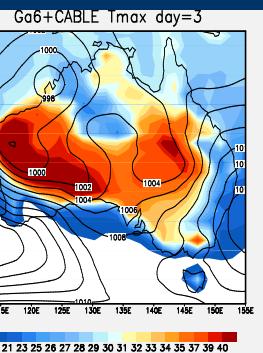
Fcst day1



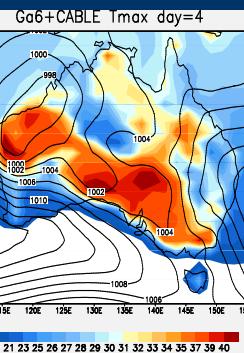
day2



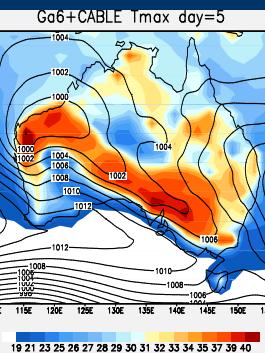
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day4

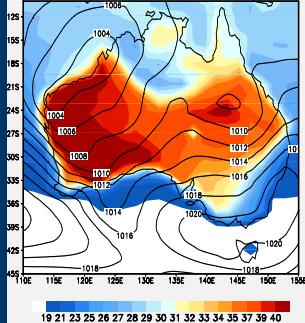


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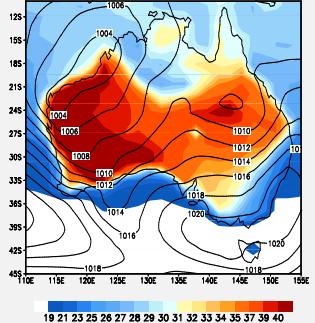


GA6+
JULES

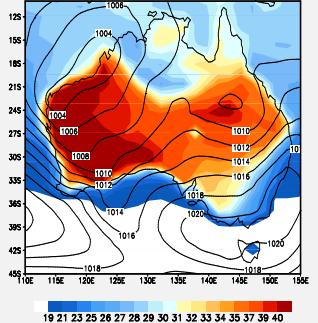
Ga6+JULES Tmax day=1



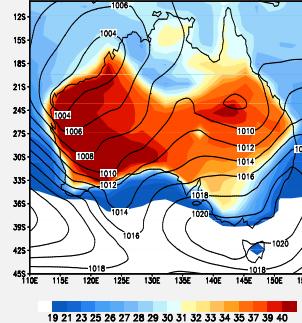
Ga6+JULES Tmax day=2



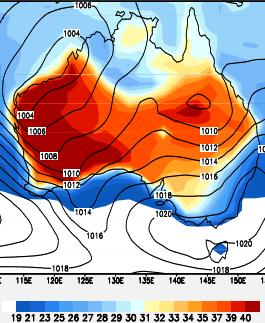
Ga6+JULES Tmax day=3



Ga6+JULES Tmax day=4

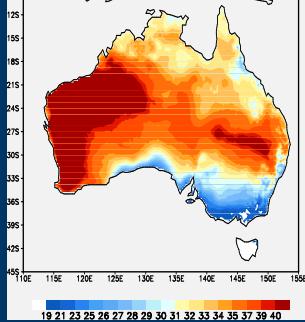


Ga6+JULES Tmax day=5

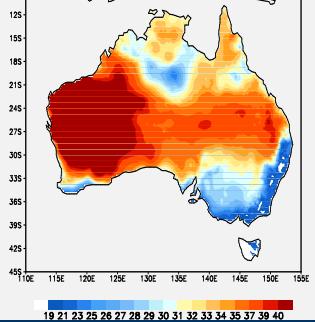


Tmax
obs

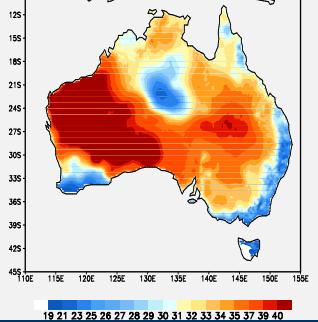
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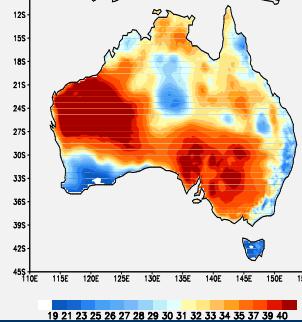
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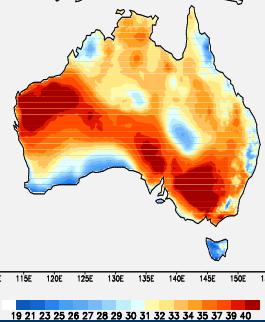
Obs day=3



Obs day=4



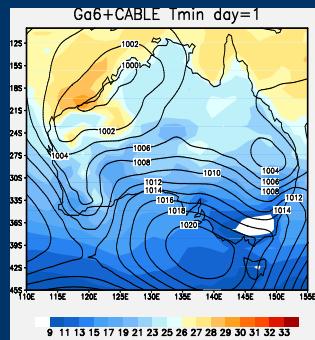
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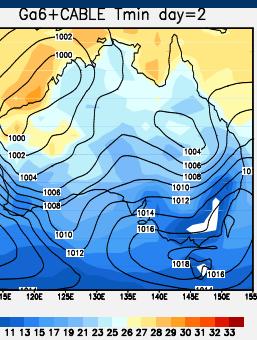
CASE 2009-01-16

GA6+
CABLE

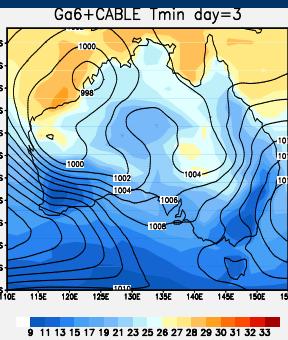
Fcst day1



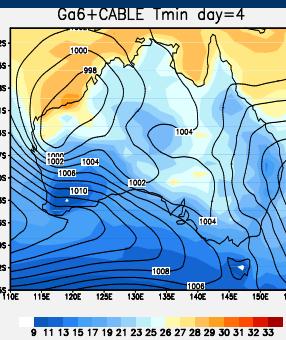
day2



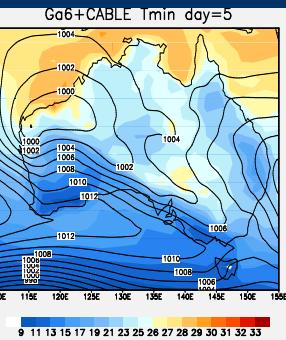
day3



day4

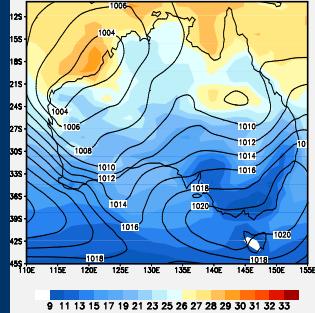


day5

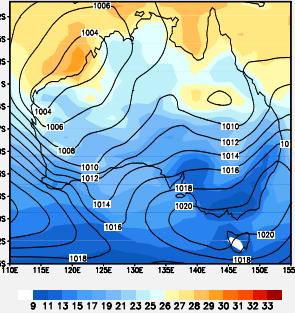


GA6+
JULES

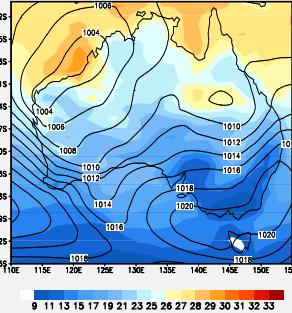
Ga6+JULES Tmin day=1



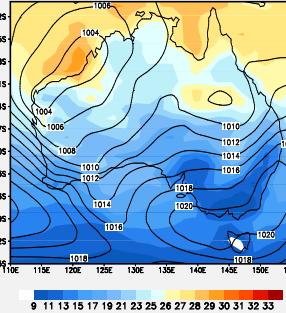
Ga6+JULES Tmin day=2



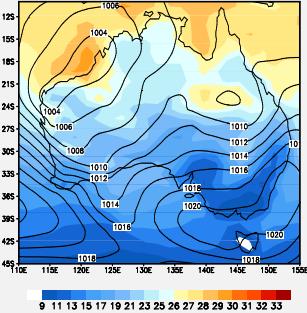
Ga6+JULES Tmin day=3



Ga6+JULES Tmin day=4

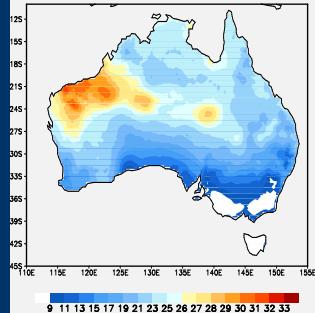


Ga6+JULES Tmin day=5

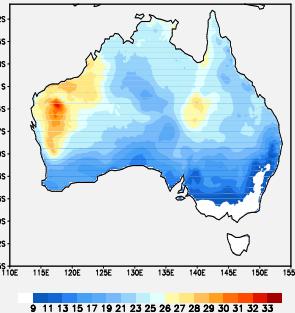


Tmin
obs

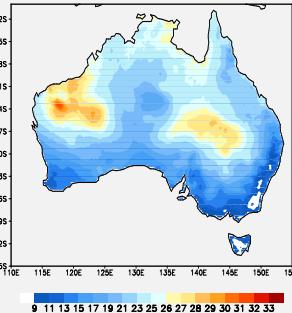
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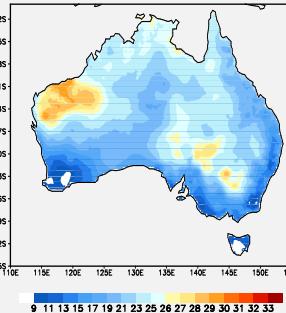
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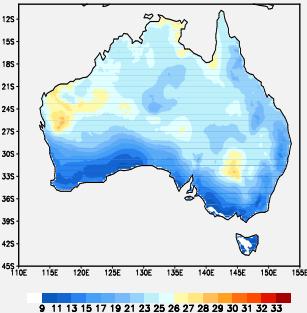
Obs day=3



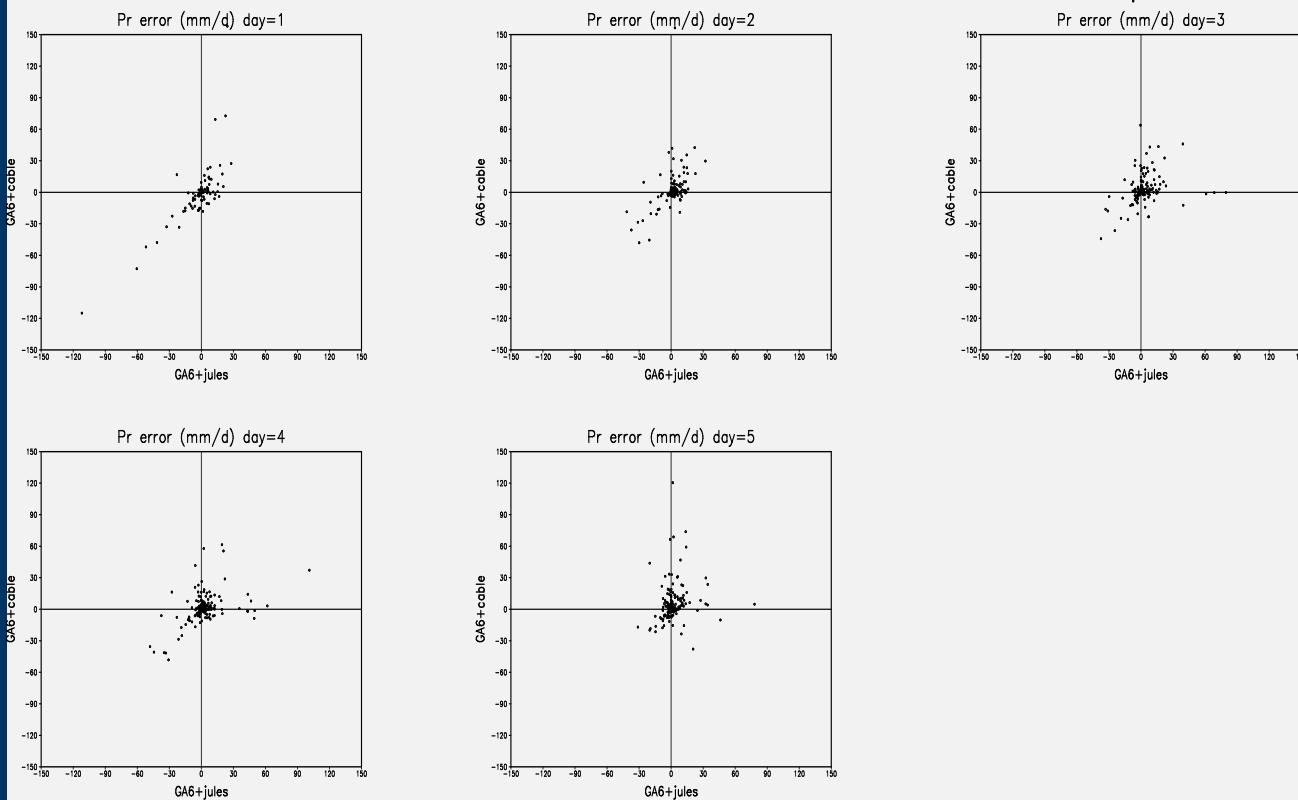
Obs day=4



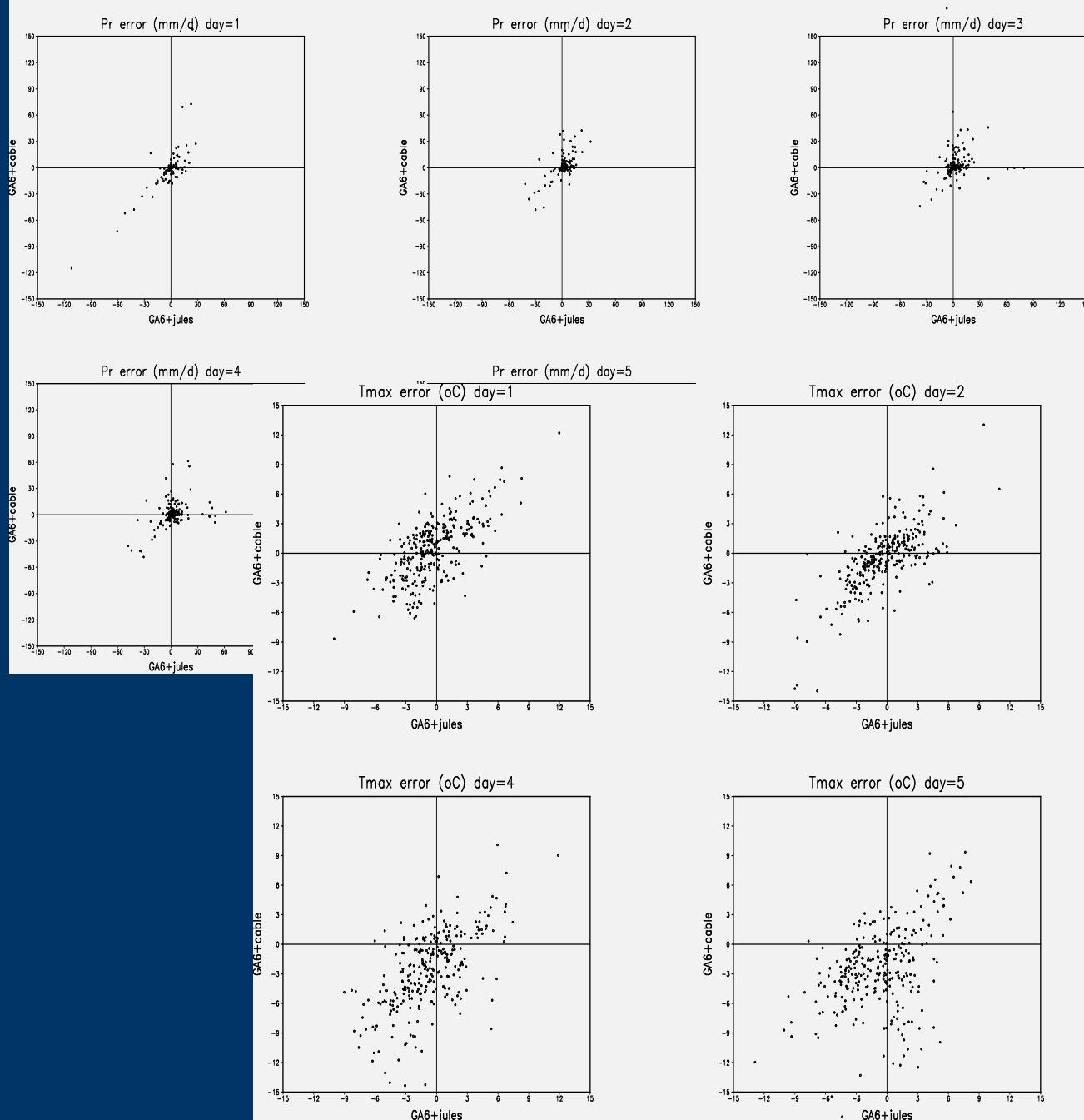
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Pr forecasting error across the Australian domain between GA6+CABLE and GA6+JULES

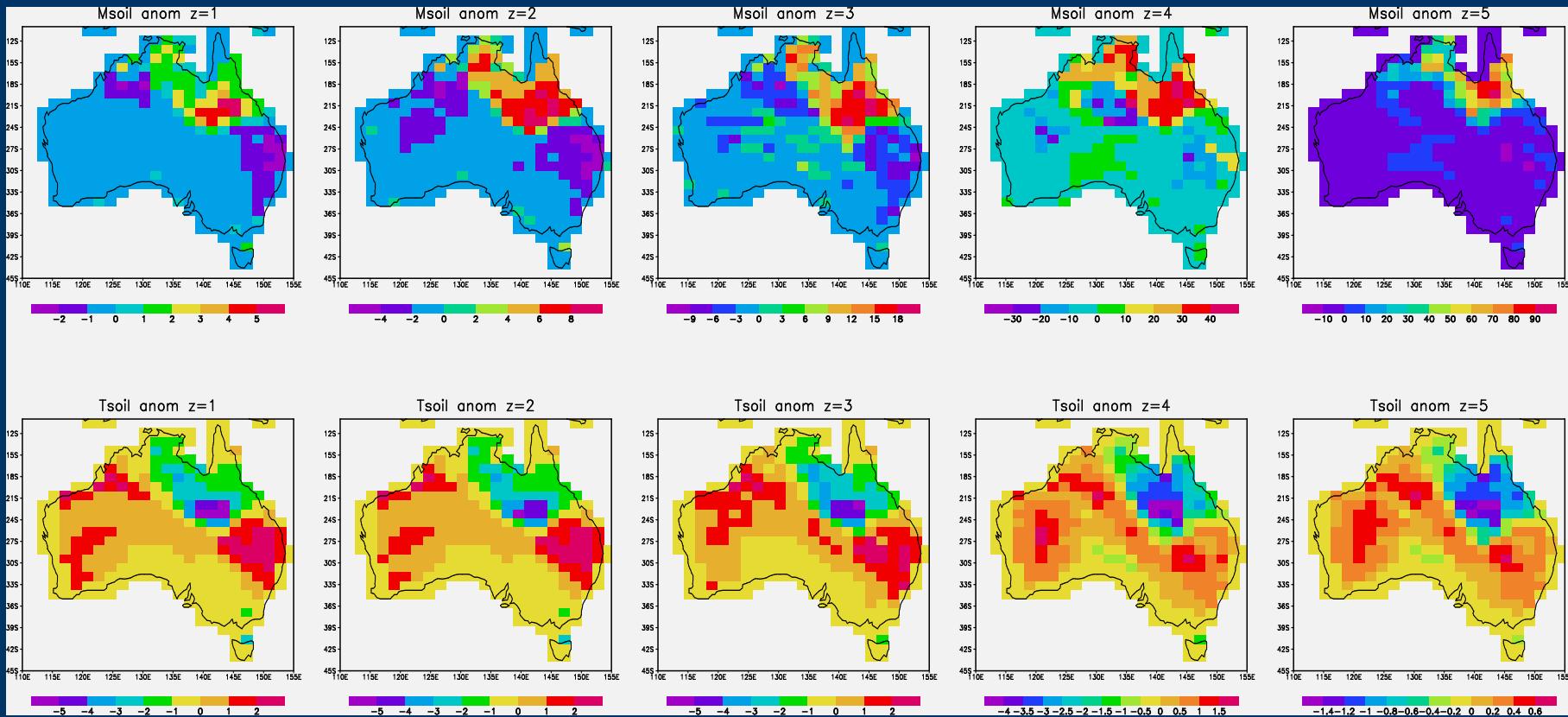


Pr forecasting error across the Australian domain between GA6+CABLE and GA6+JULES

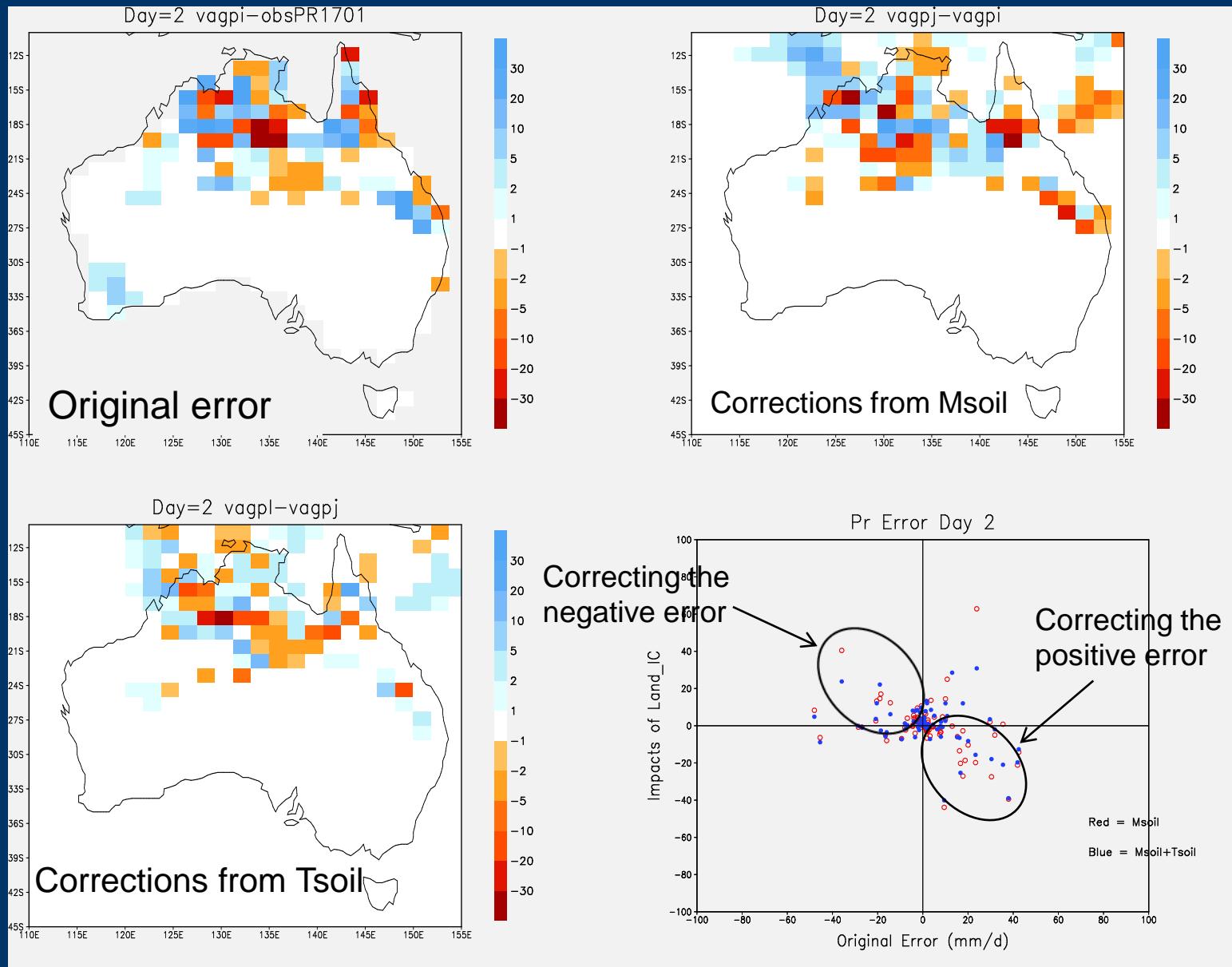


Tmax forecasting error comparison

GA6+CABLE tests: superimposing following anomalies in initial conditions based on Era-interim for 2009-01-16

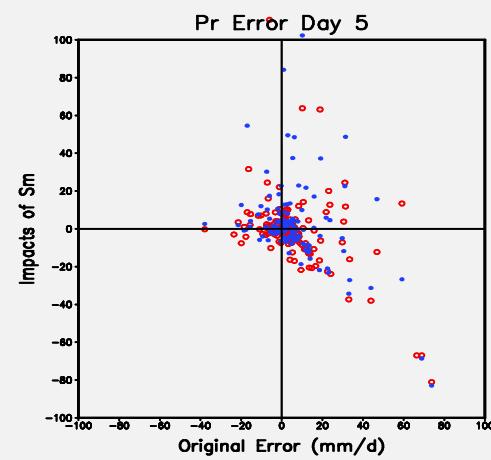
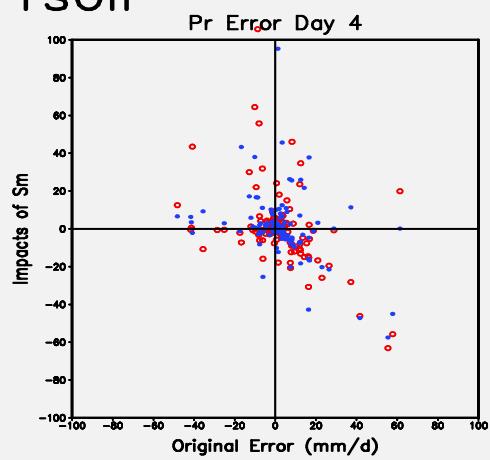
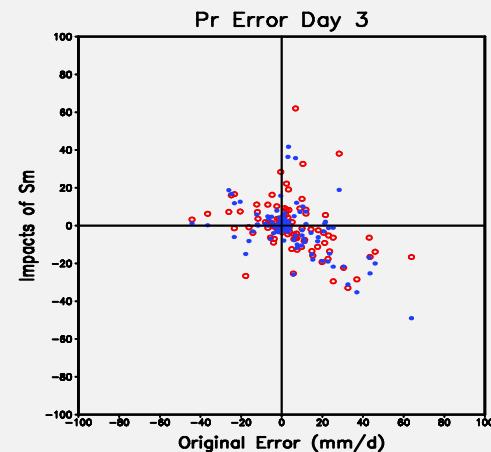
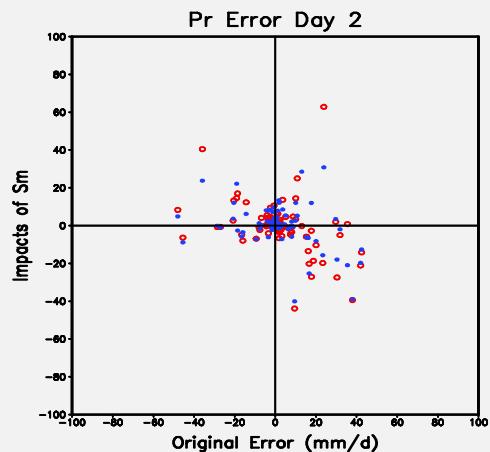


Impacts on Rainfall Forecasts (day 2 as an example)

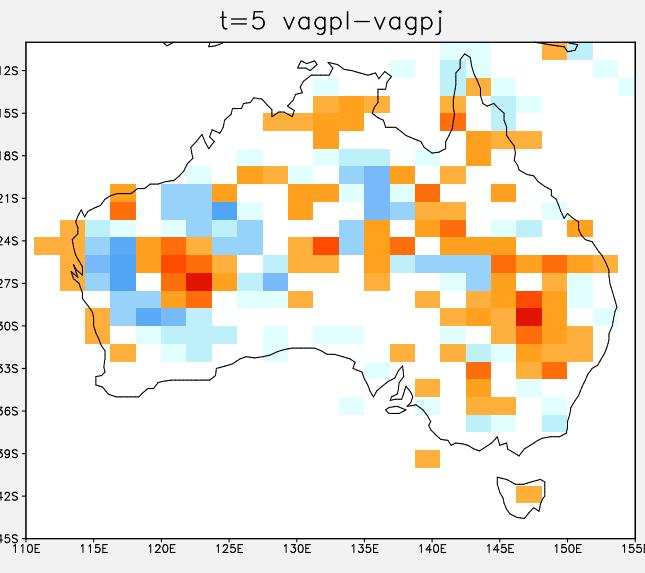
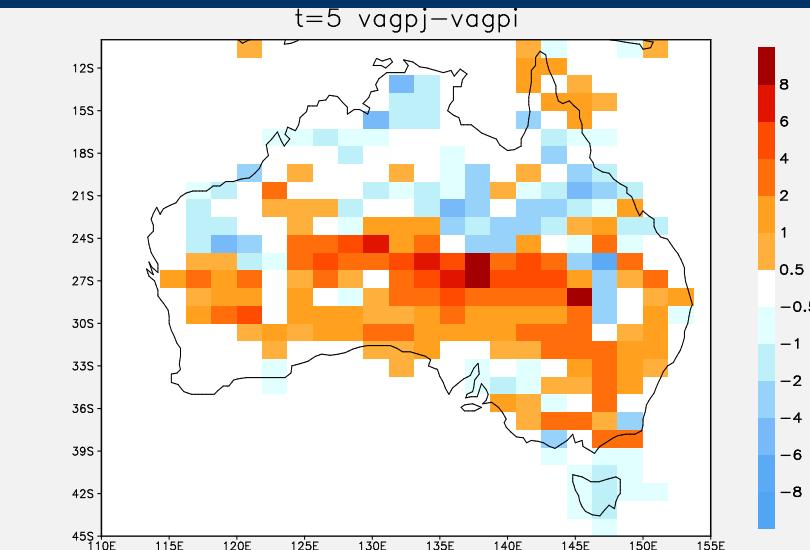
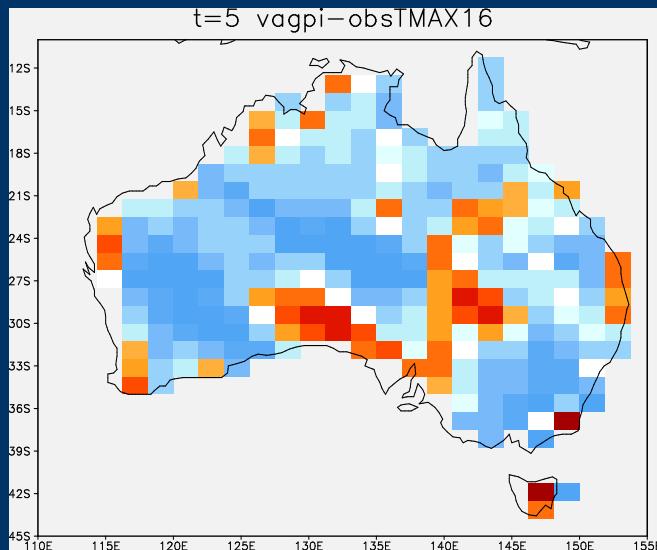


Red = Msoil

Blue = Msoil+Tsoil

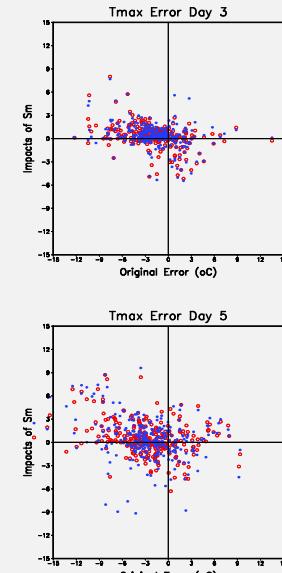
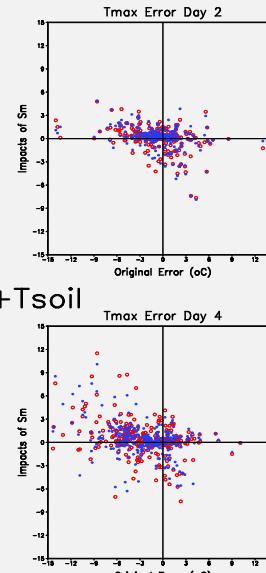


Impacts of initial condition on Tmax



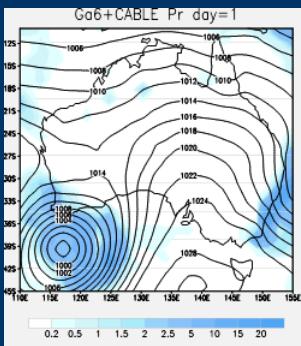
Red = Msoil

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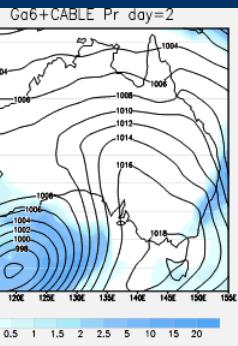


Similar JULES ~ CABLE story for CASE 2009-07-16

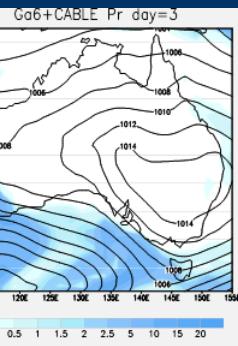
GA6+
CABLE



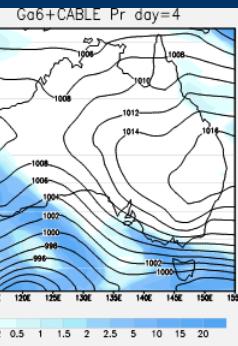
day2



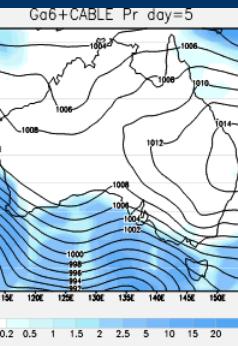
day3



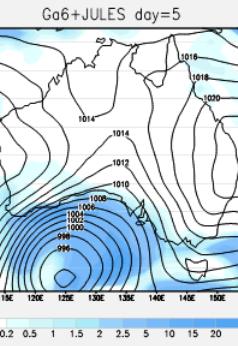
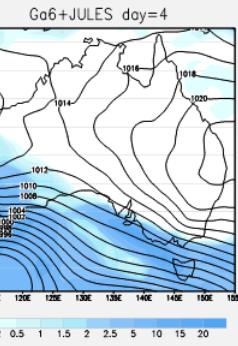
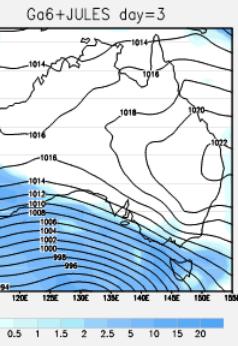
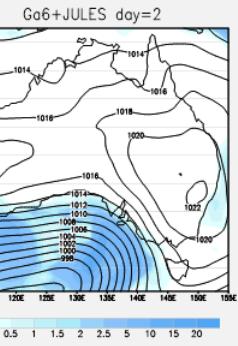
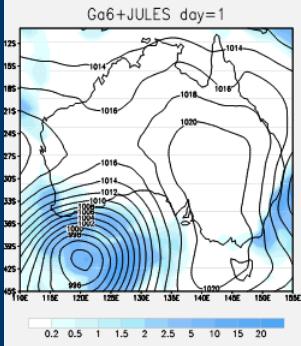
day4



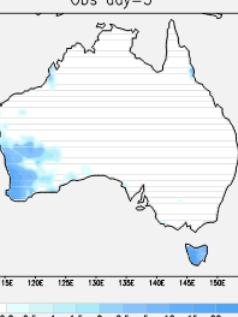
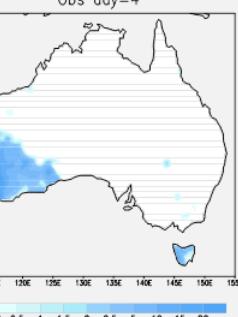
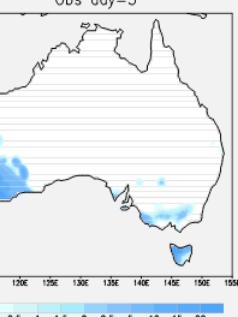
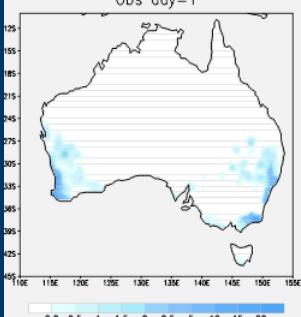
day5

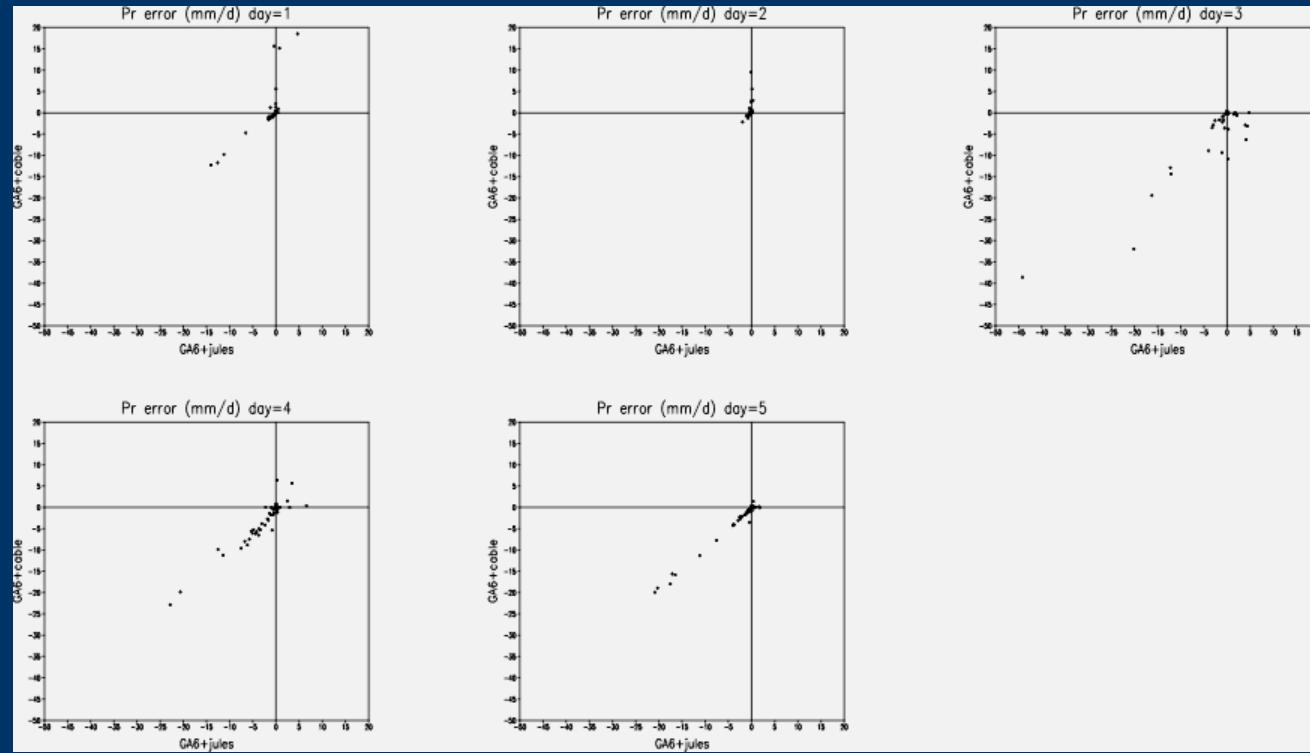


GA6+
JULES



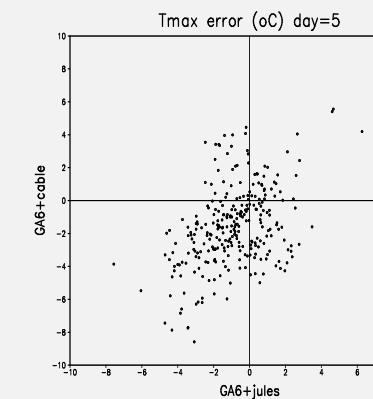
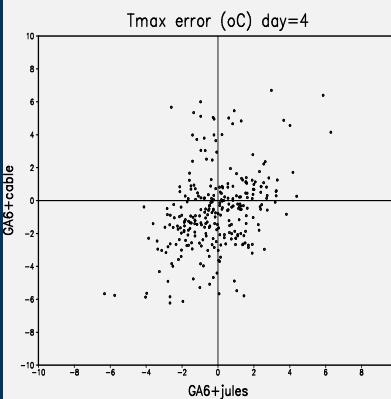
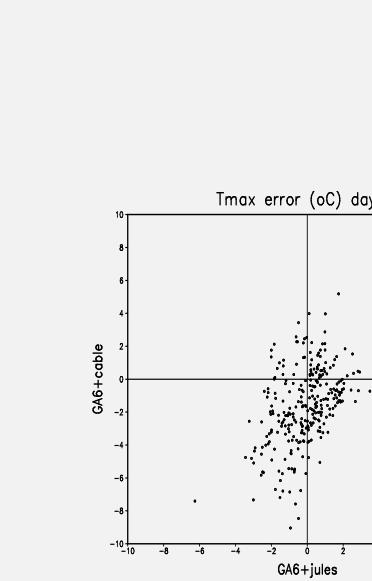
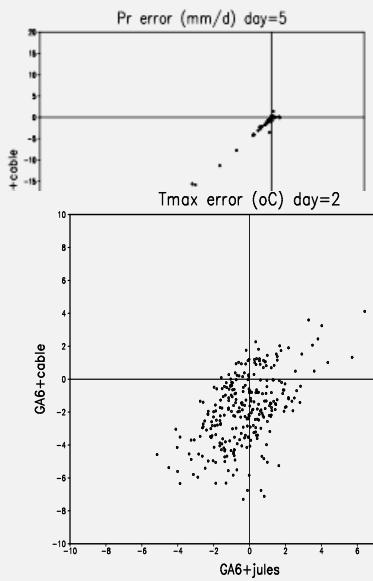
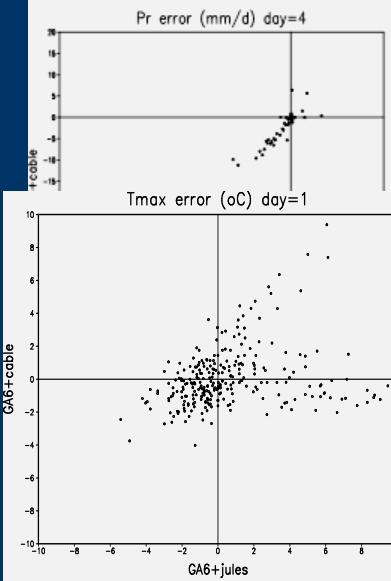
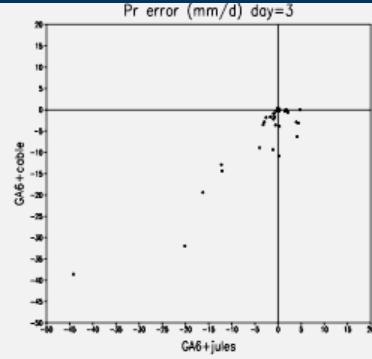
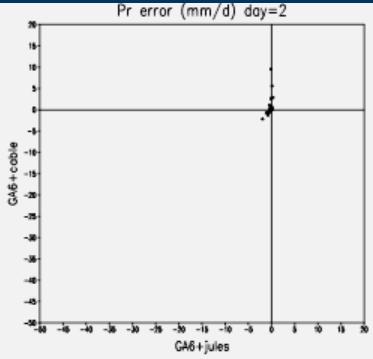
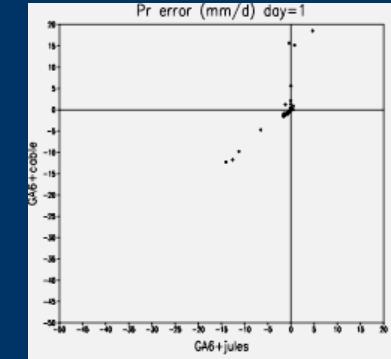
PR obs





Pr forecasting error comparison between
GA6+CABLE and
GA6+JULES

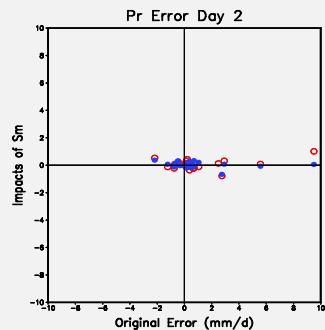
Pr forecasting error comparison between GA6+CABLE and GA6+JULES



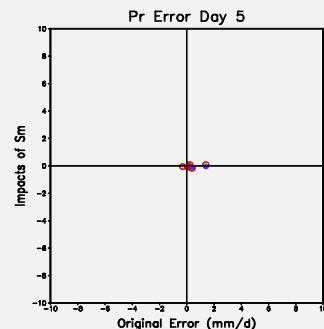
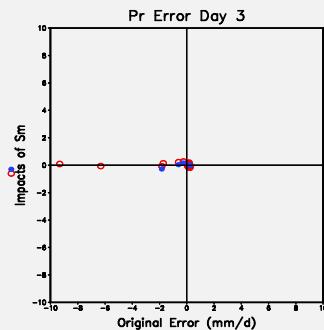
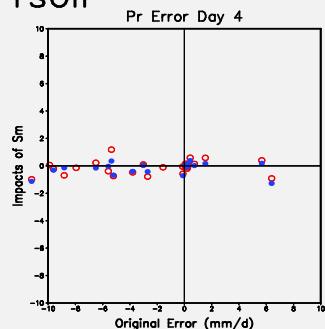
Tmax forecasting error comparison

However less impacts on forecasts from surface IC tests for July case

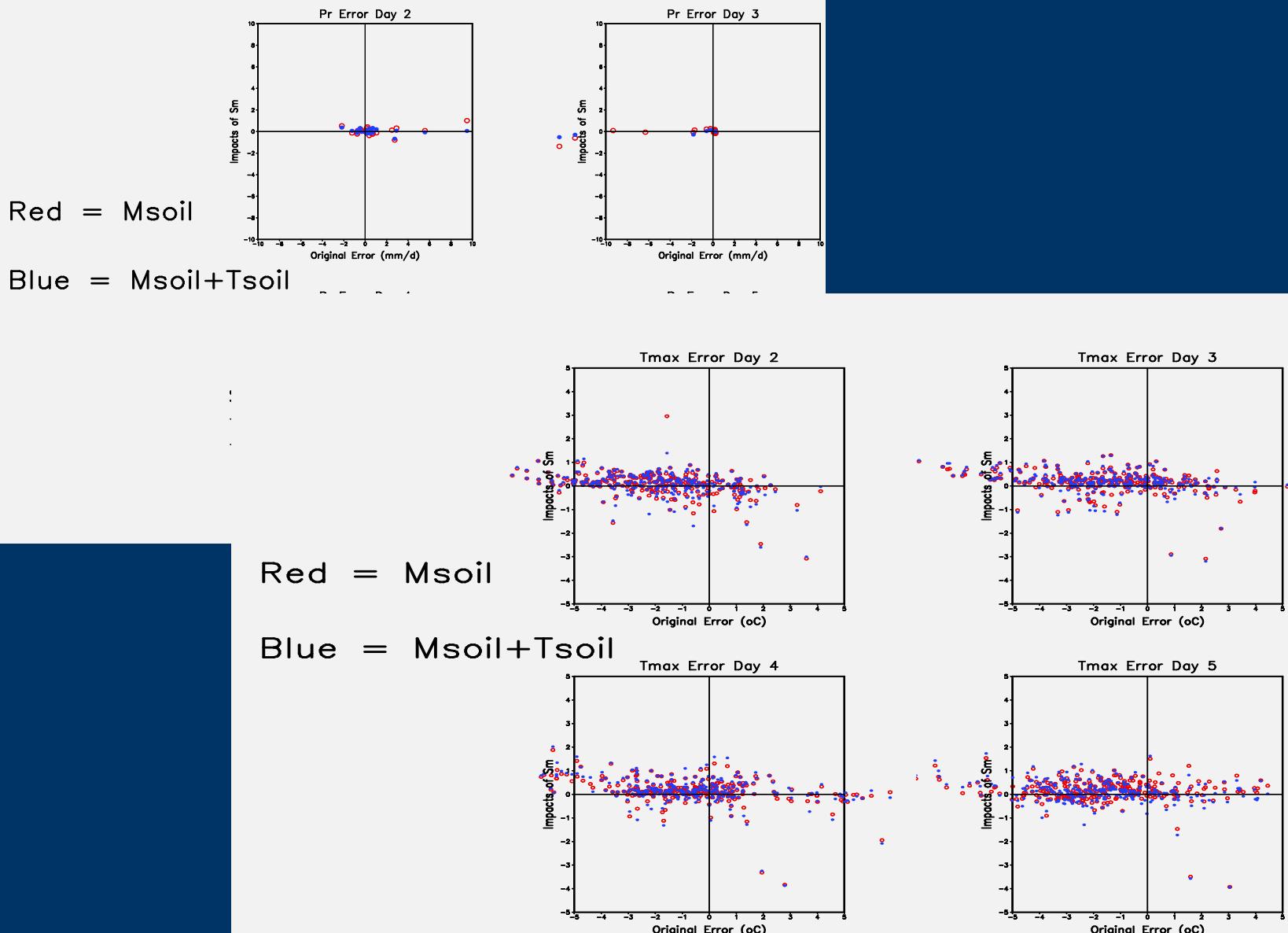
Red = Msoil



Blue = Msoil+Tsoil



However less impacts on forecasts from surface IC tests for July case



Summary

- Transpose-AMIP N96L85 setup developed for future quick testing of GC2 configuration for NWP application - some encouraging results so far: "forecasting" skill is comparable between "GA6+CABLE" with GA6+JULES
- Simple land-surface initialisation setup done - TransAMIP closer to NWP and the tests offered some interesting results: land-air coupling strength varying with seasons???
- Further Trans-AMIP work includes (i) full GA6-CABLE testing when available; (ii) "statistical comparison" with 64 sets of forecasts; (ii) N216 and higher resolution
- More challenging work is testing within real NWP configuration
- We welcome any interest/involvement/collaborations in this area!

At ~1.5km resolution for ACCESS-city, critical components are needed for CABLE itself. They need commitments from the CABLE community.

1. high quality soil/vegetation parameter datasets: impacts of tree height demonstrated such a need;
2. An urban model in CABLE: the impacts of urban parameters on city temperature forecasts demonstrated such a need;
3. A lake model in CABLE: currently forecasting models showed the impacts of unrealistic treatment of lakes;
4. A need for considering lateral water movement in soil column.

Comments: It would be desirable that modules within JULES and CABLE can be exchangeable so one can pick up the best from the two to form an optimized setup.

Background: ACCESS-CABLE for NWP

- An important step to make ACCESS a truly seamless forecasting system from weather, seasonal, climate to climate change;
- Producing realistic "weather" in climate models has become an important part of climate model development and assessment;
- A local model developed with local expertise/knowledge and extensively tested for local environment is a significant plus.