

Uncertainties: Land Surface

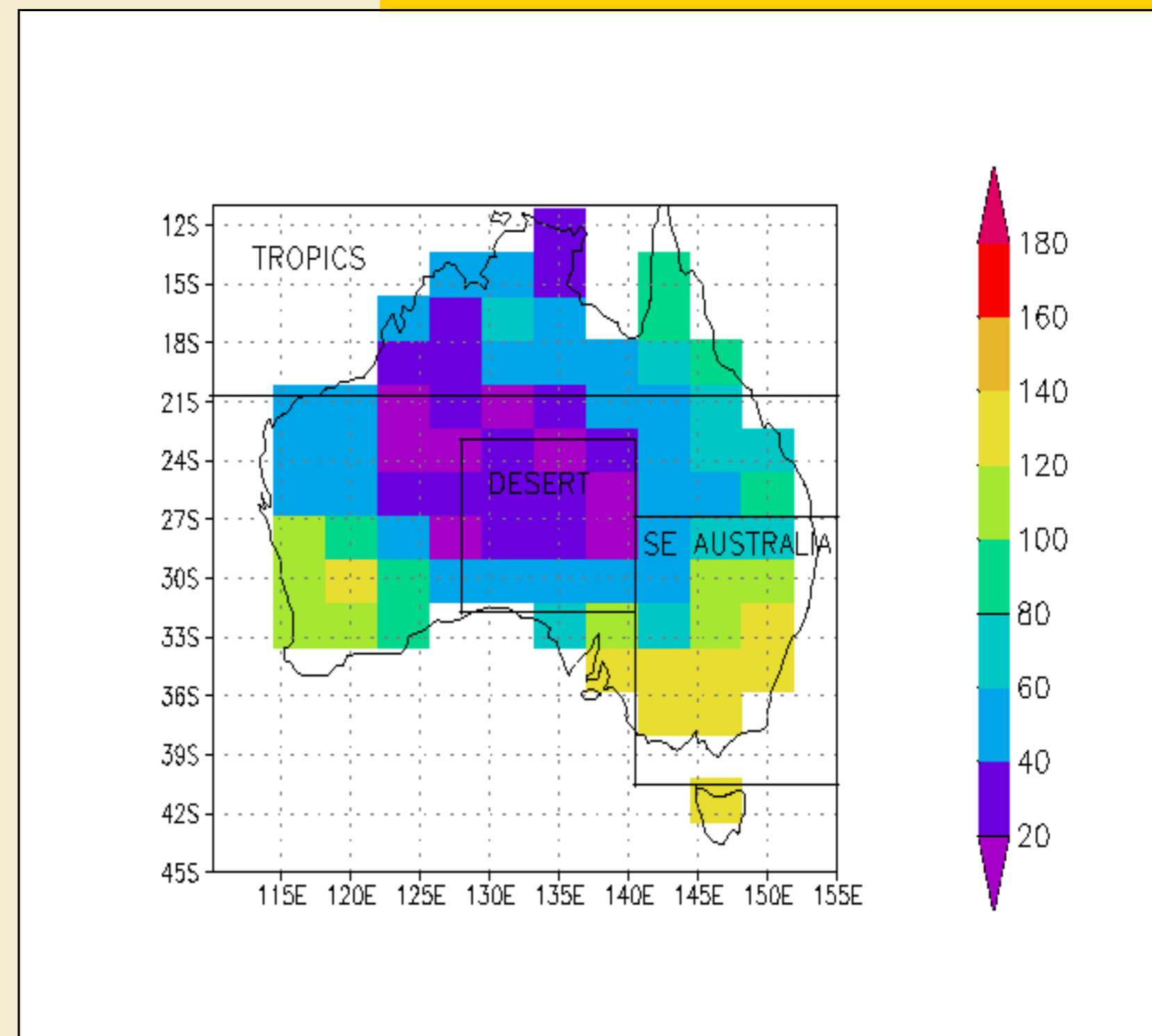
The Land Surface and Climate Change: Uncertainties

Simulation of climate change is subject to many uncertainties. One of these is due to the land surface. As yet there is no “optimum” method of incorporating the land surface into a climate model.

In BMRC we are attempting to understand the uncertainties in climate projections for the Australian Region due to different assumptions about the land surface.

We have run the BMRC climate model in “time-slice” (i.e. SST forced) mode for 1*CO₂ and 2*CO₂ using four different specifications of the water holding capacity of the land surface. (This was part of an experiment conducted under the experimental conditions of a European Union climate change initiative).

Experiment Label	Water Holding Capacity
A	150mm (fixed)
B	Variable - Dunne and Wilott (average is 62mm for Australia)
C	75mm (fixed)
D	600mm (fixed)

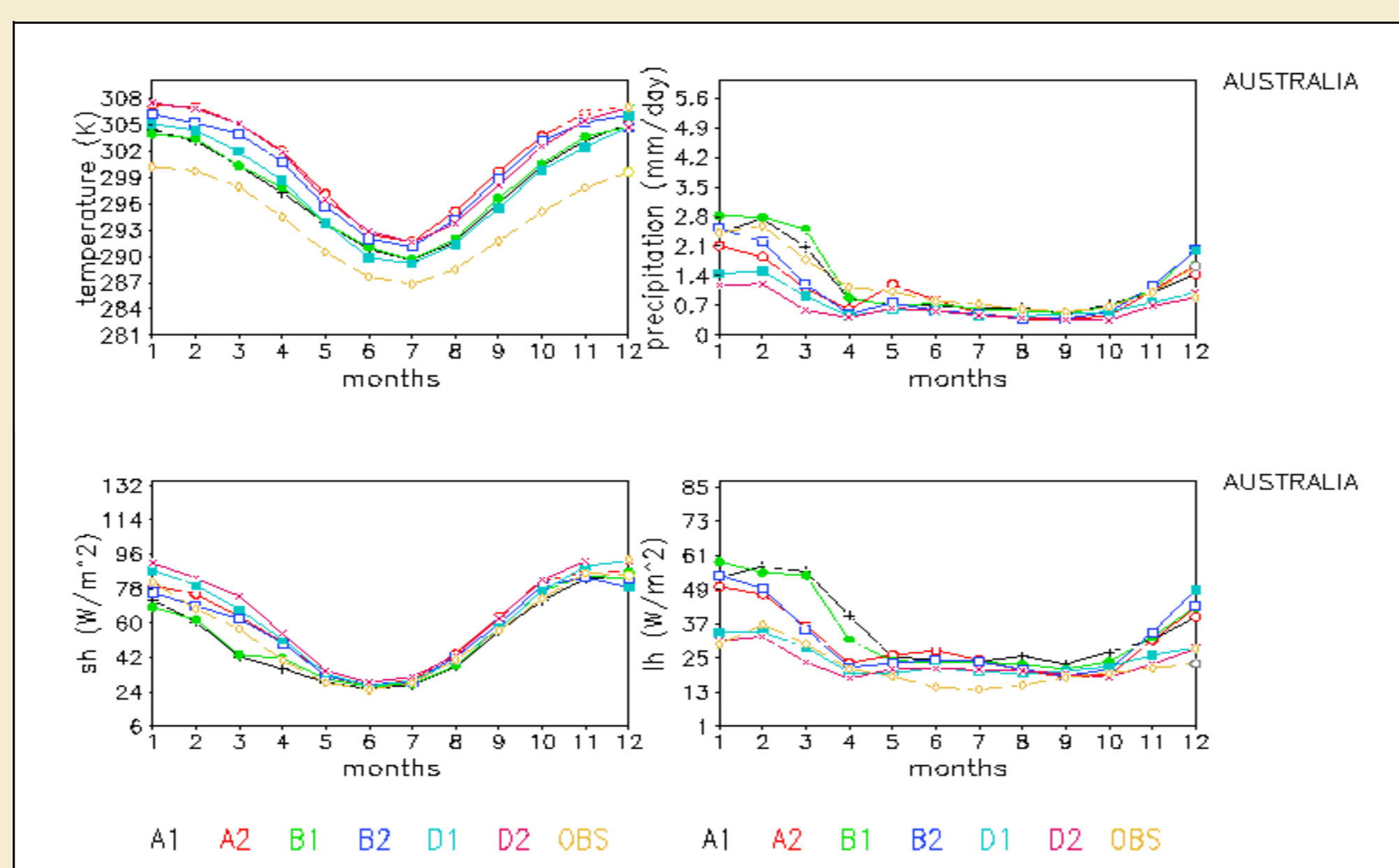
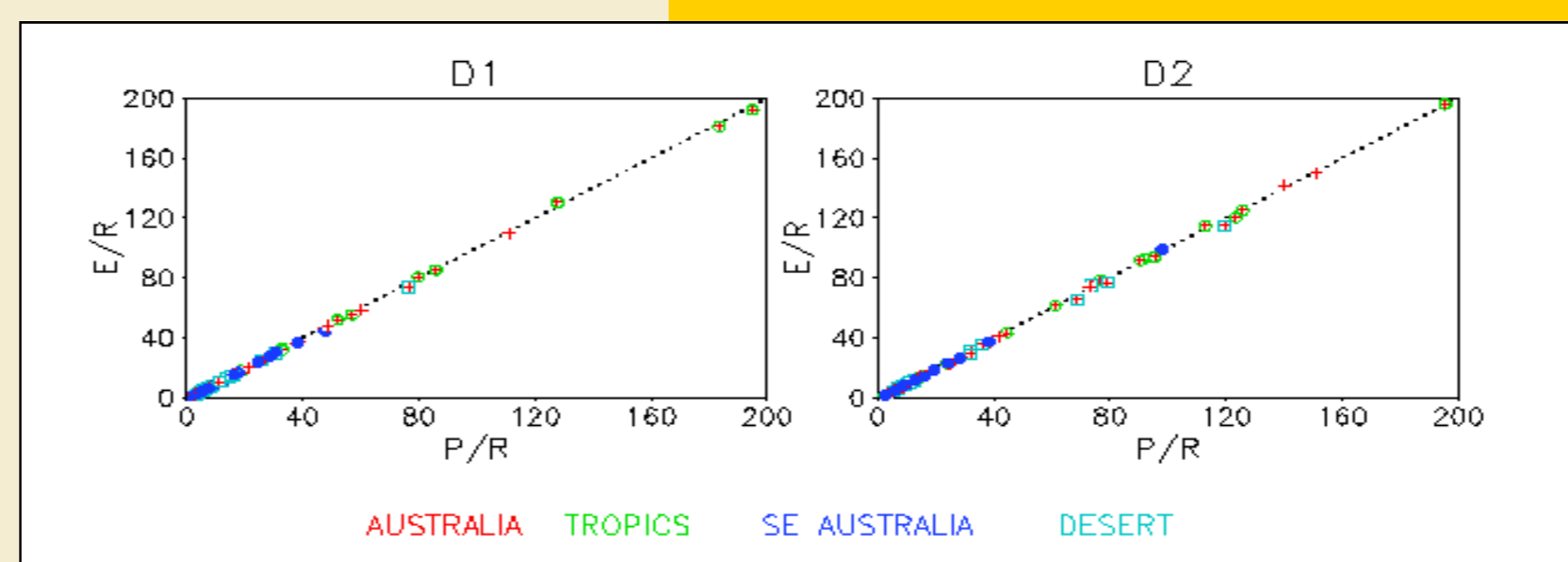


The water holding capacity of the soil as used in Experiment B.

Water Budget

The surface water budget equation (1) is used as a method of checking conservation of water in the model. The straight lines indicate that water is conserved in the model.

$$\frac{1}{R} \frac{dW}{dt} \approx 0 = \frac{P}{R} - \frac{E}{R} - 1 \quad (1)$$



Experimental Results

The differences in precipitation (2 * CO₂ - 1 * CO₂) is shown for each experiment (e.g. A2A1). The results indicate that, except possibly during the Austral summer, the change in precipitation forced by the change in CO₂ is similar to the change due to the land surface.

The differences in surface air temperature results indicate that the warming due to CO₂ increases is much larger than any change due to the land surface; it is noteworthy that the *actual* CO₂ induced change in temperature is quite sensitive to the specification of the land surface.

Comparison with Observations

The surface air temperature averaged over all of Australia is plotted for each experiment and for each month of the year. The model is seen to be too warm compared to the observations (this has now been diagnosed as due to a too large amount of low cloud which has reduced the short wave radiation of the surface).

The precipitation averaged over all of Australia is plotted for each experiment and for each month of the year. The model agrees with observations quite well.

Seasonal variation in sensible heat fluxes in each model experiment. The agreement with observation is quite good.

