Projections of water demand using NARCLiM

Building on work funded by Sydney Water, UNSW has now used NARCLiM simulations to examine changes in water demand through to 2020-2040. This uses our stochastic weather generator, but feeds simulated pseudo-weather sourced from the NARCLiM simulations. This provides an ensemble of projections for water demand due to the use by NARCLiM of four global climate models, each downscaled with three varieties of the Weather Research Forecasting (WRF) model. The NARCLiM data used is identical to that provided by NSW OEH and thus the following is consistent with those products being used widely over NSW.

Figure 1a shows the forecast consumption using NARCLiM for 1990-2010. Each bar provides the median and range in estimated consumption from 100 weather scenarios. This can be compared to estimated consumption over 2020-2040 (Figure 1b) assuming no change in population – the change from Figure 1a to 1b only reflects the impact of changes in the weather associated with a change in climate.

Figure 1b reflects an increase in consumption (2020-2040) of typically 0-2% relative to 1990-2010. The change in consumption is insensitive to the ensemble member (R1, R2, R3) but is sensitive to the choice of climate model used to provide the forcing boundary conditions for the WRF downscaling. At the lowest, and focused on the median, MIROC forecasts increasing demand of 0.23-0.45%. At the highest, ECHAM forecasts increasing demand of 1.88-1.99%. Note, CCCMA forecasts a range which includes both the highest and the lowest estimates and might therefore be a good choice of model if choosing one for future purposes.

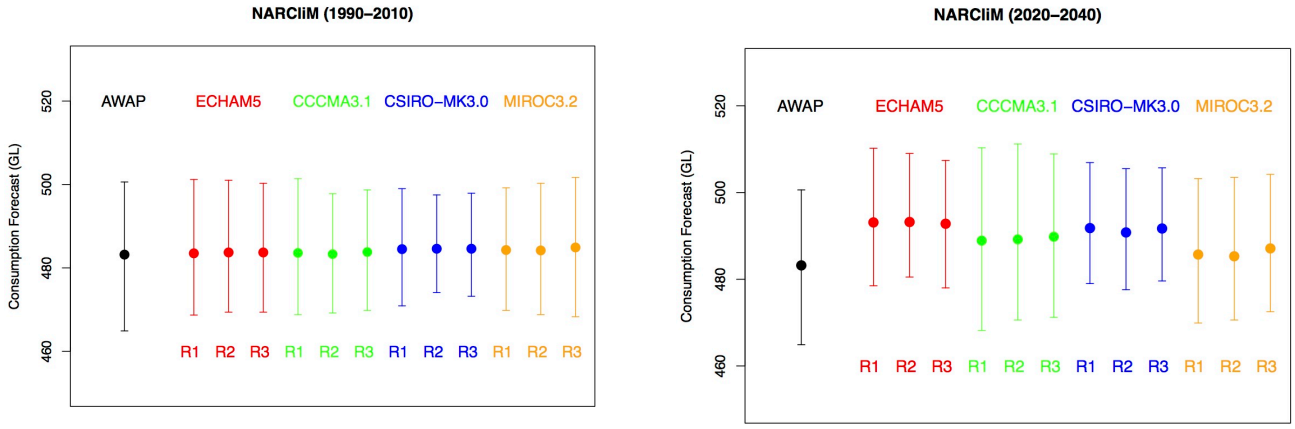

Figure 1. Water consumption forecast for (a) 1990-2010 (left) and (b) 2020-2040) right.

We can isolate the impact of changing extremes on forecast consumption. Figure 2a shows the relationship between number of days over 30^{o}C and consumption. The red dots (1990-2010) are all below any dot for 2020-2040 (blue dots). This

is caused by increasing frequency of days over 30°C which is a projection consistent with many previous studies. Figure 2b shows the change in the number of days with more than 2mm of rainfall. Here the impact is less obvious with some models forecasting little change, and others suggested a slight decrease. Again, this is consistent with previous studies that changes in rainfall are less certain than changes in rainfall.

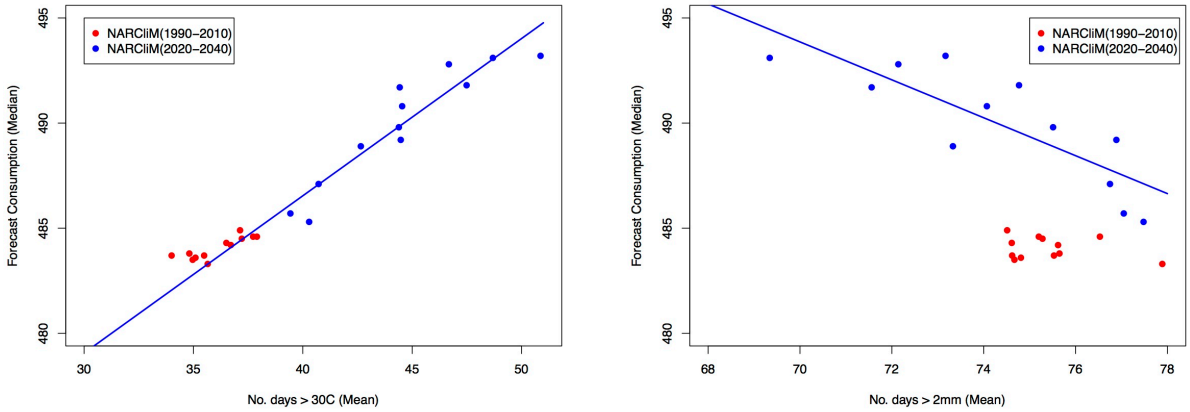

Figure 2. Water consumption forecast for depending on number of days over 30C (left) and (b) on number of days with over 2mm of rainfall right. Red dots are for 1990-2010, blue dots are for 2030-2040.

We are currently extending this analysis to include the NARCLiM 2070-90 period. This might be relatively straightforward, but it is also possible that the changes by 2070-90 move the climate to a state that is poorly captured by the existing weather generator. This would require significant additional work.