NARCLIM: Exploring new observational data-sets to validate regional climate simulations. An example with radio-soundings

L. Fita[1], S. Liles[1], D. Argüeso[1], and J. P. Evans[1]

[1]Climate Change Research Centre - ARC Center of Excellence for Climate System Science, UNSW, Sydney, Australia

l.fitaborrell@unsw.edu.au

INTRODUCTION

NARCliM (NSW/ACT Regional Climate Modelling project) is a regional climate modeling project for the Australian area. It will provide a comprehensive dynamically downscaled climate dataset for the CORDEX-AustralAsia region at 50km, and South-East Australia at a resolution of 10km. NARCliM data will be used by the NSW and ACT governments to design their climate change adaptation plans.

EXPERIMENTAL SETUP

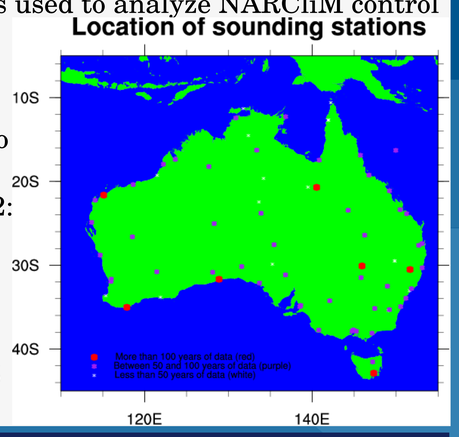
NARCliM uses WRFv3.3 regional climate model (RCM) to perform an ensemble with 12 members for the present and the projected future climate.

* 3 WRF model configurations
* 4 different GCMs: MIROC, ECHAM5, CCMA, CSIRO mk3.5
* 3 periods: 1990-2009, 2020-2039, 2060-2079
* 2 domains: Australia (CORDEX AUS-44, 50 km), SE Australia (10 km)

Additional to the GCM-driven simulations, 3 control run simulations driven by the NCEP/NCAR reanalysis for the entire period of 1950-2009 have also been performed.

BoM sounding data

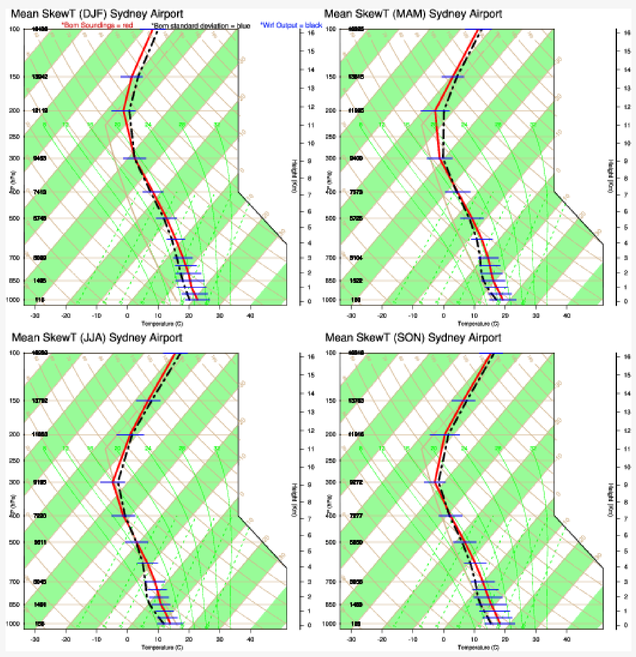
* Bureau of Meteorology historical sounding data of entire Australia is used to analyze NARCliM control period runs
* First results for Sydney sounding data (from 1980 to 1999) used to validate 1 run (R2: MYJ/ETA, BMJ, WDM5, Dudhia/RRTM)
* Soundings are interpolated to 15 vertical levels



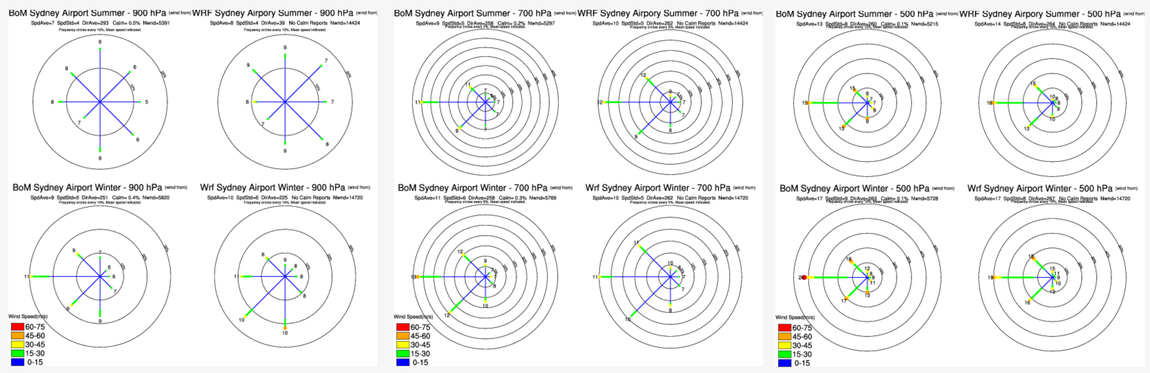
CONTROL period preliminary results. Validation with BoM sounding data

Mean sounding

* Better agreement in mid troposphere
* Underestimation at low levels
* Overestimation at upper levels
* Stronger differences in Winter
* Stronger residual well mixed layer (850 to 600 hPa) in WRF simulations (Autumn, Winter)
* Similar height of tropopause



Wind roses at 900, 700, 500 hPa



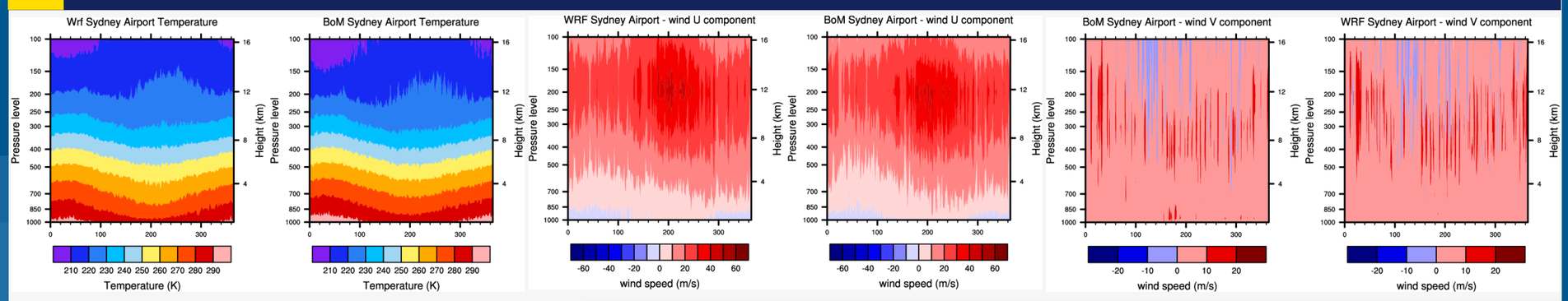
* Climatological wind directions are well represented by WRF
* Mixture of results for wind strengths at all levels
* Worse representation at 900 hPa

CONCLUSIONS & FURTHER WORK

* WRF captures pretty well the climatologies of the analyzed variables in Sydney
* A mixture of underestimation and over estimation with a dependence on the vertical level
* The worst results are close to the surface
* WRF presents more deficiencies in Winter

* On going experiment. We will analyze all 3 NARCliM control period simulations using all the available BoM soundings data
* Quality of the results encourage us to analyze different sounding-related indices like: CAPE, LCL, thermal inversion, wind shear and vertical water column content
* More information:
  http://www.ccrc.unsw.edu.au/NARCliM/

Temporal evolution of vertical structure



* Good temporal agreement between WRF and BoM
* Small underestimation of vertical thermal gradient at low levels (up to 500 hPa)
* Light underestimation of wind strengths

ACKNOWLEDGMENTS

NARCliM is funded through a consortium of project partners including NSW Office of Environment and Heritage (OEH), ACT Environment and Sustainable Development Directorate, Sydney Water, Sydney Catchment Authority, Hunter Water, NSW Department of Transport, NSW Department of Primary Industry, NSW Office of Water. This research was undertaken with the assistance of resources provided at the 'NCI National Facility' through the National Computational Merit Allocation Scheme supported by the Australian Government. S. Liles thanks ARC Centre of Excellence for Climate System Science undergraduate summer scholarship @ UNSW. Bureau of Meteorology is also acknowledge as the providers of the data.

NARCliM

NSW | ACT Regional Climate Modelling project