Precipitation bias correction of very high resolution regional models

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AMOS National Conference 2013
11-13 February 2013, Melbourne
Why bias correcting?

Impact studies require realistic values

Mean Seasonal precip. (1990-2009)

- ObsDJF
- MAM
- JJA
- SON

- RCM DJF
- MAM
- JJA
- SON

mm/month

0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160
Why bias correcting?

Contribution to total precipitation by events

- OBS
- RCM

REG1
Current methods

• Several papers on bias correction methods

• Based on a multiplicative factor to adjust intensity
• Different complexity: adjust different orders of distribution
• Generally using gridded observational datasets
• Common assumption:
  RCM more rain events than obs.
Assumption: number of rain days

Example of a 10-km WRF simulation over Sydney and AWAP (~ 5km)

Annual mean of rain days: 1990-2009

No. days/year

10   30   50   70   90   110  130  150  170

AWAP5km

WRF10km
Assumption: number of rain days

Example of 2-km WRF simulations over Sydney

annual mean of rain days: 1990-2009

no. days/year

10 30 50 70 90 110 130 150 170
Assumption: number of rain days

Different spatial scales in different datasets (the “drizzle effect”)

Annual mean of rain days: 1990-2009

Different spatial resolutions:
- WRF2km
- AWAP5km
- WRF10km
Assumption: number of rain days

Example of BoM stations over Sydney

annual mean of rain days: 1990-2009

no. days/year

10 30 50 70 90 110 130 150 170
Correcting towards stations

Two main problems:
1) Spatial and temporal coverage issues
2) Grid cells and stations represent different scales

Solution: Adapt an existing method ($\gamma$-distribution adjustment, Piani et al. 2010) using several stations.

γ-distribution adjustment

Situation with stations
γ-distribution adjustment

Using 5 closest stations
γ-distribution adjustment

Further penalising by region
Y-distribution adjustment

Regions and stations in Sydney area
Results

Comparison WRF 2km with BoM stations

Bias in mean seasonal precipitation (mm/month)

WRF 2km Original

WRF 2km Bias-corrected

- < -75
- -75 to -50
- -50 to -25
- -25 to -10
- -10 to 0
- 0 to 10
- 10 to 20
- 20 to 50
- 50 to 75
- > 75
Results

Comparison WRF 2km with AWAP (~ 5km)
Results

Comparison WRF 2km with BoM stations and AWAP
Conclusions

Need for bias correction
Impact studies require realistic values. RCMs are of great value but often diverge from obs.

The number of rain days
Bias correction method assume that RCMs generate more rain days than obs. This is not true as resolution increases.

Method adapted to high-res
Using stations instead of gridded datasets. Weighting and regionalising several stations.
Conclusions

Significant improvement at seasonal timescales

With respect both stations and AWAP gridded dataset, the bias-corrected output compares much better.

Also improvement in the precip. distribution

The bias correction method produces more realistic precipitation distribution at daily timescales.