ACCESS sensitivity to horizontal resolution over Darwin

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• CPOL: C-band polarimetric radar located at Gun Point (12.25°S-131.04°E, about 20 km northeast of Darwin). It performs a volumetric scan every 10min within a 150 km radius. Rain rate is estimated using a multi-parameter rainfall algorithm (Bringi et al 2001, 2004) on a 2.5 km horizontal resolution.

• ACCESS forecast model
• ACCESS forecast model: Australian Community Climate and Earth System Simulator. The rainfall is derived from the convective and large-scale area cloud fractions of the model (except for the cloud permitting high resolution 1.5 km).
  • ACCESS-G: global model at 40 km horizontal resolution
  • ACCESS-R: regional model at 12km
  • ACCESS-C (DN): 4 km, for Darwin
  • ACCESS-C2: 1.5 km, convection permitted (rainfall derived from large-scale area cloud fractions only)
Mean daily rainfall

4 km
Convection parameterised

1.5 km
Convection permitted

Land-sea contrast error due to the convective parameterisation: too much rains over sea, not enough over land.

Rainfall pattern more realistic but too strong especially over land.
Rainfall intensity and frequency

Compensation between underestimates rainfall intensity and overestimated rainfall frequency

This compensation is more marked over the sea.
Total amount of rainfall overestimated in all simulations. Diurnal peak occurs too early in the "convection parameterised" resolutions of the model. Correct timing of the diurnal peak only in the "convection permitted" resolution of the model.
Light rain frequency or occurrence

4 km
Convection parameterised

Land-sea contrast error due to the convective parameterisation: overestimated more over land than over sea

1.5 km
Convection permitted

Rainfall pattern more realistic but overestimated over sea
Intermediate rain frequency of occurrence

4 km
Convection parameterised

Land-sea contrast error due to the convective parameterisation: underestimated especially over land

1.5 km
Convection permitted

Rainfall pattern more realistic but underestimated over sea
Heavy rain frequency of occurrence

4 km
Convection parameterised

1.5 km
Convection permitted

Concentrated on the south-west coast

Overestimated especially over land: grid-point storms contributing to rainfall overestimate
ACCESS-C2 is the only one closest to CPOL for rain rates ≤ 30 mm/hr.

Land-sea differences are concerned mainly with large rain rates (especially in ACCESS-R and –DN).
WRF daily rainfall

WRF experiments run by Claire Vincent and Todd Lane
Domain: Maritime Continent, resolution: 4 km, Convection permitted.
WRF diurnal cycle

- Plot showing diurnal cycle of total domain rainfall (mm/hr) vs. local time (hours).
- Maps indicating diurnal rain peak (mm/hr) for CPOL DJF 2013–14.
WRF rain frequency of occurrence

CPOL DJF 2013–14

light hourly rain rates

intermediate hourly rain rates

heavy hourly rain rates
Summary

- Rainfall overestimated over the CPOL domain in all versions of the ACCESS model:
  - Intensity too weak.
  - Frequency of occurrence too strong.
- Diurnal peak timing captured only in the 1.5 km version (convection permitted).
- Land-sea contrast error fixed when convective parameterisation is switched off allowing convection to develop.
- Comparison with WRF suggest the errors tends to be common amongst models.
Thank you…

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