YMC Plans

Todd Lane

Regional Convection-Permitting & Cloud-Resolving Modelling.
Focus areas for ARCCSS – Tropical Convection Program

Key questions we plan to address:

- How well do high-resolution models represent the structure and dynamics of convection cells in the maritime continent region – including differences over land / ocean?
- What are the dynamics governing offshore propagating convective systems in the maritime continent?
- How well do convection-permitting and cloud-resolving models represent the diurnal cycle of convection in the maritime continent? Including:
  - Land / sea-breeze interactions
  - Gravity wave processes
  - Orographic forcing

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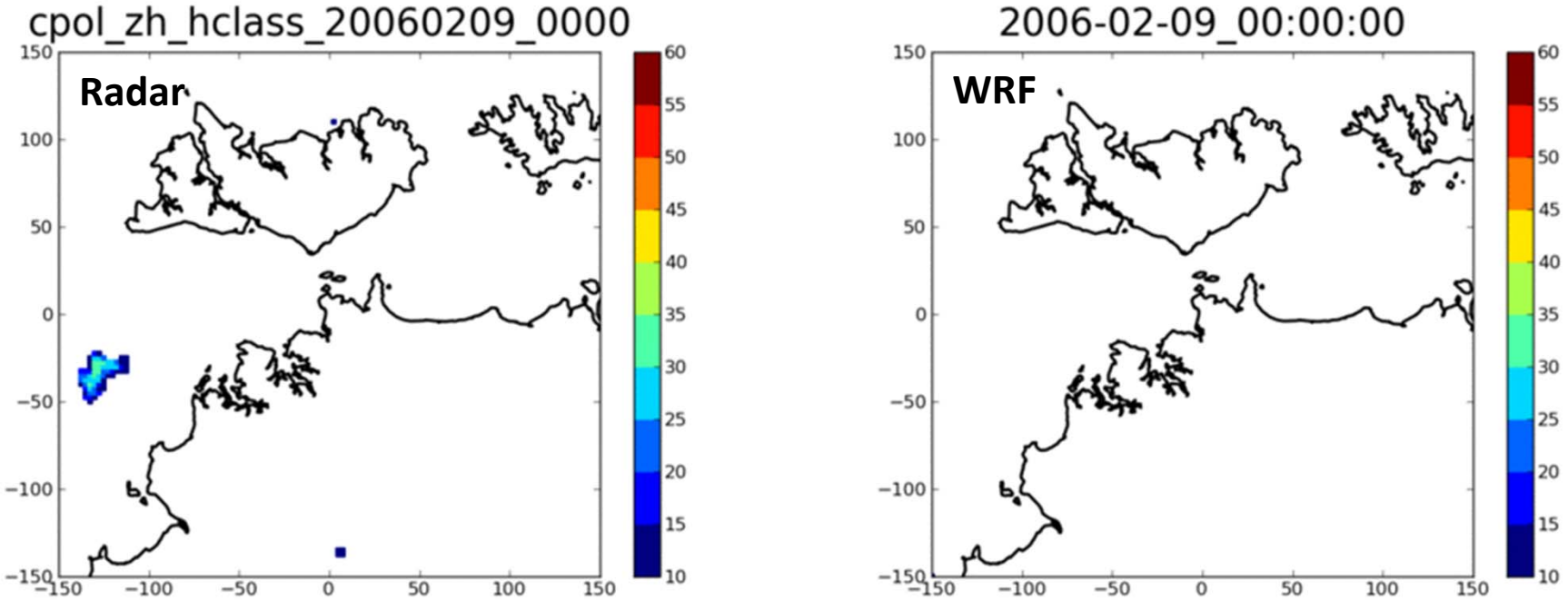
Modelling Tools:

- Large-domain (multi-island / large portion of MC) convection-permitting models
  - Explicit convection, grid spacing ~1-4 km.
- Smaller domain (single island) cloud resolving models
  - Explicit convection, sub-kilometre grid spacing, approaching LES.
- WRF – primary tool
- UM – developing high-res capability at ARCCSS; still undergoing development

Crucial observations required to answer questions / evaluate models:

- High temporal resolution (1-3 hourly) radiosonde soundings
  - Offshore soundings (from ship) – high priority
  - Coastal and Inland soundings also
- Radar obs of convection in coastal locations (to capture onshore initiation and offshore propagation)

High-resolution (Δx<1km) modelling domain for direct comparison to radar to evaluate simulated cell properties. Darwin (TWP-ICE) example.

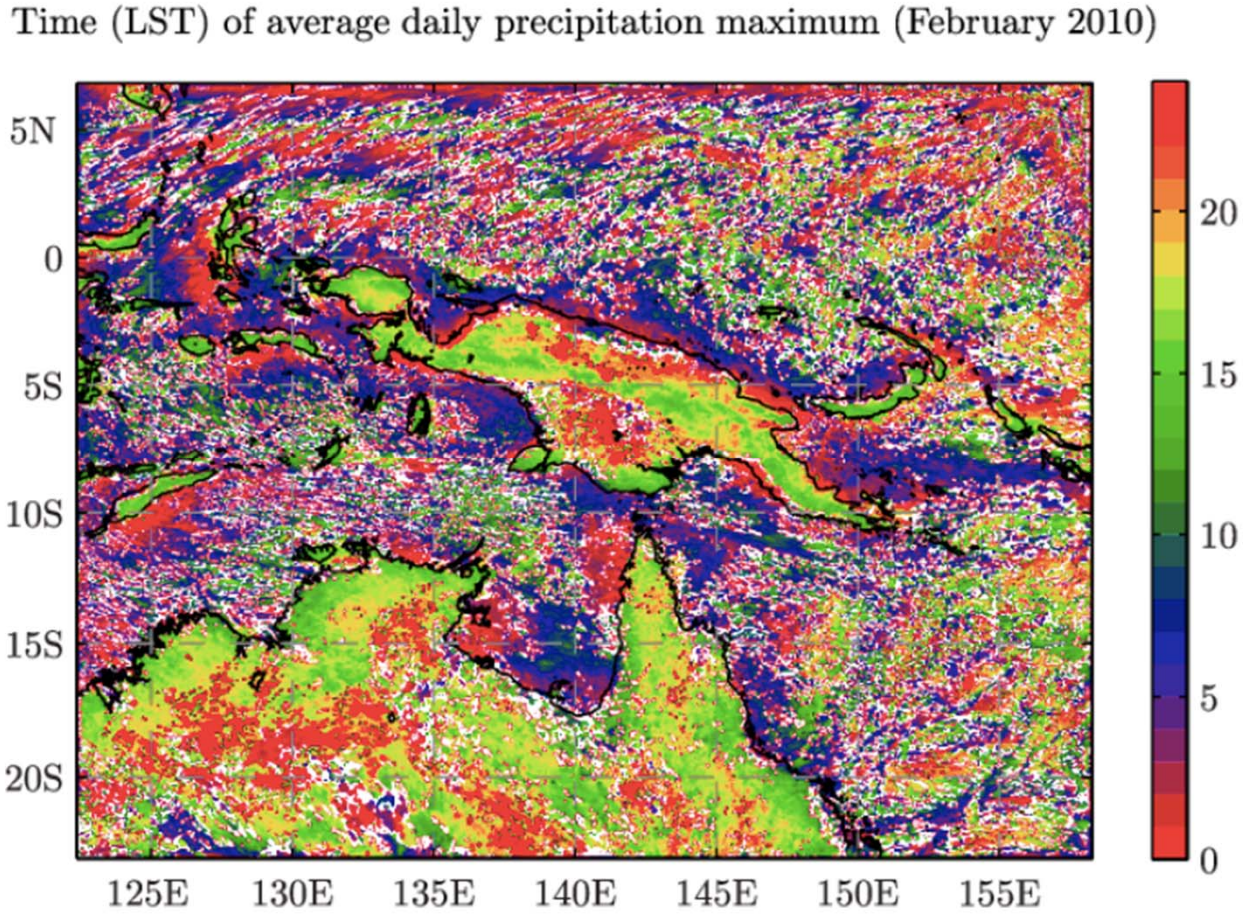


From Caine et al. 2013

- Will aim for Δx ~ 300 m.
- Requires careful post-processing of model data, which facilitates direct comparisons between model and radar.
- Plans to locate model domain over intensive obs site (e.g., Java; RV Investigator, etc.) to capture coastal interactions.

Large-domain convection-permitting modeling over the MC

WRF simulations @ 4km resolution



Courtesy: C. Vincent (Unimelb), M. Hassim (CCRS)

Observations and models identify unique aspects of the diurnal cycle in the maritime continent.

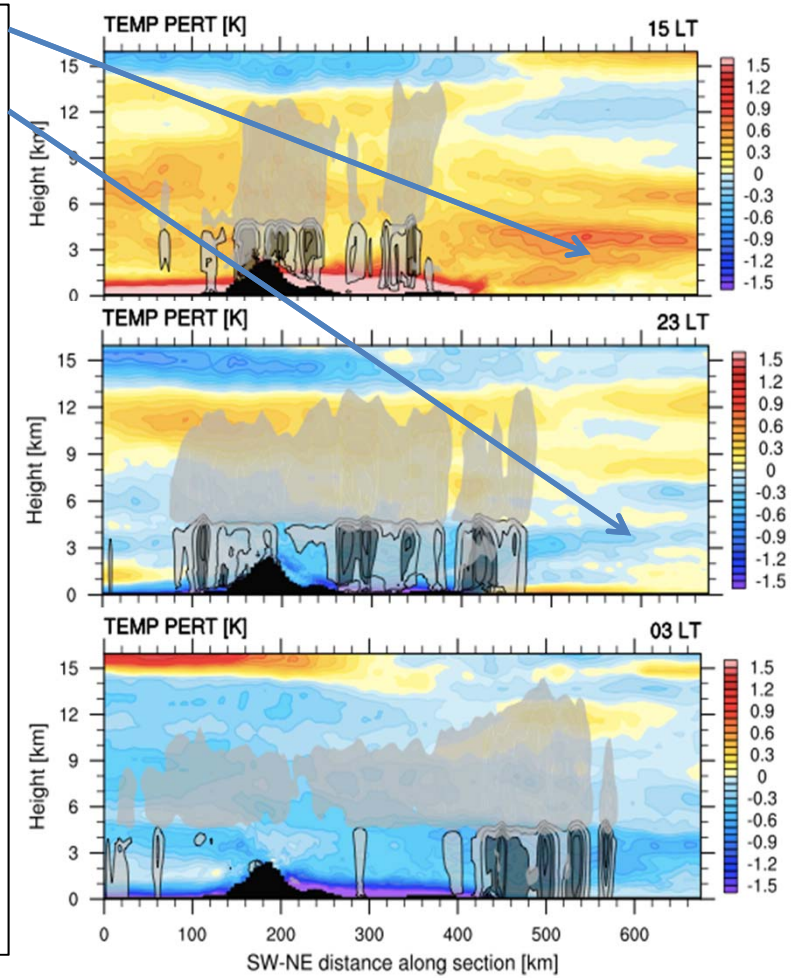
- A key characteristic of most large islands is the daytime maximum over land and the early morning maximum over adjacent ocean.

- Focus area: **dynamics of progression offshore. What governs this?**
  - **Relative roles of land breeze / gravity waves**

Offshore propagating convective signals – New Guinea example

Model simulations have already demonstrated the important role of offshore propagating gravity waves in destabilizing the environment and promoting convection over the ocean in the early morning. (see Love et al. 2011; Hassim and Lane 2015)

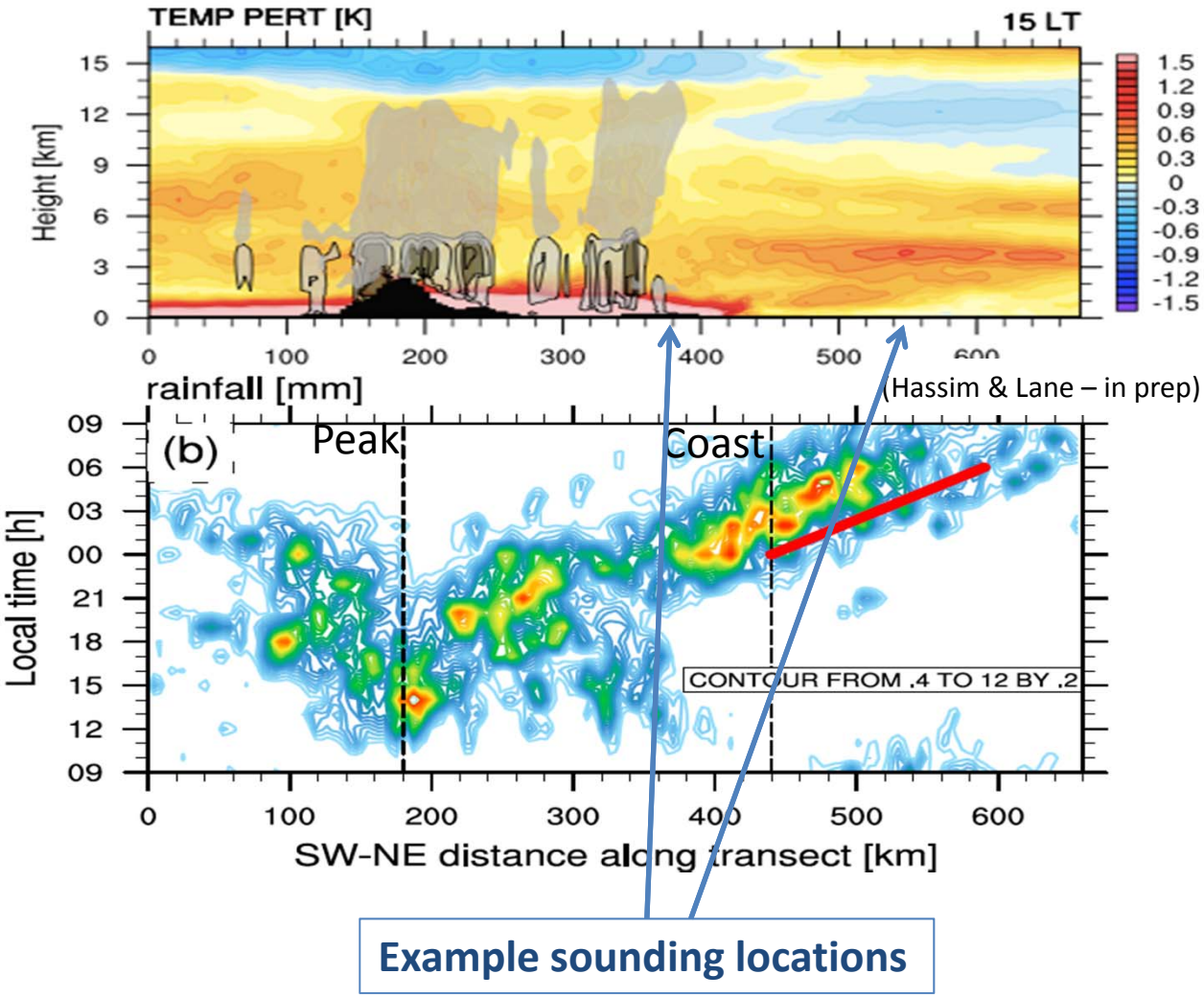
- Gravity waves generated by convection over land, propagate offshore and destabilize offshore environment and promote convection.
- How realistic are these modelled signals?
- How important are these waves near smaller islands (e.g., Java, Timor) compared to larger islands (e.g., Borneo).
- Would focus on one specific intensive observational site (e.g., Java Sea, Banda Sea)



(Hassim & Lane – in prep)

Offshore propagating convective signals – New Guinea example

- Propose a combined modelling / observational approach to this problem.
- YMC: High-time resolution (~1-3 hours) offshore soundings from ship(s) and coastal soundings could observe the vertical structure of the temperature perturbations associated with gravity waves and their diurnal variation.
- YMC: Radars on ship(s) should observe passage of the convective systems from land through to ocean



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