Long Term Observations of Tropical Precipitation for Model Development and Improvement

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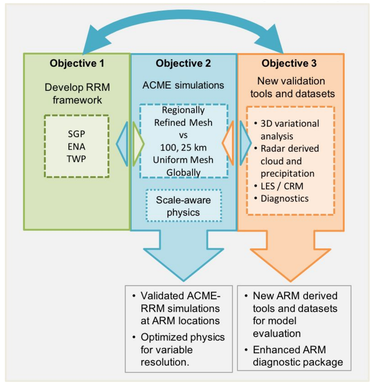
1. Introduction

The Climate Model Development and Validation-Regionally Refined Meshes (CMDV-RRM) focuses on enhancing the representation of clouds and convection in the DOE's Energy Exascale Earth System (E3SM) Model model using regionally refined meshes (RRM).



2. Darwin

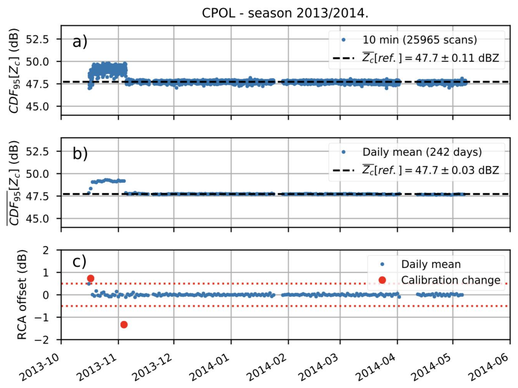
Nov. to May, Northern Australian Monsoon [1] + Madden-Julien Oscillation (MJO) [2] important

Higher echo top heights in break vs. monsoon, multimodal distributions sometimes observed [3,4]

19 years of continuous data from CPOL in Darwin -> examine cloud top heights in different phases of monsoon/MJO + provide statistics for E3SM evaluation

3. Instrumentation

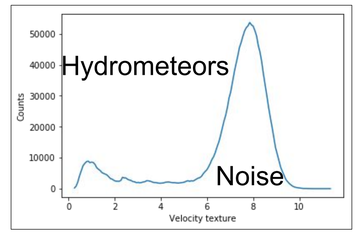
CPOL: C-band POLarization radar, PPI scans @ 18 elevations every 10 min. from 1998-2017



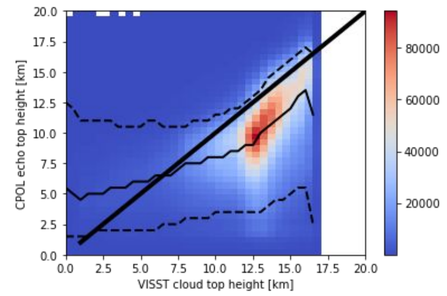
Meticulous attention to calibration check. 4/day rawinsondes: Monsoon/Break [1] VISST product [5] → MTSAT brightness temperatures

4. Echo top height (ETH) retrieval

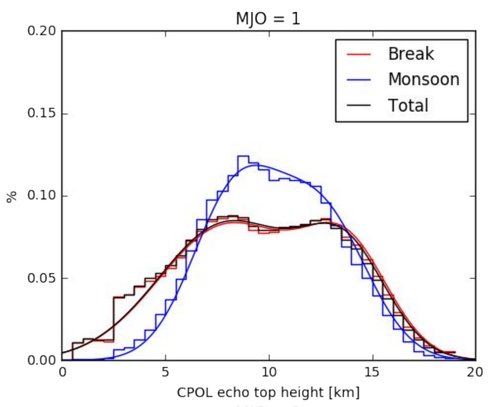
Python ARM Radar Toolkit (Py-ART) [6] used to process, grid, + calculate texture (std. dev. of 3-gate window) of radial velocity

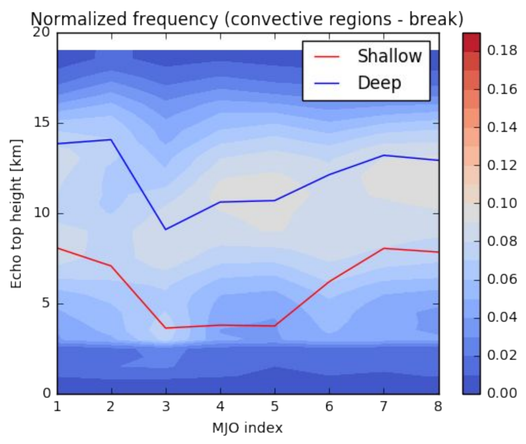


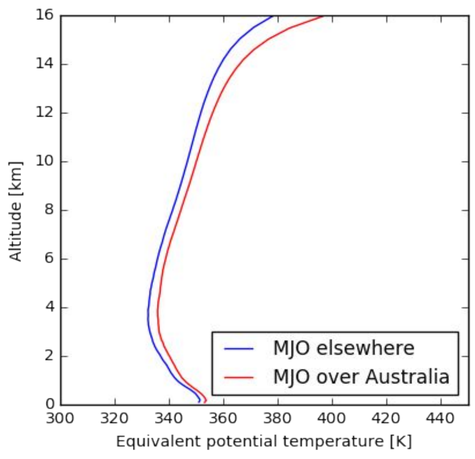
CPOL ETH underestimates satellite retrieved cloud top heights by 2-3 km

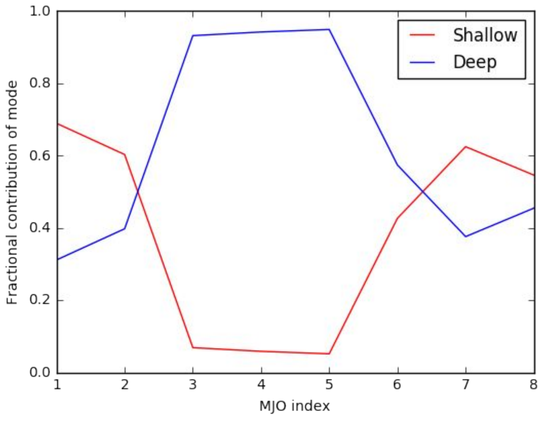


5. Statistical distributions









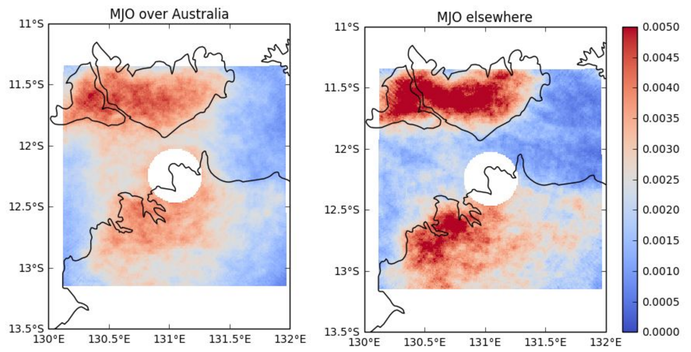
Bimodal ETH distributions observed → stable layer inhibiting more moderate convection

Distributions more bimodal when MJO inactive over Australia. Similar heights, but more unimodality in monsoon (not shown).

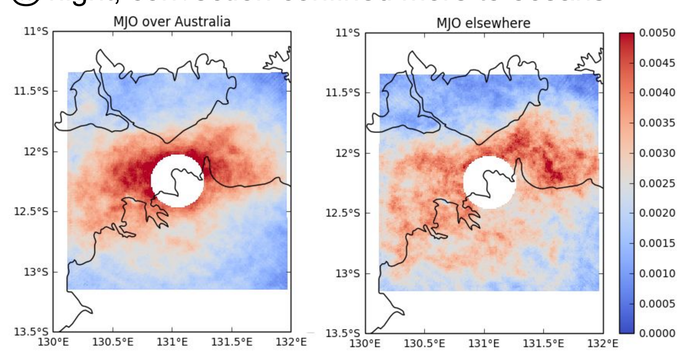
6. Spatial distribution

ETH > 7 km occurences during day in break conditions. Hector & seabreeze convection prevalent.

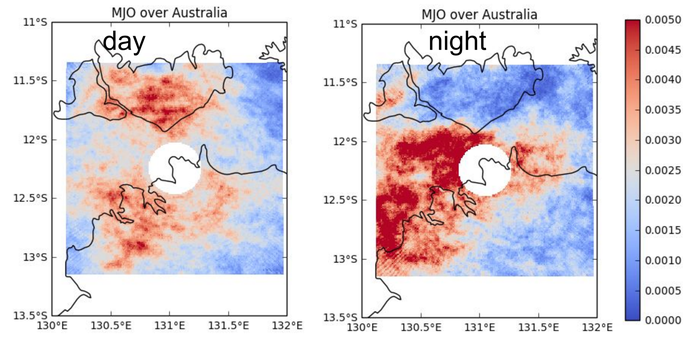
More counts over ocean during active MJO.



@ night, convection confined more to oceans

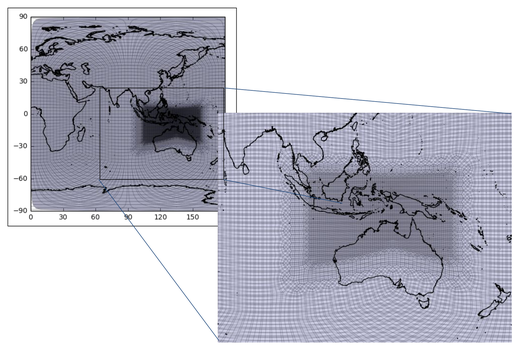


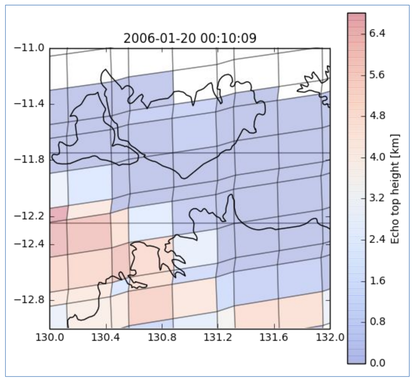
Monsoon more widespread over ocean



7. Next steps

Now that the data set has been prepared the key question is: **Can E3SM in RRM mode reproduce the same seasonal variability we observe?**





8. Give Me The Data!!!!

Data will be submitted as an ARM PI product, this is in process now. Contact Scott, Valentin or Alain. Some data is available on NERSC.

References

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