Convective cloud tops in differing wet season regimes in Darwin

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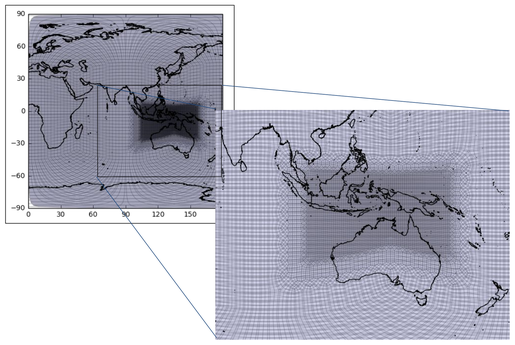
1. Motivation

Evaluate DOE Energy Exascale Earth System Model (E3SM) convective parameterizations in maritime continent @ 10-25 km resolution



Link between large scale forcing + macrophysical properties of convection in Darwin not well understood.

2. Darwin

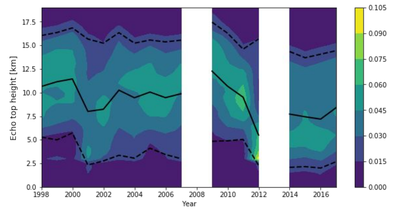
Nov. to May, Northern Australian Monsoon [1] + Madden-Julien Oscillation (MJO) [2] important

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 differing 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



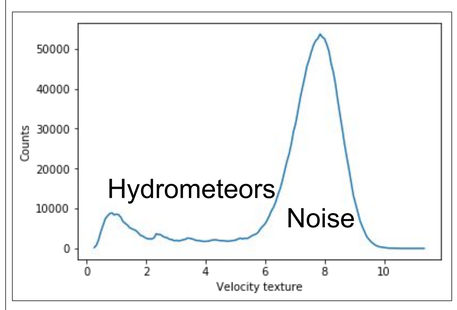
4/day rawinsondes: Monsoon/Break [1]

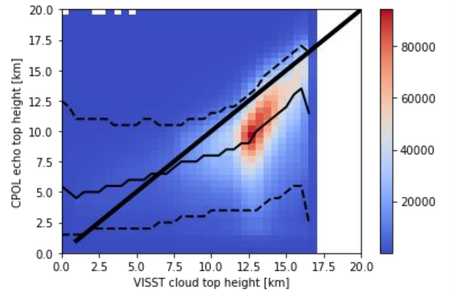
VISST product [5] → MTSAT brightness temperatures

4. Echo top height (ETH) retrieval

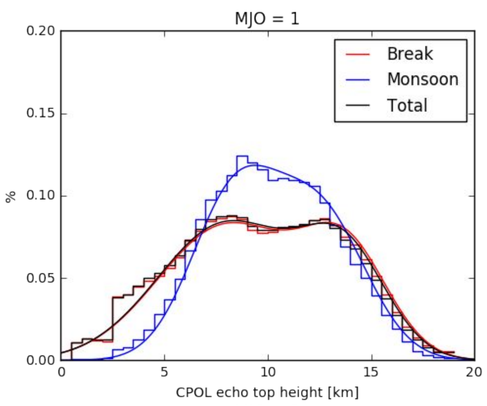
Python ARM Radar Toolkit (Py-ART) [6] used to process, grid, + calculate texture (std. dev. of 3-gate window) of radial velocity

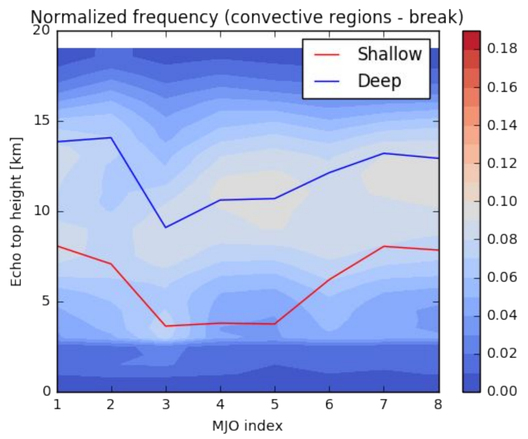
CPOL ETH underestimates satellite retrieved cloud top heights by 2-3 km

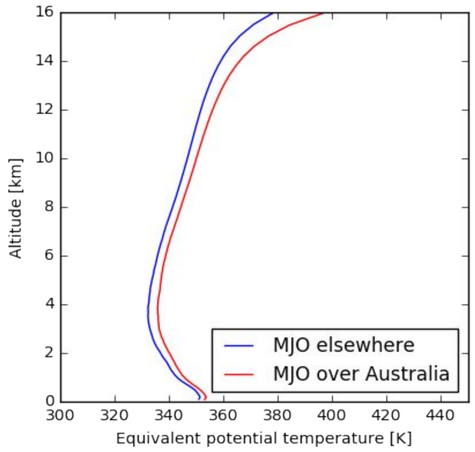


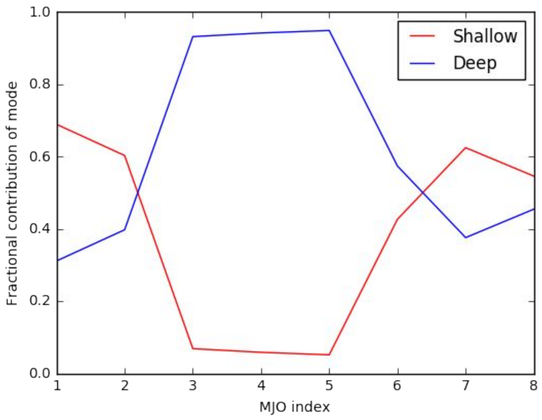


5. Statistical distributions







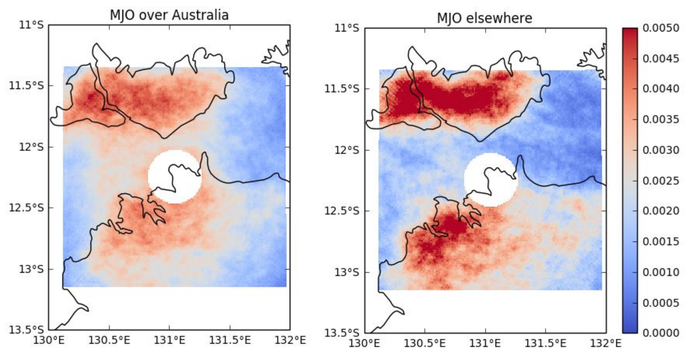


Bimodal ETH distributions observed → stable layer inhibiting more moderate convection

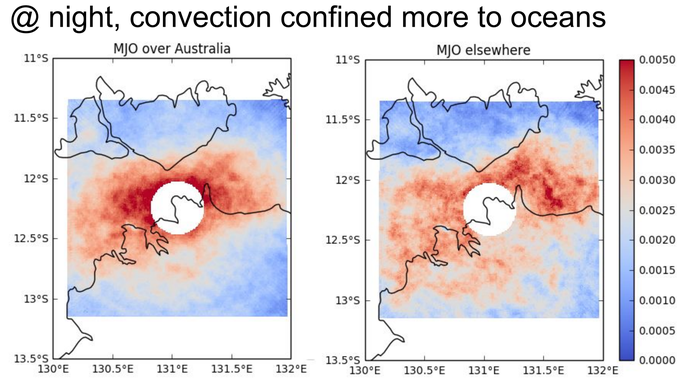
Distributions more bimodal when MJO inactive over Australia. Similar heights, but more unimodality in monsoon (not shown).

6. Spatial distribution

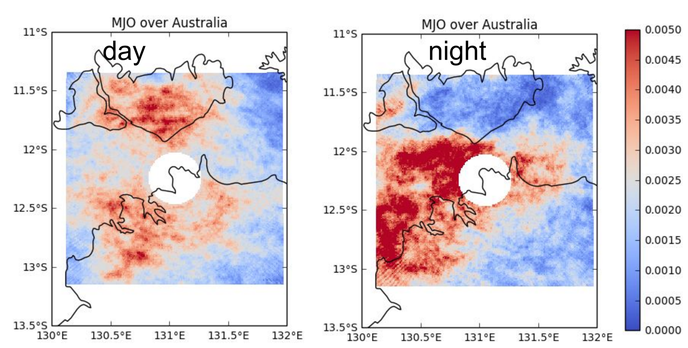
ETH > 7 km occurences during day in break conditions. Hector & seabreeze convection prevalent. More counts over ocean during active MJO.



@ night, convection confined more to oceans



Monsoon more widespread over ocean



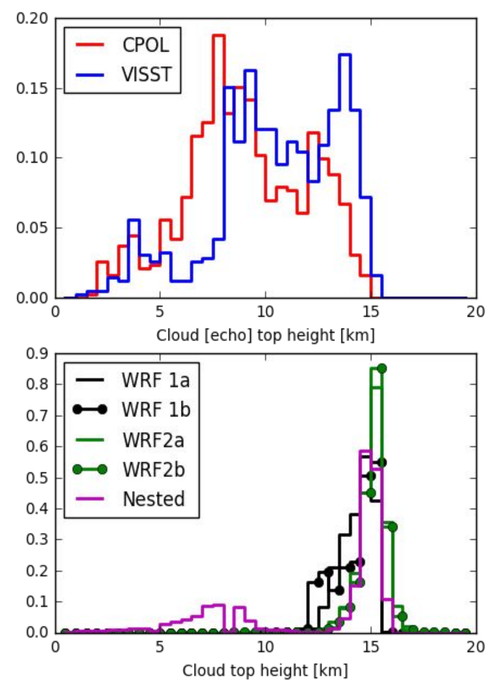
7. Comparison vs. WRF

ETHs for model evaluation:

- p.d.f.s of ETH from retrieval vs. WRF on 20 Jan 2006

Comparison activity still ongoing.

Simulation	Parameters
WRF1a	Baseline
WRF1b	Baseline w/ large scale advection
WRF2a	Relaxation
WRF2b	Relaxation w/large scale advection



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