The dynamical and microphysical properties of wet season convection in Darwin as a function of wet season regime.

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1. Motivation

Convection poorly represented in GCMs due to parameterization and parameterizations need to incorporate convective organization (Del Genio et al. 2012)

Such parameterizations not designed for 10-25 km resolutions – need to validate Accelerated Climate Model for Energy (ACME) + develop scale-aware parameterizations

Link between large scale forcing and microphysical/dynamical properties of tropical convection in Darwin not well understood.

2. Darwin

From Nov. to May, synoptic regimes occur corresponding to active/break periods of the Northern Australian Monsoon (Drosdowsky 1997).

Isolated deep convection more likely in break periods, widespread convection more likely in monsoon in past studies

15 years of continuous data from 2 radars in Darwin allows examination of convective microphysical/dynamical properties as a function of large scale forcing

3. Instrumentation

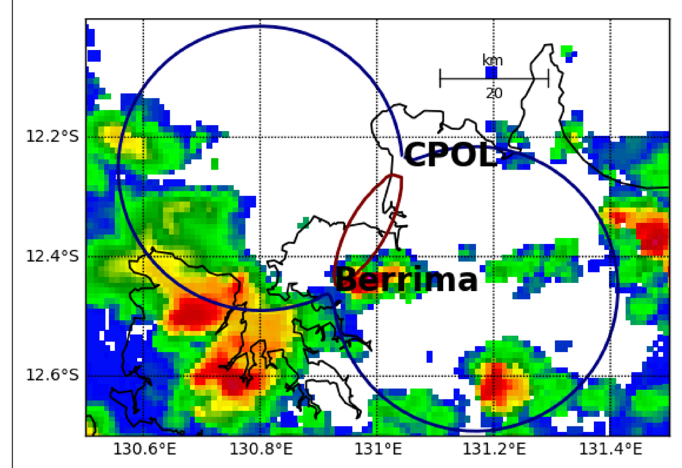
CPOL: C-band Dual polarization radar, PPI scans @ 18 elevations every 10 min. from 1999-2014

Bureau of Meteorology C-band radar @ Berrimah

4/day rawinsondes: classify days into regimes (Monsoon/Break, c.f. Drosdowsky 1997)

MTSAT brightness temperatures → approximate cloud top temperatures

4. Dual Doppler retrieval

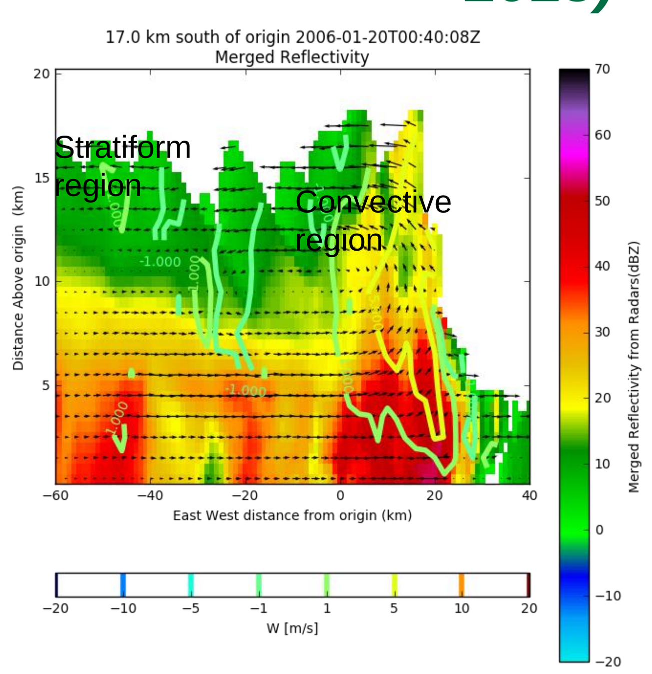


Retrieval of winds within Dual Doppler Lobes (circles)

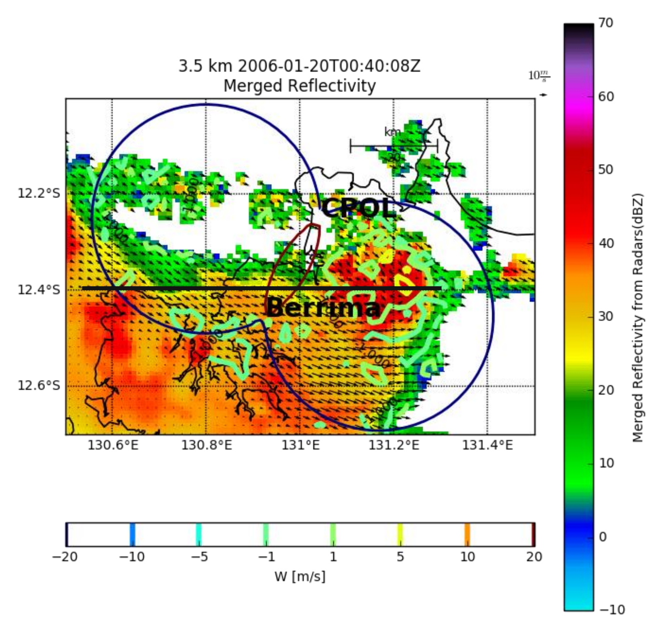
4 years with Berrima/CPOL: 2005-2006, 2006-2007, 2009-2010, 2010-2011

Processing + Gridding	**Python ARM Radar Toolkit (Py-ART) (Helmus and Collis 2016)**
Dual Doppler retrieval	**Multidop (Python wrapper around Potvin et al. (2012) C code)**
Cost function minimization	**Mass continuity, soundings, vorticity equation, smoothness**
Retrieval parameters	**Mass continuity = 1500, no vorticity, sounding on, horizontal smoothness = 100 (suppress noise at high altitudes/lobe edges)**
Dealiasing	**4DD/Region based agree within 5%**

5. Multidop test 1: monsoonal convection – 20 Jan 2006 (Collis et al. 2013)

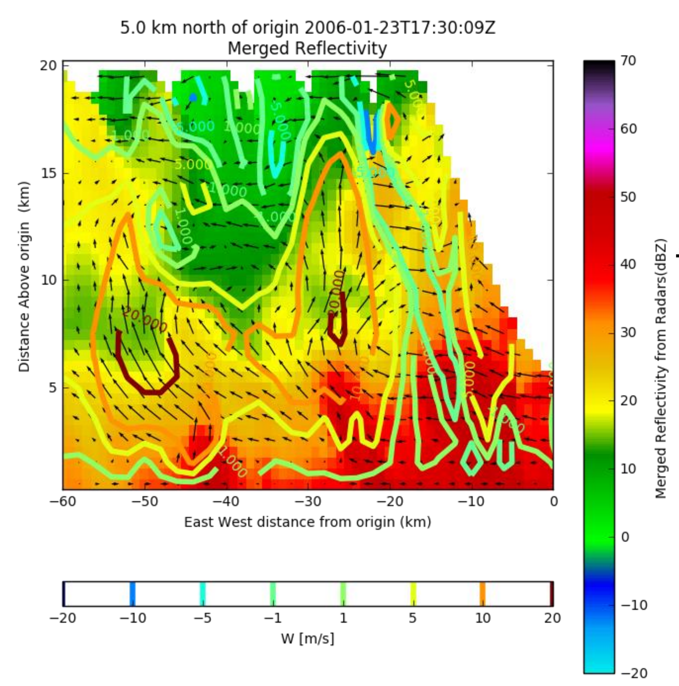


Multidop retrieved winds CPOL reflectivity (contours = vertical velocity *w*) for E-ward propagating MCS of Collis et al. (2013)

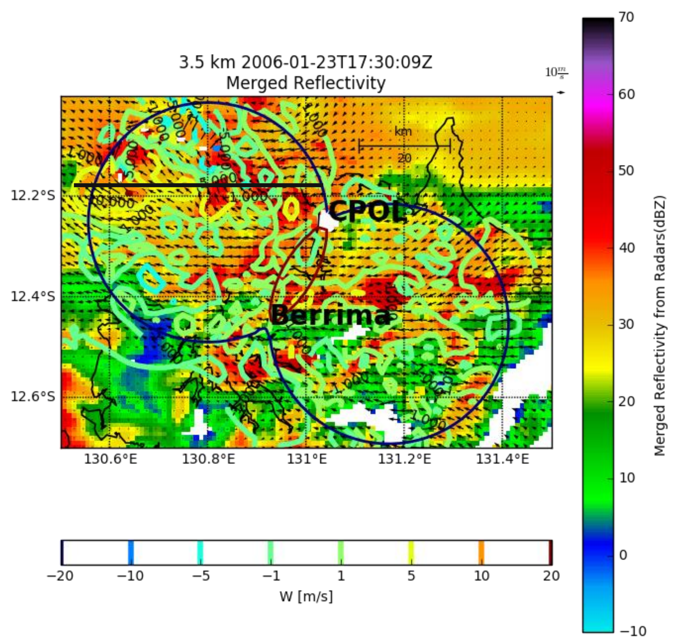


Multidop successfully reproduces updrafts adjacent to highest reflectivities

6. Test 2: break convection – 23 January 2006 (Varble et al. 2014)

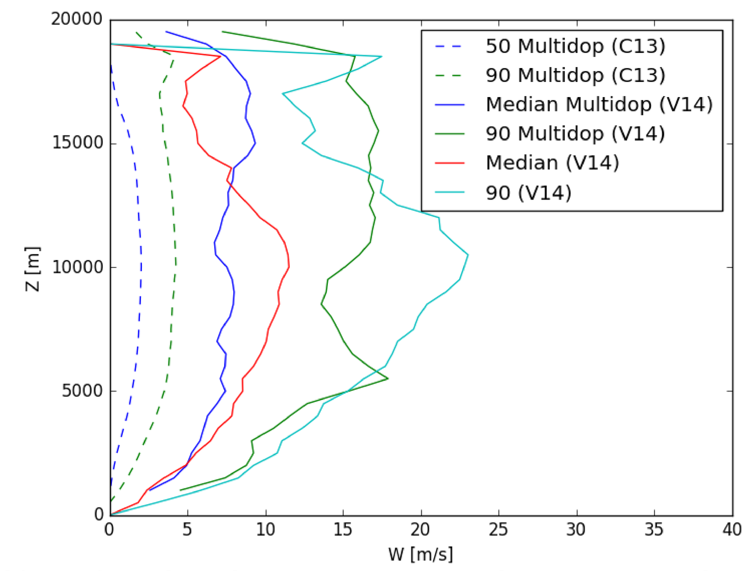


NW-ward propagating break MCS from Varble et al. (2014)



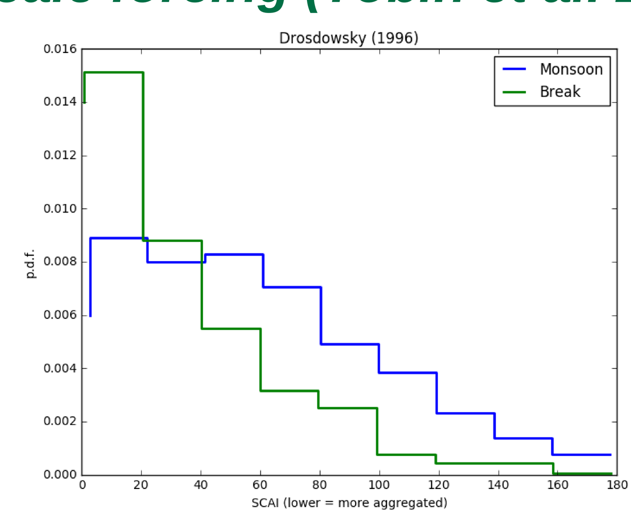
Multidop successfully reproduces updrafts adjacent to highest reflectivities

7. Multidop w validation



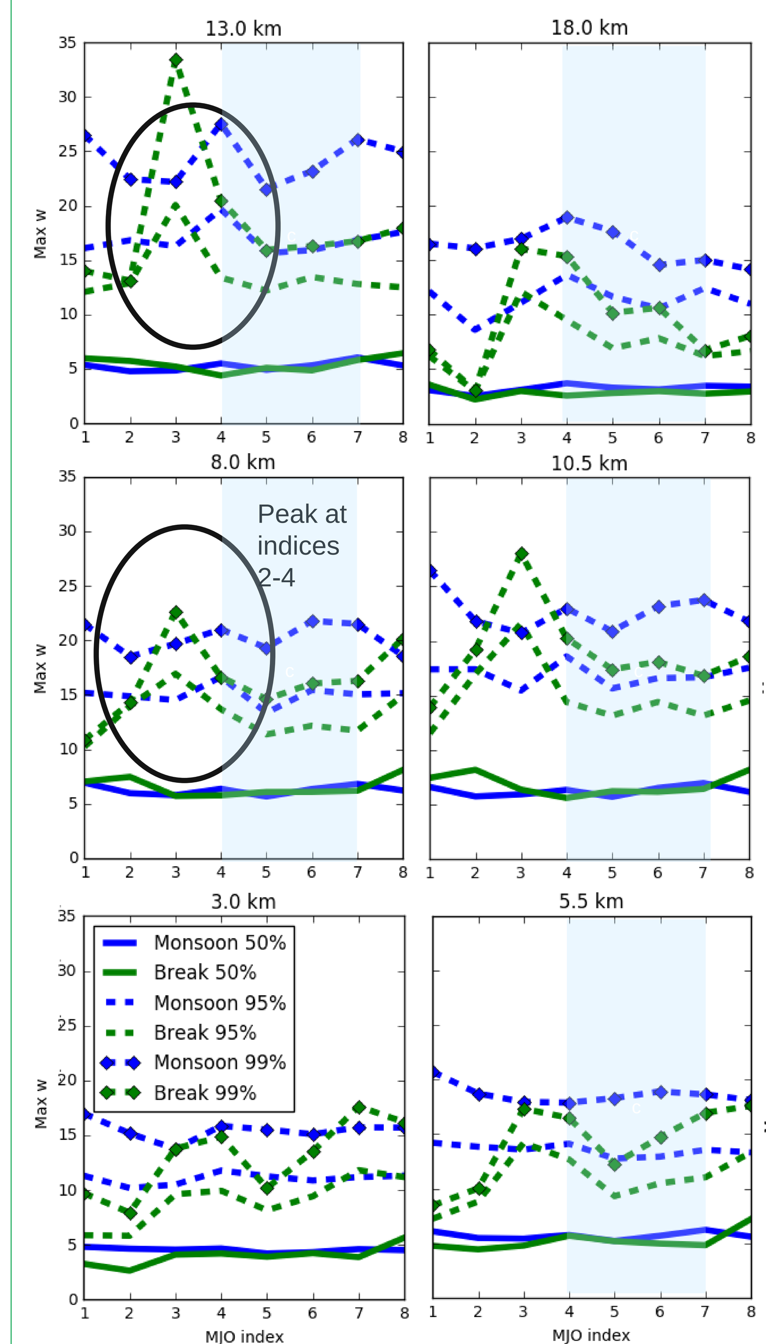
Pdfs of *w* in deep convective cores in 5 m/s of Collis et al. (2013) + Varble et al. (2014) (reasonable agreement)

8. Convective organization and large scale forcing (Tobin et al. 2012)

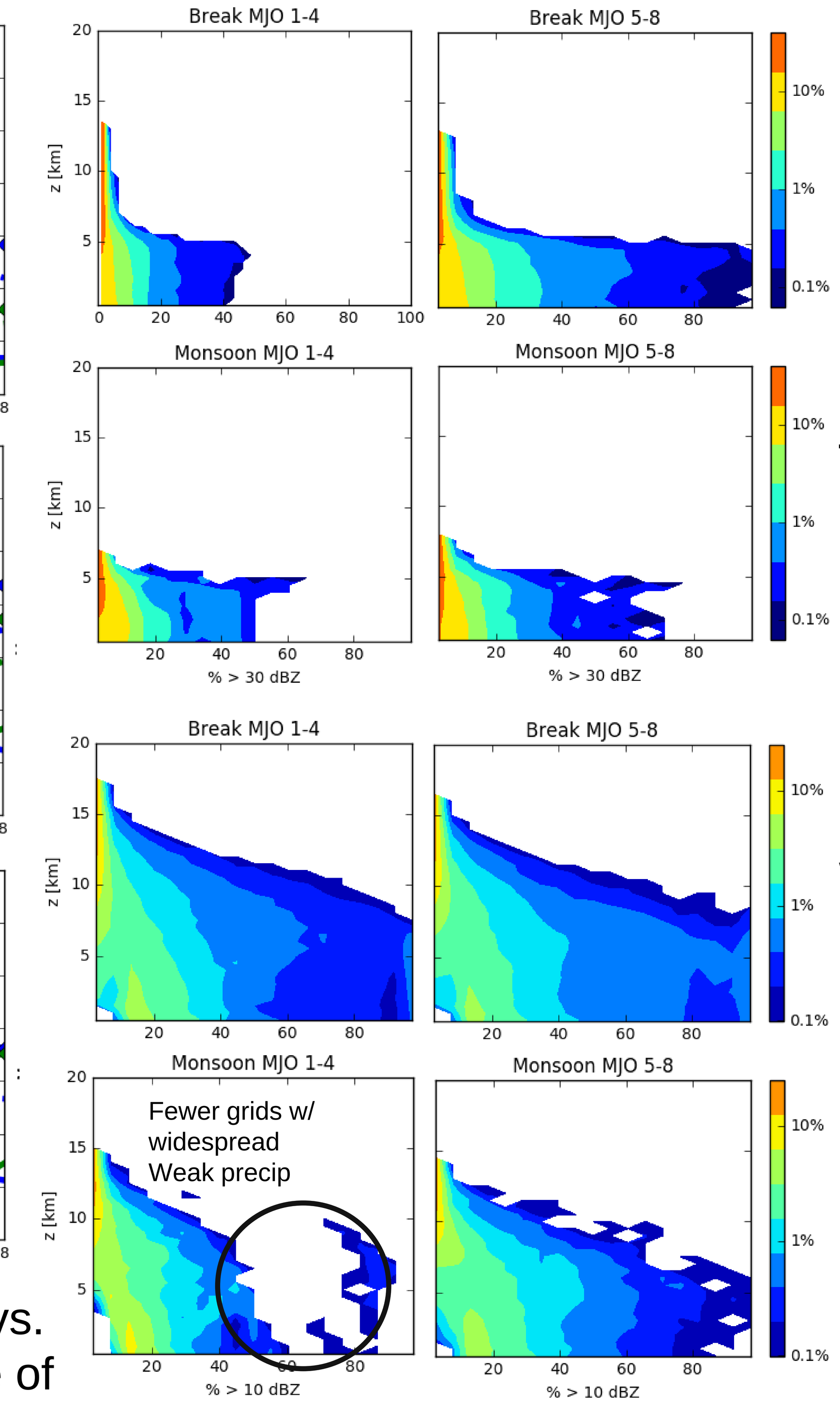


More aggregated convection in break regime vs. monsoon in Jan-Feb 2006

9. Statistical analysis



95th/99th %ile w greater in break vs. monsoon (Shading = conv. Mode of MJO over Australia)



Statistical coverage product (% of grid level > x dBZ) – norm. freq. histograms

More widespread precipitation @ < 10 km in MJO 5-8 (especially in monsoon).

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10. Future work

Examine how *w*, vorticity, convergence in cores vary as a function of regime, organization for entire dataset

Find specific case studies to use for verification of the Accelerated Climate Model for Energy Regionally Refined Mesh runs

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