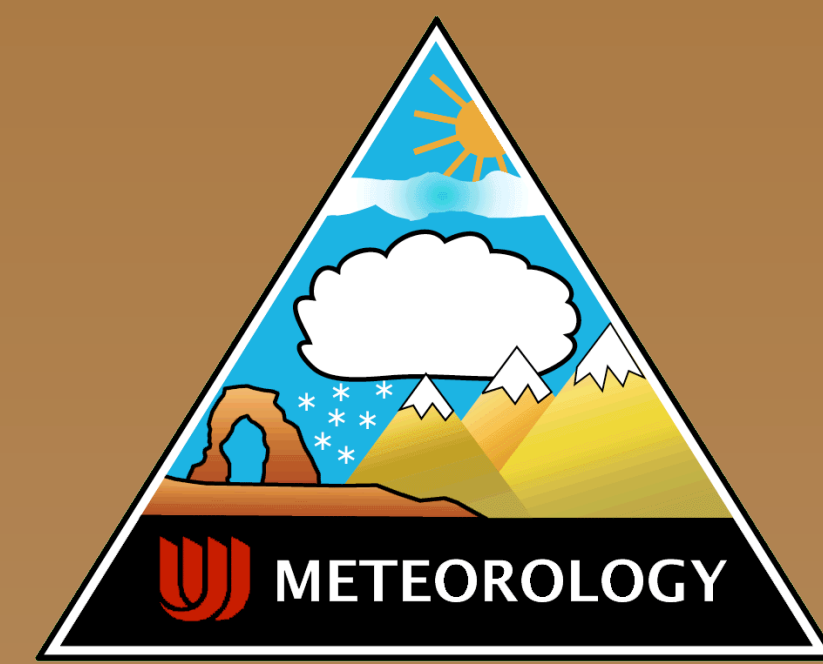




Climatological Context for TWP-ICE Convective Precipitation Features

Adam Varble and Ed Zipser

Department of Meteorology, University of Utah



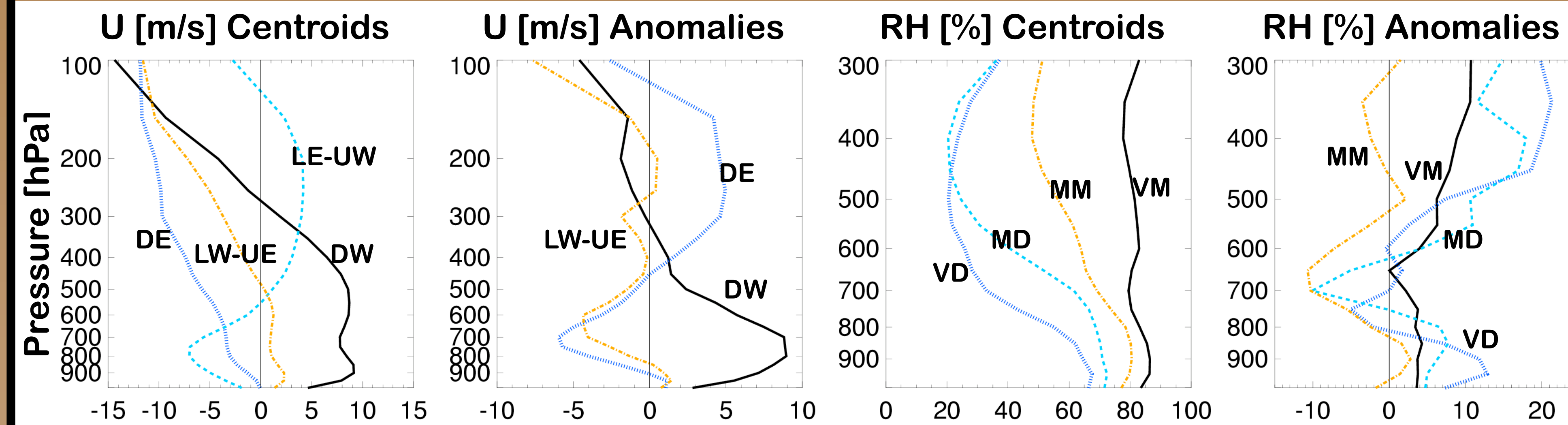
Objectives

- Define kinematic and thermodynamic regimes that exist in Darwin during the wet season using k-means cluster analyses of ERA-Interim soundings
- Compare convective properties of the regimes using 10 years of TRMM PR data
- Put the TWP-ICE IOP period into context using the Gunn Pt. CPOL radar and the constructed climatology
- Attempt to explain differences in convective properties between TWP-ICE and climatology

Data and Methods

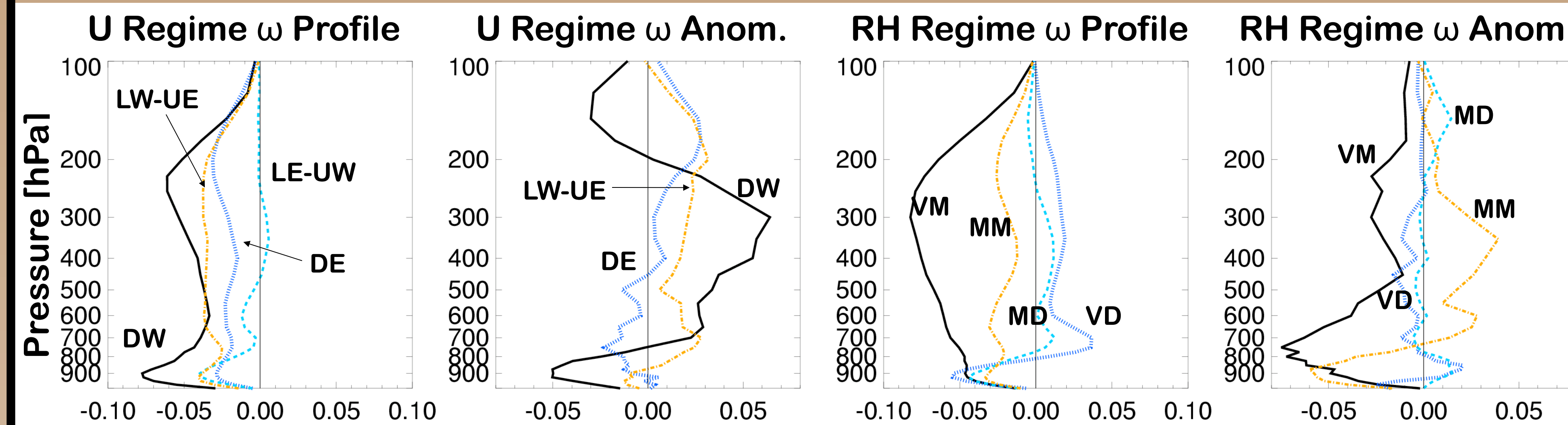
- 1997/98-2006/07 DJFM ERA-Interim data
- Temporally and spatially averaged daily ERA zonal wind and RH soundings used for kinematic and thermodynamic cluster analyses respectively
- Precipitation features are defined as at least 5 contiguous 17 dBZ or greater near-surface reflectivity pixels (16 km²) using TRMM PR for climatology and CPOL radar for the TWP-ICE period
- Convective strength is defined using the vertical profile of maximum radar reflectivity for precipitation features with at least one 40 dBZ pixel
- There is about a 2 dBZ low bias in corrected CPOL reflectivity below the freezing level when compared with the TRMM PR

Regime Centroids and TWP-ICE Anomalies



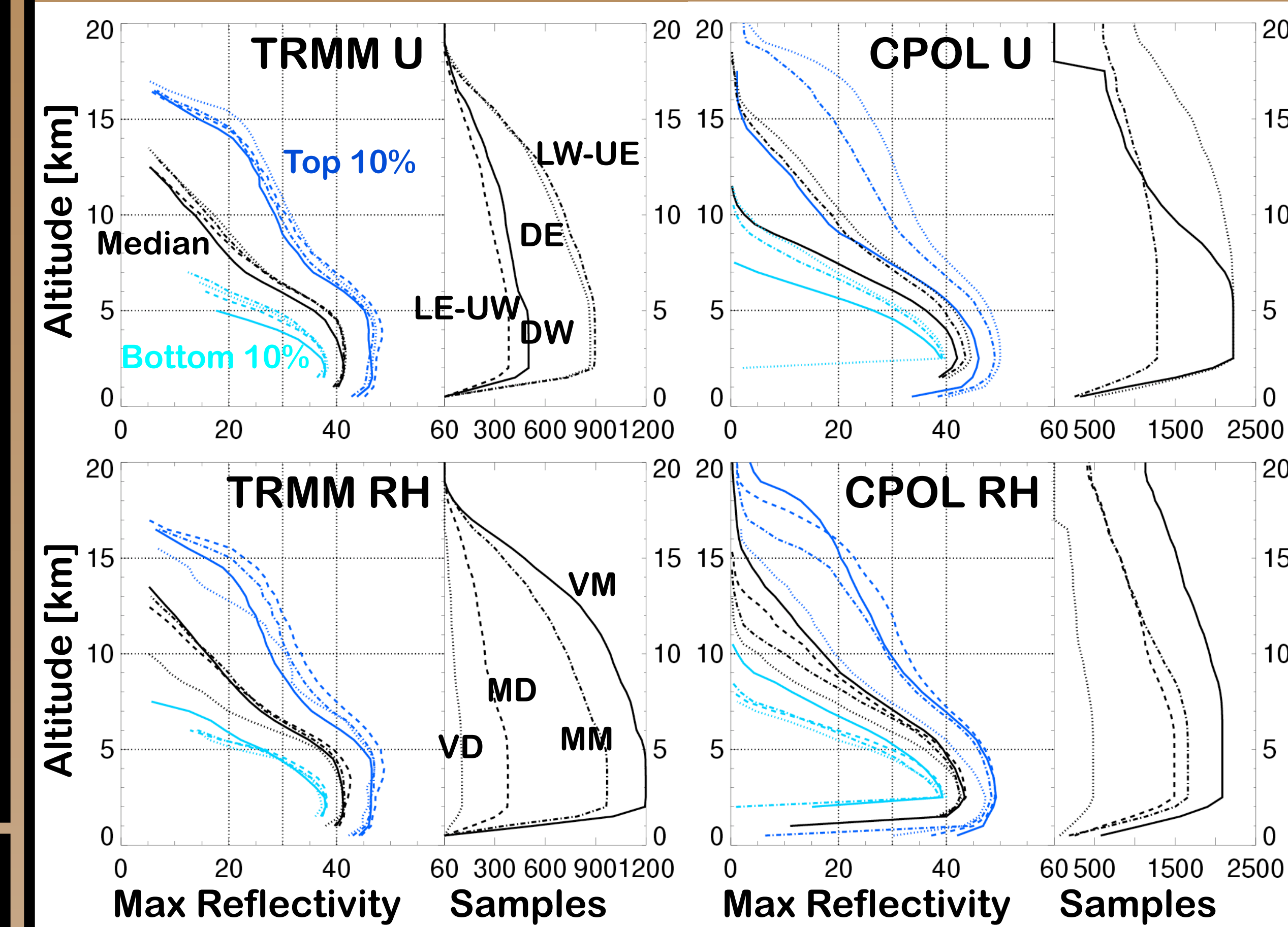
The 4 zonal wind (U) regimes are deep east (DE), low east-upper west (LE-UW), low west-upper east (LW-UE) and deep west (DW). The 4 RH regimes are very dry (VD), moderately dry (MD), moderately moist (MM), and very moist (VM). The DW regime is anomalously stronger westerly in the lower troposphere during TWP-ICE. The DE regime is more easterly at low levels and more westerly at upper levels. The MD and VD regimes are anomalously moist at low and upper levels during TWP-ICE, while the VM regime is more moist at all levels and the MM regime has a drier mid-troposphere.

Regime Vertical Velocity [Pa/s] and TWP-ICE Anomalies



The TWP-ICE period has much less upward vertical motion in the mid-troposphere in the DW and LW-UE regimes and greater upward vertical motion below 450 hPa in the DE regime. The TWP-ICE period VM regime has much greater upward vertical motion than climatology, whereas the MM regime has less upward vertical motion than climatology. The VD and MD regimes were about average climatologically during TWP-ICE.

Convective Core Vertical Structure (CFADs)



Differences in convective intensity between the TWP-ICE period and climatology are primarily seen in the top 10% (strongest) precipitation features. For the zonal wind regimes, these differences are weaker DW features and stronger DE features for the TWP-ICE period. For the RH regimes, these differences are stronger VM features, weaker VD features, and slightly weaker MM features.

Conclusions

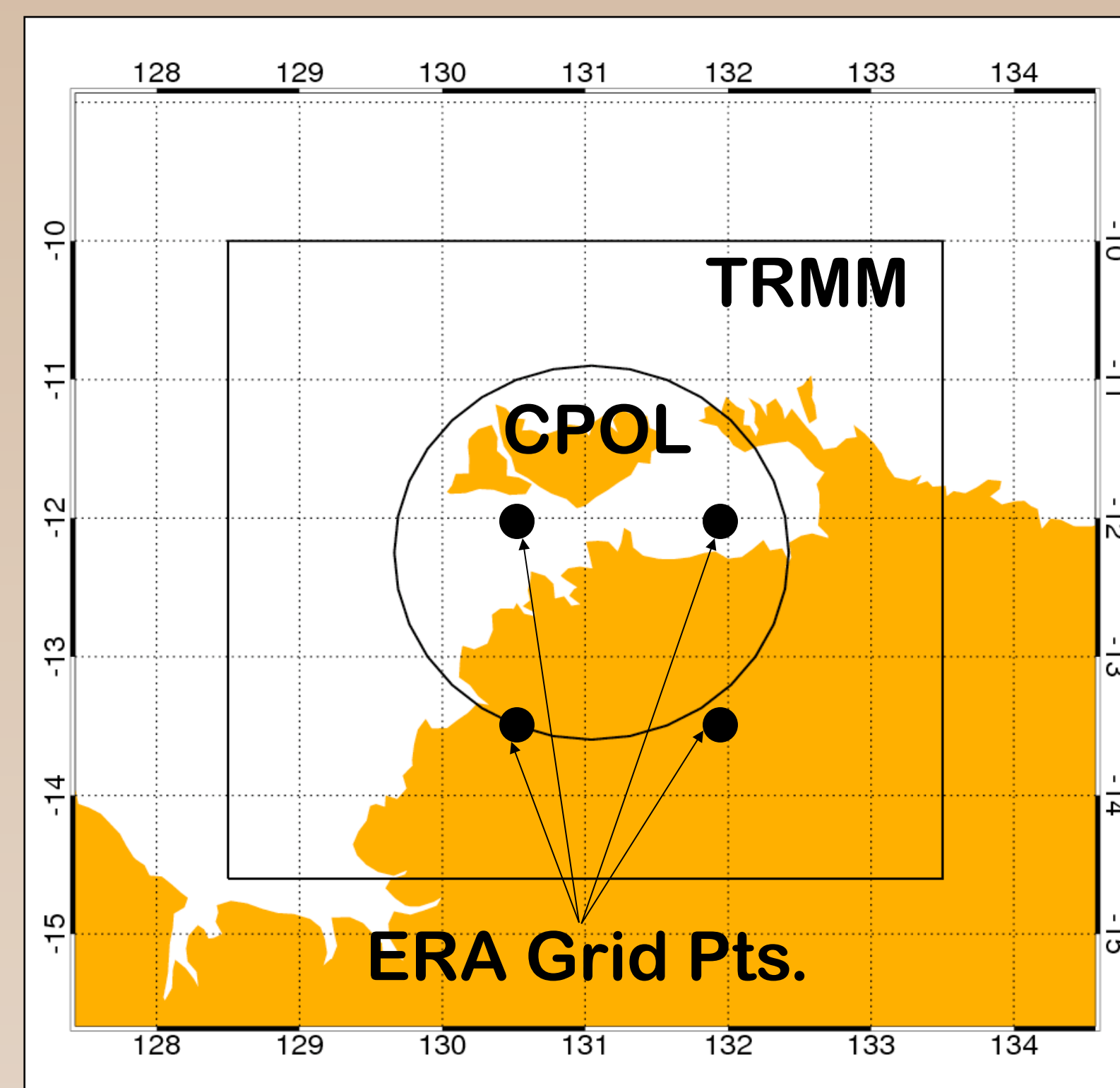
- TRMM is a valuable resource for providing climatological context for IOPs. Doing so gives insight into the reasons for convective variability within meteorological regimes and provides information for extending CRM results to longer time periods.

- The convective precipitation features during TWP-ICE were stronger than climatology during the DE and VM regimes. They were weaker than climatology during the DW, MM, and VD regimes. These differences are especially apparent in the top 10% strongest convective features.

- Convective intensity differences are closely correlated with differences in the forcing (vertical velocity). Other related and important factors appear to be total column water (TCW), mid-tropospheric RH, low level vertical wind shear, and to a lesser degree CAPE.

- Surprisingly, CAPE is weaker in all regimes during TWP-ICE when compared with climatology.

Domain



Median Regime Properties (TWP-ICE Quantities)

	Kinematic (Zonal Wind)				Thermodynamic (RH)			
	DW	LW-UE	LE-UW	DE	VM	MM	MD	VD
# days/yr	17.8 (10)	42.1 (7)	23.5 (0)	37.8 (9)	46.2 (8)	42.4 (8)	23.9 (6)	8.7 (4)
Surface CAPE	1417 (478)	1564 (521)	1500	1709 (1400)	1346 (1066)	1696 (724)	1844 (1403)	1183 (188)
CIN	11 (15)	15 (22)	33	19 (32)	10 (0)	19 (16)	34 (33)	46 (27)
TCW [mm]	56.4 (49.8)	55.6 (50.6)	48.9	53.4 (52.4)	59.3 (62.2)	53.1 (50.6)	46.4 (47.8)	38.6 (38.0)
U Shear (sfc-700)	-2.8 (-9.1)	2.6 (4.7)	5.7	6.3 (10.6)	0.8 (-1.4)	4.8 (-5.8)	8.4 (10.8)	6.8 (-7.9)