The two-way feedback between convective updrafts and cold pools has been suggested as a critical mechanism for the shallow-to-deep convective transition and maintenance of deep convection. The unified convection scheme (UNICON) is an existing cumulus parameterization scheme that explicitly represents this interaction. This study uses ARM datasets to constrain the two-way feedback process between convection and cold pools simulated by UNICON.

**OBJECTIVES**

- Diagnose convective organization and cold pool processes over the Indian Ocean (AMIE/DYNAMO) and over SCIF (MAB) by combining field campaign datasets and high-resolution CRM simulations driven by ARM observations
- Evaluate processes related to cold pools and cold pools that are explicitly parameterized in UNICON

**2. UNICON**

**IMPACTS OF COLD POOL ON CONVECTION**

Cold pools affect plume radius, temperature, specific humidity, and vertical velocity perturbation through a scalar that represents the degree of mesoscale convective organization.

**SOURCE OF COLD POOL ENERGY**

Evaporatively driven convective downdraft penetrating down into boundary layer

**AMIE/DYNAMO**

- Suppressed period (locally generated convection 4-12 November 2011)
- Size distribution of contiguous convective echoes (CCEs) and contiguous convective updrafts (CCUs)
- Cold pool statistics
- WRF simulation, 500 m (Feng et al. 2013)

**CCEs and CCUs**

- CCE and CCU size distributions vary similarly in time
- Increase in large CCEs and CCUs indicative of organization convection
- CCE/CCU sizes increase with cold pool fraction in WRF, supporting UNICON's formulation of CCEs (organization) and plume radius being linearly proportional to cold pool fraction

**COLD POOLS: WRF**

- Potential Temperature < 0.5 K (virtual T in UNICON)
- Fractional area determined
- Can relate to thermodynamic (water vapor) and dynamic (vertical velocity) mechanisms for convection–cold pool interaction
- Relate cold pool properties to CCEs/CCUs

**COLD POOLS: SPOKas**

- Manual tracking of cold pools from SPOKas (echo vold bounded area in wake of convection)
- Estimates of maximum diameter, lifetime, fractional coverage
- Initiation and clustering of deep convection on intersecting cold pool boundaries (Rowe and Houze 2015; Feng et al. 2013)

**CONVOLUTION PULSATE ECHOES**

- Powell et al. (2016) algorithm modified Steiner et al. (1995) applied to 1-km SPOKas and 500-m WRF reflectivity at 2.5 km height
- Group connected grid points of ‘Convective’ and ‘Isolated convective core’ echoes

**CONVOLUTION PULSATE UPRDRAFTS**

- Grid points with updraft 5 m s⁻¹ (> 1 km deep) above boundary layer

**3. OBSERVATIONS AND WRF**

**CONTINUOUS OBSERVATIONS AND WRF**

- WRF and UNICON capture observed increase in precipitation throughout ARM, but suppressed period, with peak event on 11 Nov, but vary in terms of magnitude and timing of individual events
- Cold pool fraction timeseries follows precipitation with a few hours lag
- UNICON produces the lag, but cold pools tend to persist longer than observed and WRF

**PREDICTATION AND COLD POOLS**

- WRF and UNICON capture observed increase in precipitation throughout ARM, but suppressed period, with peak event on 11 Nov, but vary in terms of magnitude and timing of individual events
- Cold pool fraction timeseries follows precipitation with a few hours lag
- UNICON produces the lag, but cold pools tend to persist longer than observed and WRF

**4. RESULTS**

**UNICON**

- CCE and CCU size distributions vary similarly in time
- Increase in large CCEs and CCUs indicative of organization convection
- CCE/CCU sizes increase with cold pool fraction in WRF, supporting UNICON’s formulation of CCEs (organization) and plume radius being linearly proportional to cold pool fraction

**5. CONCLUSIONS**

- SPOKas and WRF cold pool fractions lag precipitation by ~1-2 h; lagging reasonably represented in UNICON but cold pools tend to sustain longer (possibly due to lack of horizontal advection)
- SPOKas CCE size distributions vary similarly to WRF CCE sizes, which vary similarly to WRF CCU sizes → all increase with increasing cold pool fraction
- UNICON plume radius is linearly proportional to cold pool fraction; this relationship between organization and cold pools supported by radar and WRF results
- Future work will extend the analysis to entire AMIE/DYNAMO period, examine the sensitivity of UNICON results to varying evaporation parameters (for example), evaluate cold pool properties in UNICON, and extend this analysis to midlatitude continental cases (MC3E)