## **Cloud Observations and Processes in Surface Induced Convection over Central Saudi Arabia**

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## Motivation

The Saudi Aerosol-Cloud-Precipitation Enhancement Campaign (SARPEC) overall objective is to obtain observations that assist in determining the effectiveness of cloud seeding techniques used for rainfall augmentation within the Kingdom of Saudi Arabia. Cloud observations are obtained at the -10 °C, -15 °C, and -20 °C levels as clouds develop and grow vertically.



Image showing the 20231024-A1 cloud taken from the North Dakota



Citation Research Aircraft at 10:58:45 (39,525 sfm) UTC .



of cloud microphysics properties are obtained using the North Dakota Citation Research Aircraft, which included a Precipitation Imaging Probe (PIP), Cloud Droplet Probe (CDP), King Hot-wire Liquid Water Content Probe (King Probe), a Cloud Imaging Probe with 25  $\mu$ m diodes (CIP-25 $\mu$ m), an Aircraft Integrated Meteorological Measurement System (AIMMS), a Cloud, Aerosol, a Precipitation Spectrometer with Depolarization (CAPS-DPOL) that contains a Cloud and Aerosol Spectrometer (CAS) and a Cloud Imaging Probe with 15  $\mu$ m diodes (CIP-15 $\mu$ m), a Pitot Tube, a Rosemount Temperature probe and a two-dimensional Stereo (2D-S) Probe.



20231027-A2	40,772.3 - 40,775.8	$-13.8 \pm 0.60$	255 ± 48	$1.67 \pm 0.43$	$25.0 \pm 0.21$
20231027-B1	40,989.5 - 40,995.5	$-10.5 \pm 0.20$	211 ± 52	$1.12 \pm 0.31$	$23.9 \pm 0.65$
20231027-B2	41,316.0 - 41,321.5	$-11.7 \pm 0.90$	289 ± 41	$1.94 \pm 0.35$	$24.7 \pm 0.20$
20231028-A1	39,585.0 - 39,586.3	$-10.6 \pm 0.19$	651 ± 38	$2.20 \pm 0.13$	$19.0 \pm 0.62$
20231028-A2	39,859.2 - 39,859.7	$-15.3 \pm 0.32$	326 ± 20	$1.13 \pm 0.06$	$20.0 \pm 0.13$

732 ± 71

274 ± 26

 $-15.5 \pm 0.32$ 

20230813-A2 42.380.3 - 43255.7

20231027-A1 40,359.6 – 40,365.6 -10.9 ± 0.50

 $17.3 \pm 0.20$ 

 $1.87 \pm 0.22$ 

 $1.50 \pm 0.20 \mid 24.6 \pm 0.13$ 

## **Conclusions and Future Work**

Cloud cores have small increases droplet effective radius with altitude compared to other locations (Figure 15, Zhao et al. 2023).
Having an effective radius less than 14 µm indicates a lack of droplet coalescence in the parcel's updraft (Freud and Rosenfeld 2012).
Similar analysis will be conducted for additional cloud core measurements contained within the SARPEC data set.