Objective
1. Develop an objective classification technique to identify Deep Convective Systems (DCS) and separate their rain core and associated anvil clouds using merged radar and GOES observations.
2. Calculate Cloud Radiative Forcing (CRFs) of different cloud types within DCS (core, anvil) and quantitatively estimate their impact to the radiation budget.

Dataset
NEXRAD Q2 Product (NSSL)
- 3D Mosaic reflectivity in Southern Great Plain (SGP) region (8×15°)
GOES Cloud Product (NASA Langley)
- Pixel-level cloud property retrievals

Time Period: 2009-2010 Summer - JJA (6 months)

Separating DCS Anvils from Cirrus
- High cloud patch with precipitating area < 5% is marked cirrus [gray color in panel (d)]
- Cirrus patch that is connected to a DCS patch is not considered as anvil

Cloud Fraction and TOA Fluxes
- The diurnal cycles of DCS rain core and deep cloud are weak, but anvil clouds peak at 20-hr (LT) and remain high during night.
- TOA SW upwelling flux from total cloud is almost double of clear-sky value, but it is only half of rain core average.
- SW upwelling fluxes for rain core, deep cloud and thick anvil are only distinguishable near local noon hours from satellite optical sensors.
- Q2s are nearly identical for all DCS cloud types, except thin anvils during nighttime.

CRFs weighted by CFs

DCS CRF Contribution

Summary
1. During summer months over the SGP, the average SW CRF is -34 W m⁻² and LW CRF is 22.5 W m⁻², resulting in a net cooling of -11.5 W m⁻².
2. Of all clouds, DCS clouds contribute 48% in SW CRF, 59% in LW CRF, and 52% in NET CRF.
3. Within DCS, anvil cloud CRF (26%, 35%, 30%) contribute slightly more than DCS Tower (22%, 24%, 22%) [SW, LW, NET].