Ten Year Climatology of CAPE observations from Hyperspectral IR Sounders

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Introduction
High priority must be given to research for new remote sensing applications especially relating to severe weather. Extreme convective instability from remote sensing technologies should be incorporated into severe thunderstorm risk assessments. For example, a climatology of Convective Available Potential Energy (CAPE) is routinely used to characterize convection as having moderate or severe potential. Relating this climatology to near real time observations from meteorological sensors on weather satellites is going to be a valuable tool in assessing the risk of severe weather. Satellite data products from AQUA/AIRS were used to compute a 10 year climatology for the ARM Southern Great Plains site near Lamont, Oklahoma.

Methods
The following definitions were used in the computation of selective convective indices (Blanchard, 1998).

There is much discrepancy in calculating CAPE. Most of the discussion revolves around the standard way to lift a parcel (Doswell, 1994). The 4 most common parcel times are as follows: surface parcel, mixed layer parcels, parcel’s with the largest CAPE and the forecasted parcel. This paper utilizes the surface parcel method for calculating CAPE. In addition, this study uses the SHARPpy software routines described in Halbert et al., 2015 in comparison to the UW surface CAPE matlab script. SHARPpy is a program that can be used for both research and operational applications (Hart, 1999).

Surface Dependence
The correlation of AIRS CAPE with coincident ARM Sonde depends on surface dew point temperature error.

The table shows that the mean error in the surface parcel temperature and dewpoint temperature of both AIRS and ERA increases as the Sonde CAPE increases. The figures above show improved correlation for the subset of cases that have dewpoint error < 1 degree C.

Future Improvements
ASOS (Automated Surface Observing Systems) stations will be used to improve satellite CAPE east of the Rocky Mountains by providing an improved estimate of the surface parcel temperature and dewpoint.

References


Gartzke, J. et al. 2015, Comparison of Satellite, NWP and Radiosonde Convective indices in the southern Great Plains Region JGR, in preparation.


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An example of a smoothed soundings and an original sounding on August 27, 2005 at the ARM SGP site containing a nocturnal temperature inversion.

CAPE values (J/kg) computed from ERA-interim (left) and AIRS (middle) for May 20, 2013 (upper) and May 31, 2013 (lower). The star symbol represents the location of the ARM site (36.605 N, 97.485 W) and the circle symbol is the Norman Oklahoma location (35.23 N, 97.45 W), a distance of 153 km. The right panels illustrate the cloud development using MODIS visual satellite imagery.

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