Seasonal And Decadal Variation of the Mixed Layer Across the ACRF Using RWP Data

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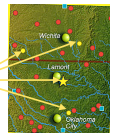
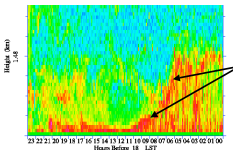
INTRODUCTION

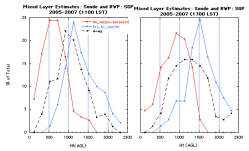
The radar wind profilers (RWPs) located at the ACRF Southern Great Plains site have been collecting data for more than a decade at the intermediate facilities (I1: Beaumont, KS; I2: Medicine Lodge, KS; I3 Meeker OK) and 15 years at the Central Facility. They provide a good picture of the temporal and spatial variation across the SGP site over this time period Here we elucidate the variation of the height of the mixed layer (z_i) and precipitation, two parameters that illustrate the potential richness of the wind profiler data beyond wind profiles.



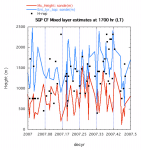
Daytime Mixed Layer

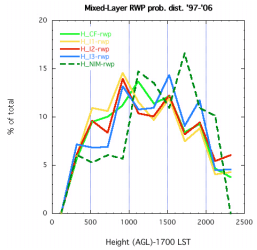


An automated routine, operating since 1997 uses primarily SNR to estimate z_i hourly.

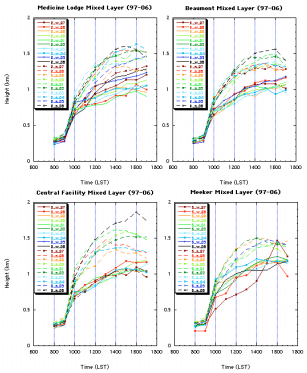


Comparison with estimates from radiosonde show good agreement (RWP values within entrainment zone, as expected)





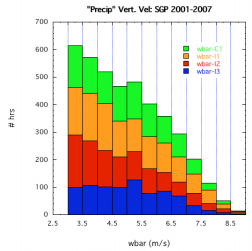
Overall distribution of 'end-of-day' (1700 LST) z_i shows minor differences among SGP sites. One-year's data from Niamey shows much larger values, not surprisingly.



Mean daily evolution of z_i shows roughly 30% larger values during summer (dashed) than winter (solid), 10-20% variability year-to-year and 10-20% variability from site-to-site.

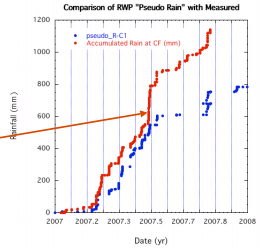
This should translate into similar temporal and spatial variations in boundary layer cloud base height.

Precipitation

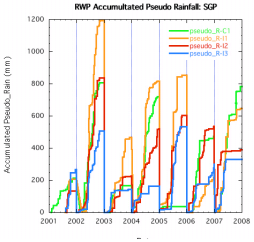


During rainfall events, scattering from raindrops overwhelms atmospheric scattering. We roughly related fall velocity (w_d) and droplet size (D) as $D = .27e^{(.304 w_d)}$ in order to estimate rainfall. Only hourly averaged vertical velocities greater than 3 m/s were included.

A comparison of RWP "pseudo" rainfall with tipping bucket measures at the CF indicates good correlation.



Very heavy, short-lived periods of rainfall are undrestimated because of the hour-long average and the non-linear relationship of rain rate to droplet size.



Yearly integration of pseudo rainfall using RWP data illustrates the variability across the SGP (note: there are some periods when a system was down: 2005 [C1], 2004 and 2007 [I3])

Proper manipulation of the raw spectral data can result in accurate rainfall as well as a number of other parameters useful to cloud modelers, including vertical profiles of drop size distribution and number density.

Note: The sunset committee has declared that the Intermediate Facilities are no longer necessary: the authors feel that this is a short-sighted decision. On the contrary, much more can be gained, with little/no cost by colocating other instruments (TSI, e g.) with the current RWPs to obtain spatial cloud statistics, including vertical velocities.

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