Impact of ARM Radiosonde Humidity Corrections on Calculation of Convective Indices

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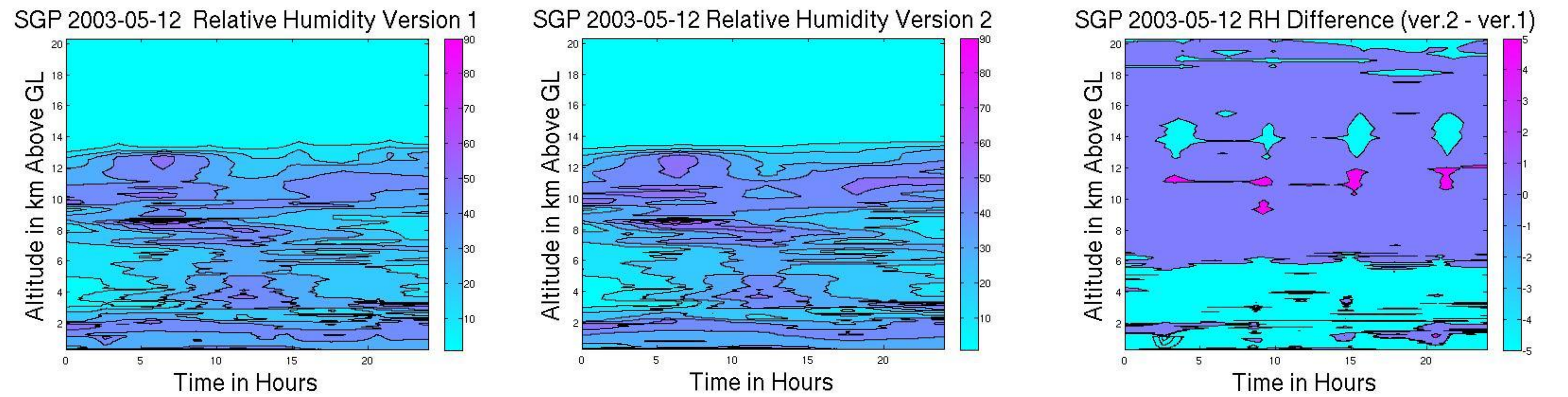
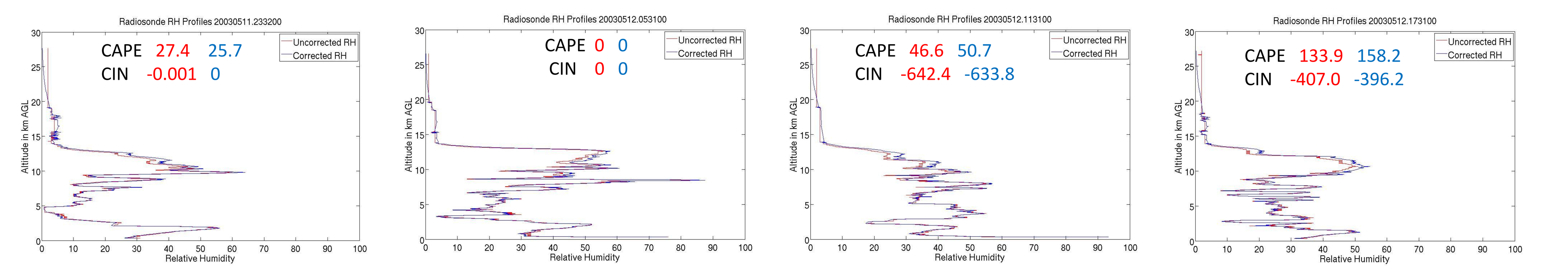
Background: Over the course of the history of the ARM and ASR programs, there have been efforts to improve the humidity profiles from radiosondes. Studies by Clough et al. (1996), Miller et al. (1999), and Lesht (1999) detected a dry bias and a loss of humidity calibration in ARM-used Vaisala soundings. Determining additional problems, devising and implementing numerical solutions to the known problems, and correcting the humidity readings from all types of Vaisala (RS-80, RS-90, and RS-92) radiosondes resulted in at least eight papers in the 2000s. Miloshevich et al. (2009, 2006, 2004, 2001), Hume (2008), Wang et al. (2002), Turner et al. (2003), and Vomel et al. (2007) present research that serves to enhance the community's knowledge of the radiosonde problems and to propose appropriate algorithmic solutions. These solutions to the humidity problems are incorporated in the **Sondeadjust** evaluation product. The **Sondeadjust** files are used as radiosonde input for the **Mergesonde** VAP. Differences in **Mergesonde** from use of either the uncorrected or the corrected radiosondes are presented at right.

Sondeadjust: In addition to including the original sounding output, derived fields contained in the output include (1) rh_smooth (relative humidity smoothed from the coarse resolution of the original sounding in order to better capture the physical surroundings), (2) rh_biased (relative humidity that is adjusted to eliminate the dry bias as reported in the literature), (3) rh_adjust (relative humidity that has been corrected for the sensor time lag and for solar warming), and (4) scaled relative humidity field (rh_adjust scaled by the integrated precipitable water vapor from the microwave radiometer). The four plots to the right show the differences between the uncorrected RH (red) and the corrected RH (blue) from radiosondes that were launched on 5/12/2003 at the SGP Central Facility. The launch times for each figure is 23:32 (5/11/03), 5:31, 11:31, and 17:31.

Convective Indexes: This presentation uses three relative humidity profiles (the original RH profile, the adjusted RH profile, and the scaled-adjusted RH profile to calculate the convective indexes CAPE and CIN. The intention of this work is to demonstrate the sensitivity of each RH correction on these thermodynamic variables. RH corrected radiosondes for the three types of Vaisala radiosondes – RS 80, RS 90, and RS 92 – used by ARM are analyzed for the sensitivity for both CAPE and CIN. These radiosondes were launched from the SGP Central Facility.

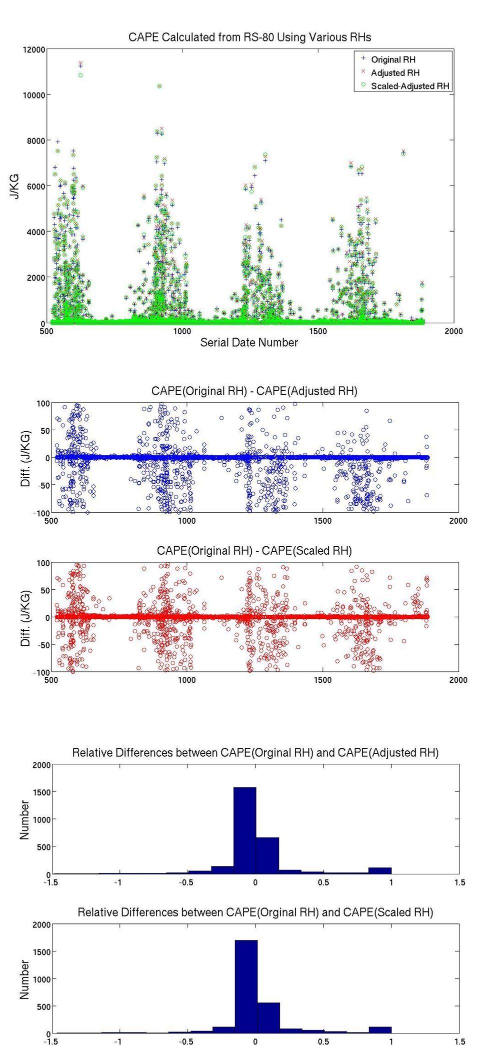




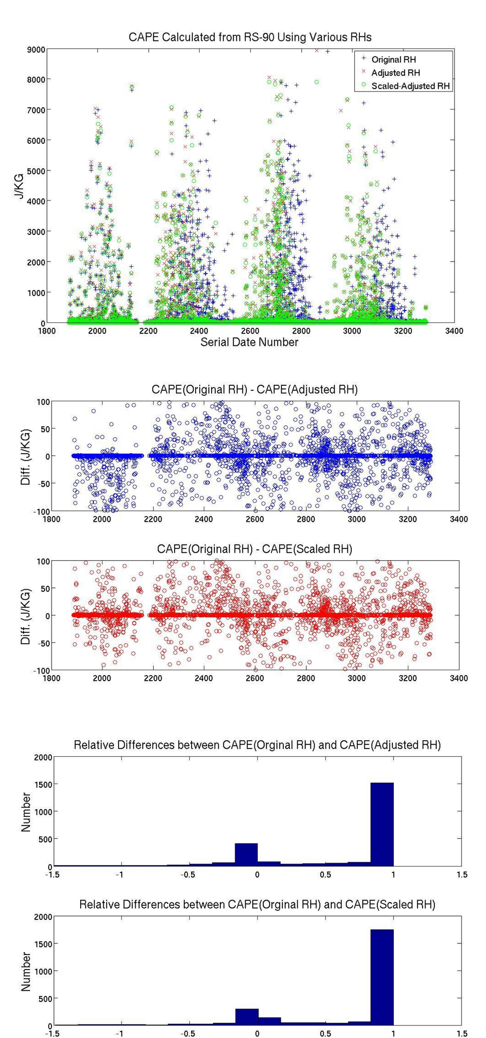
How to Interpret Relative Differences: Relative differences (x) of CAPE and CIN are calculated as x = (Original-Changed) / Original.
For CIN: When *x* < 0, *Changed* is less than *Original;* when *x* > 0, *Changed* is greater than *Original;* when *x=1, Changed is 0.*
For CAPE: When *x* < 0, *Changed* is greater than *Original;* when *x* > 0, *Changed* is less than *Original;* when *x=1, Changed is 0.*

CAPE

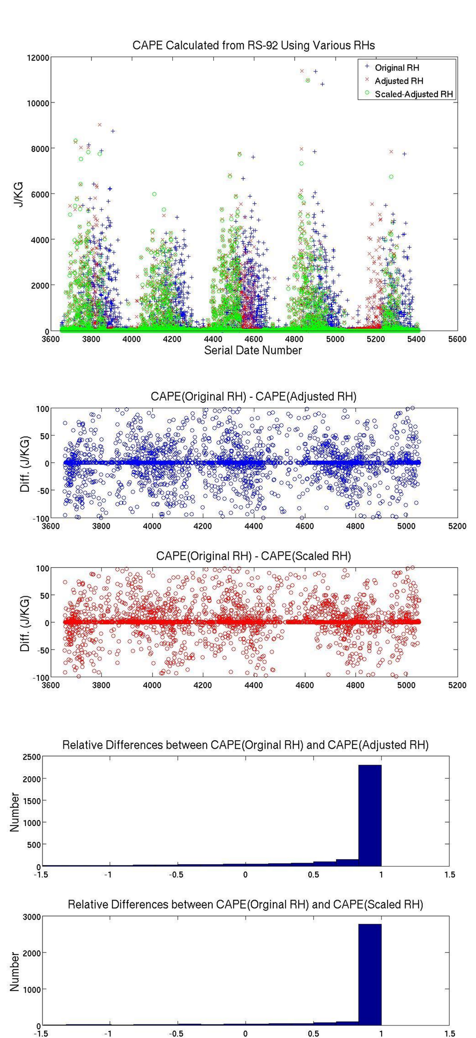
Vaisala RS-80 1996-2000 (Feb)



Vaisala RS-90 2000 (May)-2004



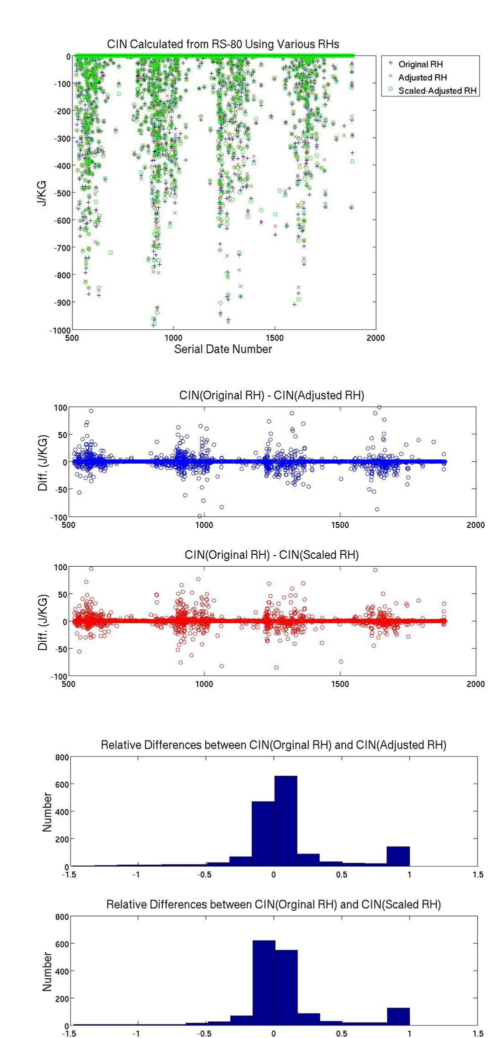
Vaisala RS-92 2005-2009



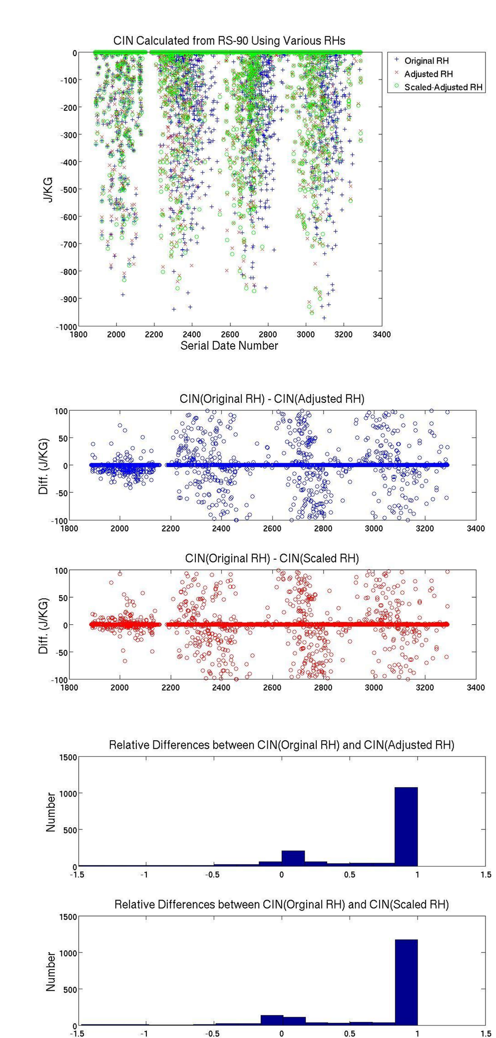
	Mean Relative Difference	Median Relative Difference	Mode Relative Difference	Standard Deviation Relative Difference
RS-80	0.02 (0.03)	-0.02 (-0.01)	1.00 (1.00)	0.28 (0.28)
RS-90	0.61 (0.69)	0.99 (1.00)	1.00 (1.00)	0.56 (0.51)
RS-92	0.79 (0.86)	1.00 (1.00)	1.00 (1.00)	0.47 (0.40)

CIN

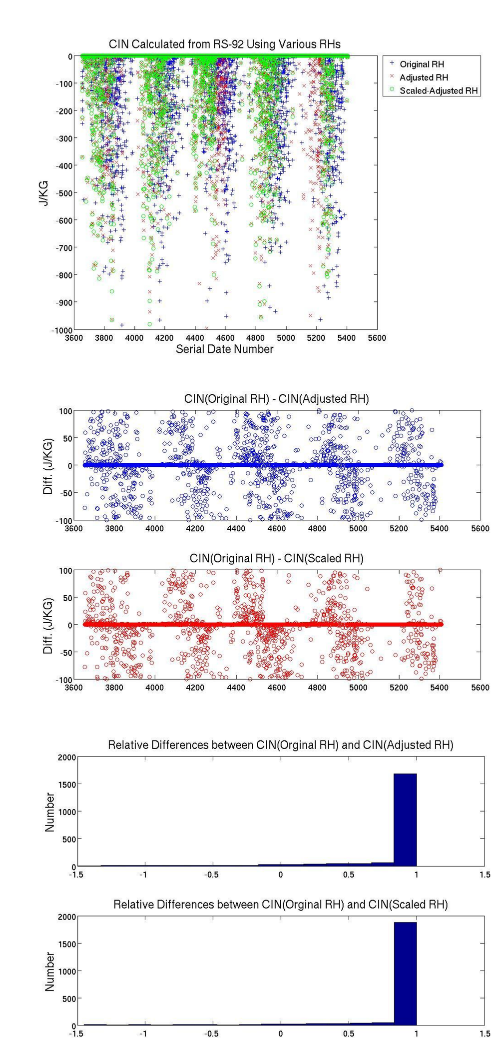
Vaisala RS-80 1996-2000 (Feb)



Vaisala RS-90 2000 (May)-2004



Vaisala RS-92 2005-2009



	Mean Relative Difference	Median Relative Difference	Mode Relative Difference	Standard Deviation Relative Difference
RS-80	0.09 (0.09)	0.03 (0.01)	1.00 (1.00)	0.36 (0.34)
RS-90	0.68 (0.72)	1.00 (1.00)	1.00 (1.00)	0.51 (0.49)
RS-92	0.83 (0.89)	1.00 (1.00)	1.00 (1.00)	0.45 (0.36)