1. INTRODUCTION

Vaisala radiosonde relative humidity (RH) measurements are widely used in such applications as numerical modeling, radiative transfer calculations, climatology development, validation of remote sensor retrievals, and development of cloud parameterizations. The accuracy of these RH measurements can be improved, especially in the upper troposphere, by correcting for known sources of measurement error. Laboratory measurements conducted by Vaisala have led to development of corrections for sensor time-lag error (Miloshevich et al. 2001, 2002) and for dry bias errors (Wang et al. 2002, Miloshevich et al. 2001a). This poster summarizes the correction algorithm and its validation, and shows the effect of the corrections on the radiosonde data acquired during CRYSTAL-FACE.

2. CORRECTIONS APPLIED TO VAISALA RADIOSONDE HUMIDITY DATA

Time-lag: A numerical inversion algorithm that calculates the ambient (true) RH profile from the measured RH and T profiles, based on laboratory measurements of the sensor time-constant as a function of temperature (Fig. 1).

Temperature-dependence: Addresses inaccuracy in the temperature dependence of the sensor calibration at cold temperatures (Fig. 2). Applies to RS80-H radiosondes only.

3. VALIDATION OF THE CORRECTION ALGORITHM

The correction algorithm was evaluated by comparing simultaneous measurements from RS80-H radiosondes and the reference-quality NOAA/CMDL cryogenic hygrometer (Vömel et al. 1995). The figures show profile comparisons and analysis of the 40 dual soundings.

4. GENERAL CHARACTERISTICS OF THE HUMIDITY SENSORS AND CORRECTIONS

- RS80-H corrections increase moisture in the UT and steepen humidity gradients above and below moist tropopause and cirrus layers (a). R909 correction is much smaller (b).
- Sippican (VIZ) carbon hygrometer sensors are unresponsive and not useful when T < 30°C (c).
- Supercooled liquid water may cause icing of RS80-H sensors (but not R909). Icing is identified by outrageous measurements in the stratosphere (d), and are not trustworthy above the icing event. Icing cases at Miami and Tampa NWS sites are identified in the archived data.

5. MAGNITUDE OF THE CORRECTIONS AT EACH RADIOSONDE LAUNCH SITE

- Corrections increase water vapor in the UT by 20% on average, at RS80-H (NWS) sites only.
- Corrections decrease water vapor in the LS by 20% at all sites, steepening UT/LS transition.
- Variability is large due to dependence of time-lag correction on the local humidity gradient, so mean values are only descriptive in a statistical sense. Range of variability is important.

6. MEAN RH PROFILES AT EACH RADIOSONDE SITE, AND IMPACT OF CORRECTIONS

- High-RH layers are consistently seen at all sites in the UT, MT, and surface. (VIZ is bad in UT)
- After correction, RS90 sites are noticeably drier than RS80-H sites in the UT. Two possibilities: 1) it is real; 2) a sensor-dependent bias remains (probably in R909). Need correlative data!