2.2 Microwave Radiometer Precipitable Water Vapor

Once data from GRIDDEDSONDE has been interpolated between soundings, INTERPSONDE uses estimates of PWV from MWR measurements as a constraint (Turner et al. 2007). As shown in Table 3, the process first attempts to use PWV estimates from the MWR Retrievals VAP (MWRRET; mwrret1liljclou; Gaustad et al. 2011), if available, and then from MWRLOS. [1]

Table 3. Input datastream and variable names.

Datastream	Input Variable
mwrret1liljclou.c1 or mwrretliljclou.c2	be_pwv
mwrlos.b1	vap

3.0 Algorithm and Methodology

3.1 General Flowchart

The flowchart in Figure 4 depicts the general steps involved in the production of the INTERPSONDE VAP.

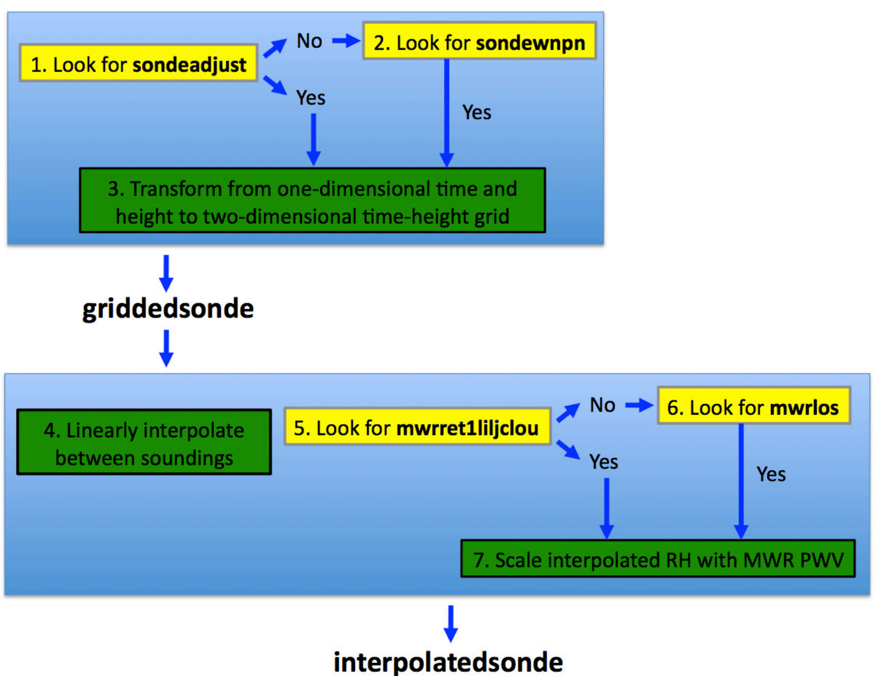

Figure 4. Steps to produce the INTERPSONDE Value-Added Product.

Note that, when processing a day of INTERPSONDE, ±2 days' worth of input data are retrieved. In this way, values may be interpolated in gaps between soundings of up to 5 days.

[1] http://www.arm.gov/data/datastreams/mwrlos

3.2 Relative Humidity Scaling Flowchart

In Figure 5, we expand on step 7 from Figure 4, depicting the steps required to scale the relative humidity.

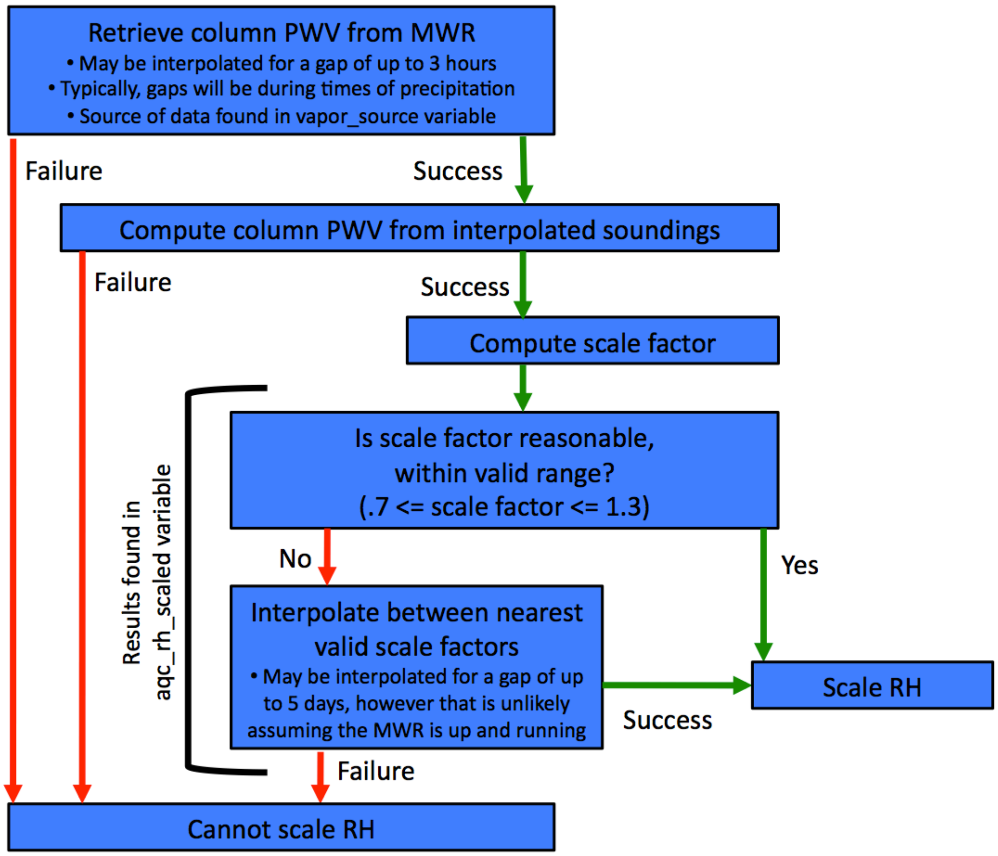

Figure 5. Steps taken to scale relative humidity.

4.0 Output Data

4.1 Output Variables

Table 4 lists the meteorological variables provided by INTERPSONDE, along with long name, an indication of whether quality control (QC) data exists for the variable, and an indication of whether source data is available for the variable. Tests to ensure that values are within a valid range are provided for variables interpolated from GRIDDEDSONDE, as well as the scaled relative humidity. Computed values, such as specific humidity, wind speed, wind direction, and potential temperature, do not require QC tests. Source fields are provided for variables from GRIDDEDSONDE, indicating whether the source is GRIDDEDSONDE itself or interpolation.

Table 4. INTERPSONDE meteorological variables.

Variable Name	Long Name	Units	QC	Source?
precip	Precipitation	Mm	yes	No; static source
temp	Temperature	ºC	Yes	Yes
rh	Relative humidity	%	Yes	Yes
vap_pres	Vapor pressure	kPa	Yes	No; computed
bar_pres	Barometric pressure	kPa	Yes	Yes
wspd	Wind speed	m/s	Yes	No; computed
wdir	Wind direction	degree	yes	No; computed
u_wind	Eastward wind component	m/s	Yes	Yes
v_wind	Northward wind component	m/s	Yes	Yes
dp	Dew-point temperature	ºC	Yes	Yes
potential_temp	Potential temperature	K	Yes	No; computed
sh	Specific humidity	g/g	Yes	No; computed
rh_scaled	Relative humidity scaled using MWR	%	Yes[a]	No[b]

[a] In addition to the general valid range QC provided for rh_scaled, ancillary QC provides additional information, in aqc_rh_scaled, that describes the quality of computed scale factors (Figure 5).
[b] The vapor_source variable provides the source of the PWV used for scaling relative humidity (Figure 5).

4.2 Grid Resolution

Regarding the fixed grid of INTERPSONDE, the temporal resolution of the VAP is 1 minute, and the vertical resolution varies with height as shown in Table 5.

Table 5. Vertical resolution (on 332 levels).

Height (km above ground level)	Resolution (m)
0–3.5	20
3.5–5	50
5–7	100
7–20	200
20–~40	500

5.0 Summary

The INTERPSONDE VAP, a continuous time-height grid of relative humidity-corrected sounding data, is intended to provide input to higher-order products, such as the Merged Soundings (MERGESONDE; Troyan 2012) VAP, which extends INTERPSONDE by incorporating model data. The INTERPSONDE VAP also is used to correct gaseous attenuation of radar reflectivity in products such as the KAZR Corrected Data VAP (KAZRCOR).

6.0 References

Gaustad, KL, DD Turner, and SA McFarlane. 2011. MWRRET Value-Added Product: The Retrieval of Liquid Water Path and Precipitable Water Vapor from Microwave Radiometer (MWR) Data Sets. U.S. Department of Energy. DOE/SC-ARM-TR-081.2.

Miloshevich, LM, H Vomel, DN Whiteman, and T Leblanc. 2009. "Accuracy assessment and correction of Vaisala RS92 radiosonde water vapor measurements." *Journal of Geophysical Research – Atmospheres* 114(D11): D11305, https://doi.org/10.1029/2008JD011565

Troyan, D. 2012. Merged Sounding Value-Added Product. U.S. Department of Energy. DOE/SC-ARM-TR-087.

Troyan, D. 2011. Sonde Adjust Value-Added Product Technical Report. U.S. Department of Energy. DOE/SC-ARM-TR-102.

Turner, DD, SA Clough, JC Liljegren, EE Clothiaux, KE Cady-Pereira, and KL Gaustad. 2007. "Retrieving Liquid Water Path and Precipitable Water Vapor from Atmospheric Radiation Measurement (ARM) Microwave Radiometers." *Geoscience and Remote Sensing* 45(11): 3680−3690, https://doi.org/10.1109/TGRS.2007.903703

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