

## ***Interactive comment on “Spatial and seasonal patterns of near-surface humidity in the foothills of the Canadian Rocky Mountains, 2005–2010” by Wendy H. Wood et al.***

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Paul Whitfield review of: Spatial and seasonal patterns of near-surface humidity in the foothills of the Canadian Rocky Mountains, 2005-2010 Wendy H. Wood, Shawn J. Marshall, and Shannon E. Fargey

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Overview: This manuscript introduces a detailed spatial dataset for surface humidity in the foothills east of the Canadian Rocky Mountains. Previously these authors have shared a dataset for surface temperatures for this same network. This manuscript

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explains the methods by which specific humidity and relative humidity data were quality controlled and missing data were infilled. The authors provide some examples that illustrate the potential for this dataset to be used in further studies.

This is an interesting dataset and the authors have presented sufficient information for it to be used by others.

Major Comments:

There are several places where the text is difficult to follow, and several places where the text could be shortened. I found the Abstract to be difficult to follow because of organization. There is quite a bit of repetitive text especially in the summary which should be edited for brevity.

The examples provided in Figures can be improved. When providing figures illustrating seasonal and spatial patterns it would be preferable to use a consistent colour scale so the reader could more readily see the seasonal and spatial differences. I particularly object to the use of colour scales with three colours when two would be sufficient (Figures 4 and 7). I would encourage the authors to consider a different colour palette for Figures 5 and 6

There are several places where there are inconsistencies or missing information that is needed to properly describe the results. These are noted in the detailed comments below.

Detailed comments:

Page 1 line 11: The following sentence is unclear. "Hourly air pressure measurements at Calgary Airport are adjusted for elevation to calculate specific humidity from the vapour pressure." Do you mean? Specific humidity was calculated from the vapour pressure and adjusted for elevation using hourly air pressure measurements at Calgary Airport.

Line 16 neighbourhood instead of neighbourhood.

I think that the text in the abstract is awkwardly ordered. The following might be better.

Near-surface humidity was monitored from 2005 to 2010 in a mesoscale network of 232 sites in the foothills of the Rocky Mountains in southwestern Alberta, Canada. Daily mean specific humidity, relative humidity, and vapour pressure from the multi-year study are available at <https://doi.pangaea.de/10.1594/PANGAEA.889435>. The monitoring network covers a range of elevations from 890 to 2880 m above sea level and an area of about 18,000 km<sup>2</sup>, sampling a variety of topographic settings and surface environments with an average spatial density of one station per 78 km<sup>2</sup>. This manuscript describes the processing methods used to quality-control and gap-fill the data. Overall data coverage for the study period is 89%. Inverse-distance weighting techniques are used to estimate the missing 11% of data, based on neighbourhood values of daily mean specific humidity. Hourly screen-level temperature and relative humidity were recorded over the study period, forming the basis for daily mean relative humidity and vapour pressure estimates. Specific humidity was calculated from the vapour pressure and adjusted for elevation using hourly air pressure measurements at Calgary Airport. We provide plots of seasonal and spatial humidity patterns for the dataset to illustrate the relations between humidity variables and temperature, elevation, and longitude in the region. We provide examples of monthly mean lapse rates of specific and relative humidity based upon this dataset as an illustration of one potential use.

Page 2. I note that ESSD allows lists of references to be by importance, chronologically, or alphabetical. It appears the choice here is chronological and is consistent throughout.

Line 21 Holden and Joly 2011 is cited but no reference provided.

Line 29 Segal et al 1992 is cited but no reference provided. Also Lengfeld and Ament 2012 is cited but no reference provided.

Page 3. Line 13. Consider changing “Here we present the mean daily values of relative humidity, specific humidity, and vapour pressure over the five-year study.” To:

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The dataset contains the mean daily values of relative humidity, specific humidity, and vapour pressure over the five-year study.

Lines 10-18. Consider adding a statement that where erroneous or missing data were gap filled the data has a flag.

Page 4. Line 26. Consider changing Calculation of mean daily humidity values can be complicated, due to the fact that RH is a constructed variable that depends non-linearly on both temperature and actual humidity. To: Due to the fact that RH is a constructed variable that depends non-linearly on both temperature and actual humidity, calculation of mean daily humidity values is more complicated.

Footnote 1: I do not understand the relevance of this footnote.

Page 5. Line 11. In the abstract you refer to Calgary Airport and that should be retained here: For a site with elevation  $z$  (m) and absolute temperature  $T_K$ , we estimate pressure based on the assumption of a standard atmosphere, using Environment Canada data from Calgary Airport which has a reference elevation of  $z_0 = 1099$  m.

Line 24. Delete “However,” as what follows is a statement of fact.

Line 26. Change to wording: We anticipate that some applications of the data may require daily RH data and others may require actual humidity measures ( $ev$  or  $qv$ ), so we include estimates of mean daily humidity derived from both methods in the dataset.

Page 6 line 7. Change “The reference site” to This reference site”

Page 7 line 15 insert “were” so “measures were calculated”

Line 23 “... has been used by Nalder and Wein (1998); however, there is variable topography in the FCA area. . .

Page 8 line 34. Here you say the optimal results are for 18 neighbours, but on page 15 line 2 you say 15. I would expect these to be the same number, or did I miss something?

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Page 9 line 18. There are problems with this sentence: This is also true for the percentage difference (Figure 2), where  $\Delta qv$  has a roughly relationship with both temperature and diurnal temperature amplitude across the full range of observed conditions (with exceptions to this behaviour).

This is also true for the percentage difference (Figure 2c & d), where  $\Delta qv$  has a roughly linear relationship with both temperature and diurnal temperature amplitude across the full range of observed conditions (with exceptions to this behaviour).

Line 22. Delete “However,”

Page 10 lines 12-21. There is something that I am missing about Figure 3. Panes a and b are the actual observations and panels c and d are the interpolated values. That would explain, based upon the method described for interpolation why the highs in a/c and lows in b/d are different. On page 7 line 15 it states that 89% of the values were complete, so when the interpolated values, which I assume to be about 11% of the total are plotted in Figure 3 the frequencies are about the same whereas I would expect the interpolated frequencies to total to a much smaller number than the actual data.

Page 13. Line 7. Should be “classic example”

Line 25. This is the very first mention of the fact that the interpolated values were accompanied by a flag. I think that this should have been mentioned earlier in the manuscript.

Page 14. Summary. I found the nearly two page ‘summary’ to be very repetitive to the preceding text. And seems to diverge from the subject of the dataset itself.

The second paragraph should be moved to page 4 after line 12.

Paragraph 6 [page 15] is very similar to page 12 lines 9-16. It would be better if these two were combined into a single paragraph on page 6.

Paragraphs 3-5 could be shortened in a summary.

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Page 15. Line 2. See my previous comment about the consistency of 15 or 18 neighbours.

Page 16. Missing references: Segal et al 1992 Holden and Joly 2011 Lengfeld and Ament 2012

Page 19. Figure 1. This just might be the quality of the Figure in the pdf that may have been generated from a Word document but the resolution is not very good.

I do not think that the inset 'b' is necessary since the location of the FCA is clear in 'a'. Inset c would need an elevation scale to be added.

Figures 4 and 6. This is a personal perspective, but I find that the present colour scales and different scales between panels leave too much for the reader to interpret. I suggest that only a single colour scale be used i.e. white to red or white to blue and the same scale to be used in each sub-panel in the figure. Single colour [i.e. white to red] scales survive grayscale printing and are easier to interpret. Using a common scale for similar panels as in Figure 4 lets the reader see both the seasonal and spatial scale; this is not the case with Figure 4 or 7.

In Figure 4 it is not immediately evident that summer has much higher specific humidity that fall because of the use of different scales and red-white-blue colour scales. In 'd' the blues are actually » than the reds in 'b'. Also, the ordering of panels in Figure 4 is odd. A more common order would be MAM, JJA, SON, DJF.

Figure 7 would be better with a single colour scale [white to red or white to blue] and common ranges for each of specific and relative humidity. This would allow the reader to readily see the differences between the four events. Here, you might use white to blue for one column and white to red for the other to distinguish between specific and relative humidity.

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