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Atmospheric Measurement Techniques Discussions

Interactive comment on "Global Hawk dropsonde observations of the Arctic atmosphere during the Winter Storms and Pacific Atmospheric Rivers (WISPAR) field campaign" *by* J. M. Intrieri et al.

J. M. Intrieri et al.

janet.intrieri@noaa.gov

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Referee #2 Comments/Responses

Hello Reviewer 2, Your comments were greatly appreciated and contributed to the paper's scientific intent. See below for point-by-point responses and text additions.

1. p 4073 lines 1-5: I suggest mentioning here how the dropsonde data is communicated to the operators at the ground control station (via satellite link?). I realise this is stated on lines 2-3 on p4074, but it would help the reader if it was mentioned at earlier.

The following sentence was added in Section 2, paragraph 4: In-situ data collected

from the sondes sensors are transmitted back in real time to an onboard aircraft data system via radio link and then transmitted to the ground-control station via satellite communications link.

2. p 4075 lines 19-20: "The wind direction measurements reïňĆect that the vortex centre was to the northeast of the ïňĆight trajectory". This is not immediately obvious. Expand on this brieïňĆy by describing the direction of the vortex winds in relation to the ïňĆight path.

The following text was added: The asymmetry in the wind speed and direction measurements indicate that the vortex center was to the northeast of the flight trajectory which was evident as well by satellite observations of total ozone.

3. p 4077 lines 12-14: "The Barrow sounding is clearly too humid in the upper troposphere and stratosphere...." How do you know for sure that it is the Barrow sounding that is too humid, rather than the dropsonde measurements not humid enough? I realise it is hard to tell. Removing "clearly" from the above sentence would weaken the statement.

The sentence was edited to reflect the above comment.

4. p 4079, lines 8-12: State speciïňĄcally what is meant by "lowest atmospheric levels". Also state here which ïňĄgure is being referred to.

"Lowest atmospheric levels" here means surface to 500 m (now added into text). This statement refers to figure 6 – specifically the boundary layer figure in the bottom left. Text was added to reflect both comments (also now referred to in the text).

5. Fig 6: Add markers to the lines representing the reanalysis products so it is easy to see the vertical resolution of the model. Markers may already exist but the ïňĄgure quality makes them hard to see, so perhaps enlarge them. The difference in vertical resolution between the observations and the reanalysis products in relation to apparent model biases should be discussed brieïňĆy somewhere in section 4.

Markers were added to an updated Figure 6. This statement was added in section 4: “While the spatial resolution of the reanalysis products is much coarser than that of the dropsondes, the biases observed does not necessarily appear to be linked directly to this discrepancy. ERA-Interim appears to have sufficient resolution to resolve some of the major features observed in the radiosonde and dropsonde profiles, yet fails to do so. The low resolution of the R-2 product could be to blame for some of the biases detected for the lower atmosphere, given the limited number of data points available for the lowest 1.5 km do not allow that model to resolve some of the major features observed”.

6. Fig 6: Add the times of the reanalysis products (1200 UTC?) to the coloured text at the top of the ïňĄgure.

Times have been added in a new Figure 6.

7. p 4080, line 7: “... the near-surface stability with R-1 being too stable and with ERA-I not being stable enough” DeïňĄne what altitude range you deïňĄne to be near-surface. Also, which part of which ïňĄgure shows this? A panel showing potential temperature (θ) or better, dθ/dz would be a useful addition to Figs 6 and/or 7.

This has been reworded to say: “the near-surface stability (surface to 1 km) with ERA-I not being stable enough”. There is insufficient evidence to support R-2’s performance. Near surface stability here is determined to be from 1 km to the surface.

8. Red shading representing MODIS data in Fig 3 and top panel of Fig 5: It is not clear what exactly the shading is supposed to show. A colour bar, units and/or a short explanation of what this shading shows is required. Changing the colour scheme of the shading may help.

Figure 3 was modified to take out the MODIS image and just represent the flight track. The text was added to describe the shading scheme. Detailed image information- Instrument: Moderate Resolution Imaging Spectroradiometer (MODIS), Satellite: Terra

Earth Observing Satellite AM (EOS AM) Overpass time: 10:30 am, Bands used for the image are: Band 3 (459-479 nm), Band 6 (1628-1652 nm), Band 7 (2105-2155 nm), Resolution: 500 m The 3-6-7 composite assigns Bands 3, 6, and 7 (479 nm; 1652 nm; 2155 nm) to the red, green, and blue components of a digital image. This combination is good for revealing snow and ice because they are very reflective in the visible part of the spectrum and very absorbent in Bands 6 and 7–which are in the short-wave infrared (SWIR) part of the spectrum. Using the 3-6-7 band combination over true-color provides an advantage for distinguishing liquid water from frozen water. Snow and Ice: Since the only visible light used in these images (Band 3) is assigned to red, snow and ice appear bright red. The more ice, the stronger the absorption in the SWIR bands, and the more red the color. Thick ice and snow appear vivid red, while small ice crystals in high-level clouds will appear reddish-orange or peach.

Water: Liquid water on the ground will be very dark since it absorbs in the red and the SWIR, but small liquid water drops in clouds scatters light equally in both the visible and the SWIR, and will therefore appear white.

9. Fig 7: It is very hard to differentiate between the bars and whiskers. Can the thickness of the bars (and size of the central dots) be increased?

A black line that represents the mean error values at each level has been added to a new Figure 7.

Interactive comment on Atmos. Meas. Tech. Discuss., 7, 4067, 2014.