

Interactive comment on “An experimental 2DVAR retrieval using AMSR2” by David Ian Duncan et al.

Anonymous Referee #1

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1 Overall

This paper evaluates SST and wind speed retrieval from AMSR-2 data using 2DVAR. While AMSR-2 data have been operationally used for SST and wind retrieval, this is a novel application of 2DVAR to the AMSR-2 data.

This is an attractive technique since it avoids the Backus-Gilbert resampling (or averaging) that is used to ensure that T_B s from multiple channels share similar effective footprints (or fields of view (FOV)), moves from a pointwise to field-based retrieval in order to take into account the spatial correlation of the true underlying wind/temperature fields, and exploits the oversampled measurements (especially at lower frequencies) to minimize noise and maximize spatial resolution. Additionally, the retrieved output values directly contain error estimates as well as the effective retrieval “footprints”.

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The research to evaluate this method is performed well and has anticipated all of my concerns. The paper is laid out well, and has sufficient references to motivate the problem and describe the previous work. The results using simulated and actual data are instructive and illuminating. The figures are clear and the English usage is good. Overall, this paper is quite well done. I recommend it for publication.

2 Specific comments

I have a few comments.

- Several times on page 2 and later on, “pixel” is used to refer to the measurements. I think a better word would be “measurement” or “observation”. One may form an image from the AMSR-2 T_B values, but as shown later in the paper each T_B measurement really is an average over an extended area weighted by the antenna footprint. “Pixel” usually connotes a square bounding box, which is a stricter definition than needed.

However, I’m all right with how pixel is redefined later in section 3.2. I think that definition should happen before the first usage in the introduction or (my preference) just use “measurements” until then.

- In equation 4, why are there asterisks between the terms? At first I thought this was a Kronecker product instead of a matrix multiplication, but after some time I think it is just a “regular” matrix multiplication operator.
- Page 5, line 29: the decorrelation distance is set to 1 degree. This is probably fine for the scope of this paper, but for global or high latitude retrievals, this may yield odd results. The linear distance of a degree of longitude or latitude varies as a function of latitude. For the second study region in the Southern Ocean, the

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zonal decorrelation length is about 70 km, whereas in the first study region it is about 105 km.

- Page 7, line 27: the spacecraft position is assumed constant over the course of a scan. How long does an AMSR-2 scan take? Or, by how much does AMSR-2 really move over one scan? I think the assumption of constant position would introduce some small error that is zero along one scan edge but increases along the scan. This helps simplify the calculations and is probably okay for the scope of this paper, but I think this should be addressed in future work.
- Page 15: possible errors due to the emissivity model. I concur with the speculation that the FASTEM model may be inaccurate at low SSTs. I am not very familiar with that particular model but I know that a few microwave emissivity models are available. I suspect that it would not be too difficult to swap out a different emissivity model. Unless it can be done quickly for this paper, I certainly recommend evaluating other models in future work.

3 Technical corrections

I have a few technical corrections.

- Table 1, and the colorbar and axis labels in Figure 3: the units (GHz, K, km, etc) should not be italicized
- Page 9, line 26: change “according to Table 1” to “according to the NEDT values from Table 1”
- Page 10, line 2: I think “WSP SI292” was meant to be “WSP is 292 K” or probably “WSP $\text{\SI{292}{\kelvin}}$ ” since it looks like the “siunitx” package is in use

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- Figures 3, 5, and 7: overlaying the “dots” to show the error values on top of a background of the “true” values is a clever way to show both quantities but it does make it a little hard to read. Overlaying the FOVs is helpful but it does not help the problem. However, I don’t have a good suggestion on how to present it instead.

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