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Interactive comment on “Controlled meteorological (CMET) balloon profiling of the Arctic atmospheric boundary layer around Spitsbergen compared to a mesoscale model” by T. J. Roberts et al.

Anonymous Referee #2

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The paper compares model simulations carried out using a mesoscale meteorological model, with resolution down to 1 km, with observations from controlled meteorological balloons. This comparison bears on the polar atmospheric boundary layer, the balloons being launched from Svalbard. The outcome demonstrates that the model fails to reproduce many characteristics of the observed boundary layer. The balloon technology used is new and makes it possible to obtain numerous vertical soundings along a flight. This study is of interest both because it is a demonstration of the usefulness of these controlled meteorological balloons and because it shows the deficiencies of the

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[Discussion Paper](#)



mesoscale model at these high latitudes and in the presence of complex terrain and of fractional sea-ice. The paper is clearly written, the conclusions are well supported. I recommend publication after a minor revision.

Major points:

1. CMET balloons are a new technology and this paper is an important demonstration of the possibilities that these balloons offer for investigating the Boundary Layer. As they are new, it would be useful to give some more description of the balloons, their design and principle, and the implementation. At present, there are a few sentences at the top of p27543. We understand or imagine what the balloons may be. It would be best to give more details (principle, autonomy, timescales for a vertical sounding, ascent/descent rates, range of altitudes that can be sampled...). Of course, this is certainly described in Voss et al, 2013; but a few sentences in the present paper would make it more self-sufficient...

2. The relative performances of the three ABL schemes used are not sufficiently described; the main conclusion insists that the three are fairly close together, and far from the observations, indicating that there is work yet to be done in understanding and modeling the polar ABL. Fine. Nonetheless, in the frame of the present study, were there some aspects which seemed better described with one scheme rather than the others?

Minor points: p27540, line 11: useful to add precision on finest resolution: 'nested grids down to 1 km'

p27541, line 9: remove comma: 'processes, is' -> 'processes is' (commas around 'however' could also be removed)

p27542, lines 9-20: make a table perhaps (type of instrument, number of observations, publication..)? This sentence is not readable.

p27543, line 2: commanded -> command

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Interactive Discussion

Discussion Paper



p27543, line 17: 'nunatak' will not be understood by many readers I expect; it may be justified to leave as is (and motivated readers will learn a new word...) or to change to something like "topographically induced convection", although less precise...

p27546, line 22: 'Gulf Stream' -> North Atlantic Drift rather...

p27547, line 3: 'cumulus convection was neglected' -> 'the cumulus convection scheme was unused'

p27548, line 2: become -> became line 3: 'given occurrence of' -> 'due to the presence of'?

p27566, figure 5: fonts are too small

p27568, figure 7: bottom right panel: for the direction, could the authors use or set up a color table that is periodic (ie the color for 360 should be the same as that for 0, eg by setting up the colormap twice, head to tail (there would be an inconvenient: a 180 degree ambiguity as each color would correspond to 2 angles) or by creating a periodic color table (eg blue to green to yellow to red to purple to blue)

p27570, figure 9: color map should be the same for all three panels in each column (see column 1, middle panel)

p27570-1, figure 9, 11: it is somewhat misleading to show observations from the whole flight and a cross section at only one given time on the same plot. Perhaps the observations should be restricted to those within +/- 4 hours of the cross section

p27573, figure 12 is difficult to read. This is perhaps an attempt to show too much information on one figure. The trajectories launched from a given height (black lines) seem fairly regular. Perhaps the authors could obtain a figure that is easier to read by showing only the balloon track and the final positions?

Interactive comment on Atmos. Chem. Phys. Discuss., 15, 27539, 2015.