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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 #3

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This paper presents the use of a new balloon technology to obtain numerous vertical soundings during a flight, an extremely useful tool for improving knowledge of weather with links to to climate in the Arctic region. Then, the balloon data is compared with the regional weather model WRF run during the same period. The strength of this paper is the measurements, there are some concerns about the WRF modeling that make it difficult to draw conclusions about the model performance as already pointed out by the short comment by GJ Steeneveld. This is a really interesting and exciting measurement technique and upon addressing the major and minor comments, the paper should be

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accepted as it's well within the scope of ACP.

Major comments:

- Recently a large problem in the surface skin temperature for the Noah Land Surface Model (LSM) over snow/ice was discovered and corrected in the most recent version of WRF (see comments for most recent WRF release 3.7.1 found online http://www2.mmm.ucar.edu/wrf/users/wrfv3.7/updates-3.7.1.html). This issue combined with the issue pointed for the YSU boundary layer scheme (noted in the short comment by GJ Steeneveld) make it clear that the model should be re-run and compared with the CMET data using the most recent WRF version, where these bugs have been corrected. In addition, the authors note they did not use fractional sea ice, which is currently commonly used for runs in the Arctic region. Finally, the authors didn't use any type of restart or nudging for the outer domain, which is also commonly used to ensure large scale meteorological features don't diverge from ECMWF.

- Rather than fixing all of these issues with the WRF run, it would be easier (and possibly even more convincing) for the authors to focus on the measurements and compare the CMET results with the meteorological forecast provided by ECMWF directly (currently these are used as the boundary conditions and initial conditions for their WRF run). Then, the authors can focus on the measurements and how they compare with ECMWF, the meteorological features that determine the balloon movement, and where the measurements and ECMWF do not agree, pointing to where the model can be improved in the future.

- The paper will be much stronger if the authors use the data to evaluate and improve WRF in a second paper mostly focused on modeling.

Minor comments:

- The paper should be re-edited for clarity and wording

- I would suggest to move the meteorological overview from the supplement into the

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main text of the paper.

- A few more details of how Figure 12 was generated and some more discussion of what this figure shows are needed.

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