Geoscientific
Model Development
Discussions

Interactive comment on "Implementation of a simple thermodynamic sea ice scheme, SICE version 1.0-38h1, within the ALADIN-HIRLAM numerical weather prediction system version 38h1" by Yurii Batrak et al.

Anonymous Referee #2

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General Comments:

This paper describes the impact of including a simplified ice scheme into the ALADIN-HIRLAM numerical weather prediction system version 38h1 for a short 2-month analysis period in March/April 2013 for 2 regions near Svarlbard and the Gulf of Bothnia with horizontal resolutions of 2.5 km. In the AROME Arctic domain, the SICE2D-NS (no snow) model performs best with the lowest mean error as a function of lead forecast time for mean sea level pressure, easily outperforming the reference run which does not include the SICE model. Some improvement is seen for that region with the 2-m air

temperature mean error, where up to a 0.5 °C improvement is made over the reference run where both have a negative bias. The SICE experiment without the snow model shows a fairly consistent 1° positive bias for the 3-45 hour lead forecast times. However, when examining the wind speed mean error, the reference run without the SICE model consistently showed the lowest bias. When examining the results for the Gulf of Bothnia domain, there was no discernible difference for any of the forecasts when examining sea level pressure. Overall, the SICE-NS experiment performed best for mean error and standard deviation for 2-m air temperature. The SICE-2D-S performed best for wind speed for both mean error and standard deviation. Experiments performed for March 2013 with a form drag parameterization (SICE-AD) could not outperform the reference run which did not include SICE. Qualitative figures presented for 2 days in March 2017 for the model versus MODIS ice surface temperature, bring little additional insight to the model performance.

The paper is filled with acronyms for numerous modeling systems (e.g., HARMONIE-AROME, ALADIN-HIRLAM etc.) which are never defined. The analysis period is short (March 1 – April 30, 2013), with limited data available for model-data comparisons.

For future reference, while coupling to an ice model such as CICE may provide the best overall improvement for Arctic NWP, the authors are encouraged to investigate the CICE Consortium's column physics package Icepack v1.0, which was released in February 2018. It is worth considering for future applications and is freely available to the public. (See https://github.com/CICE-Consortium/Icepack).

This paper is well written, but the study period is short. I recommend publication when the following issues are addressed in a revised version.

Specific Comments:

Although properly referenced, spell out all acronyms for the following:

HARMONIE-AROME, ALADIN-HIRLAM, CICE, GELATO, HIGHTSI, DWD, SURFEX

Section 3.3: The experiments occur during a short period of time, ~2 months. Can these be extended for a longer period to better assess the model's performance? How does the model perform during the summer melt season? Instead of initializing with a constant ice thickness value of 0.75 m, consider testing with 28-day averaged near real-time, or seasonal values from CryoSat-2 (CPOM, see http://www.cpom.ucl.ac.uk/csopr/seaice.html). Seasonal (Spring and Autumn) derived ice thickness data is available going back to 2011). Data is available on a 1 and 5 km grid.

Page 13: Sec 3.4: I would like to see actual comparisons between MODIS and the model experiments (e.g., tabular statistics). On page 13 lines 7-8, you state "Statistical assessments require application of special methods, which were out of the scope of this study". Why? This would add value to your paper and possibly complement the results already shown. For the examples shown for March 2017, please add figures that show the HARMONIE-AROME run without SICE. In addition, check the availability of VIIRS ice surface temperature from NSIDC: https://nsidc.org/the-drift/data-update/viirs-sea-ice-surface-temperature-swath-data-now-available. If VIIRS is available, can you examine the difference between the modeled ice surface temperature with the SICE experiments versus the VIIRS product?

Technical Corrections:

Page 3 line 10: change to "The scheme that is developed"

Page 6 line 16: define ISBA

Page 6 line 25; insert a comma after "In this case"

Page 7 line 25: what do you mean by "screen level"?

Page 11, 12, 13 (twice), 15: replace "happens" with "occurs"

Page 15 line 25: should read "which is not available to the general public"

Page 20: Müller references should be listed as 2017a and 2017b; correct the text as necessary.

Page 20: check spelling for Posey references, several surnames spelled wrong.

Page 22: Is there a range for the number of snow layers? If yes, please state it.

Page 23: Table 2: Define the "ice scheme" in the caption.

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