

Geosci. Model Dev. Discuss., referee comment RC1
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Comment on gmd-2021-199

Anonymous Referee #1

Referee comment on "Geometric remapping of particle distributions in the Discrete Element Model for Sea Ice (DEMSI v0.0)" by Adrian K. Turner et al., Geosci. Model Dev. Discuss., <https://doi.org/10.5194/gmd-2021-199-RC1>, 2021

General Comments

Over the long-time scales required for Earth system models large amounts of particle convergence can occur in Lagrangian models of sea ice. As a result, the particle configuration often needs to be "reset" to accommodate the large deformation. To address this, the authors present a novel particle-to-particle remapping scheme in their Lagrangian particle-based sea ice dynamics model DEMSI. A number of numerical examples are presented to highlight the method. Overall the article is well written and presents a critical method needed in Lagrangian particle methods of sea ice dynamics at basin scales and long time.

Specific Comments

Line 205 mentions neighboring source elements. Are neighbors in this case defined as all of the source polygons that intersect with a single target polygon?

Is equation (28) correct? Should the sum be over i instead of ij ? Also, ice thickness category k is listed on the left-hand side of the equation. Should it also be included on the right-hand side?

Line 259 states that "... the effective area is set to the polygon area A_{pj} ..." Is this statement in conflict with equation (8)? Where the effective area of the target polygon is calculated.

Line 449 mentions "the final distribution is smooth with similar results to that obtained in section 4.2" Should it be exactly the same? And if so is it worth comparing the two results?

Figure 11 shows lower ice concentration elements at the edge of the ice wake (northeast of the island). Is this expected? Or is this an artifact of the diffusive nature of the remapping?

Were thickness distributions examined in any of the two-dimensional cases? For example, in the island case would we expect to see ice thickness growth as ice collides with the island (opposite of the wake side)?

Technical Corrections

In the background discussion on pressure ridging, lines 31-42, could also mention two additional Hopkins' manuscripts, (1) On the ridging of intact lead ice and (2) On the mesoscale interaction of lead ice and floes.

Line 133 mentions that "Source element i has its effective area polygon, P_i , advecting with it, ...". I assume this includes translation and rotation?

It would be helpful to add the x and y axis scales to Figure 5, 8, 11, and 12.