The Cryosphere Discussions

The Cryosphere Discuss., referee comment RC1
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Comment on tc-2022-41

Anonymous Referee #1

Referee comment on "Predictability of Arctic sea ice drift in coupled climate models" by Simon Felix Reifenberg and Helge Friedrich Goessling, The Cryosphere Discuss., https://doi.org/10.5194/tc-2022-41-RC1, 2022

The manuscript “Predictability of Arctic Sea Ice Drift in Coupled Climate Models” discusses potential predictability of sea ice motion in four climate models from Eulerian and Lagrangian perspectives. The authors identify the potential predictability horizon and identify the wind variability as the main source of uncertainty. The role of initial ice thickness was found to be small. The manuscript is very well written, with good presentation of methodology and results, with deeply though discussions. It provides an important contribution to understanding of sea ice predictability in general. My minor comments only concern few overly complicated explanations in the text that should be simplified for less experience readers.

Line 30:

Although ‘errors’ and ‘uncertainty’ are well established terms, it is better to provide here a concise and clear definition of these terms (as well as ‘accuracy’ and ‘skill’) as understood by the authors for avoiding ambiguity in the rest of the manuscript.

Line 69:

What is “climatological uncertainty”? The following explanation “the uncertainty of an ensemble forecast constructed from independent years simulated by the same model with constant mean climate and variance” seems very short and hard to understand.

Does it mean that a model is initialized at some point of time, then it is run for several years (and external forcing is the same every year), then an ensemble is constructed from individual years, then the uncertainty of a predictand in this ensemble is computed and

used as a reference? Is there a reference to justify building the "climatological uncertainty" this way? For how many years should the model run? What if the model doesn't stabilize around a constant climate and the "climate uncertainty" continues to grow with the number of years?

If my understanding is wrong, a better explanation, possibly with a scheme, is worth adding here. On such a scheme the error, uncertainty, accuracy and predictability can be visually shown for easier understanding by readers not well familiar with the topic.

Line 208 – 211: It is difficult to understand how the measure of uncertainty is computed.

"variance ellipse", "semi-major axis" In which space? Dimensionality of this space?

Can an equation be added here?

Line 229 – 231: This sentence is also difficult to digest. How a plane can be tangential to a point (barycenter)? Please add an equation.

Line 352: What does it mean "normalized uncertainty reaches the climatological uncertainty"? Wasn't the normalization done to the climatological uncertainty? (eq. 4)? Shouldn't it read "uncertainty reaches the climatological uncertainty, i.e. normalized uncertainty reaches 1"?

Line 410: A reference to Fig. 10 should be added.