Predicting Arctic sea ice retreat to anticipate future climate changes

The rapid retreat of Arctic sea ice has been an early and prominent sign of climate change. All climate models, including those used in the Intergovernmental Panel on Climate Change (IPCC) assessment reports, predict that Arctic ice melt will continue in the next decades. But how fast? "This is where models disagree", says Dr F. Massonnet, researcher at the Université catholique de Louvain (UCL, Belgium), former post-doctoral researcher at the BSC Earth Sciences Department and currently scientific collaborator with the BSC. "There is a lack of consensus on why projected Arctic sea ice melt is so different from model to model". This is a critical issue, as sea ice retreat directly affects the Earth energy budget and might affect the climate at our own latitudes. But ice retreat also has important implications for the future navigability in the high North and, unfortunately, negative consequences for many ecosystems.

In a study published this Monday in the journal *Nature Climate Change*, Massonnet and co-authors have partly elucidated the origin of uncertainty in Arctic sea ice projections. "We noted", says Massonnet, "that if models disagree so much on the future of Arctic sea ice, it is because they already disagree on the present-day conditions. More specifically, we found that the way sea ice thickness is simulated varies greatly from model to model (by a factor of 4!), and this explains why the future response to a given global warming scenario is so different in the models".

But if sea ice thickness is the critical parameter to have well simulated in the models, why not just looking at those models with thickness closest to observations? "This is where things become tricky", says the researcher. "The first spatial programmes to monitor Arctic sea ice thickness started in 2003, leaving us with 15 years of data". This might seem like a long time, but to be representative, it is usually assumed that a climate variable should be measured over a window of 30 years. "On top of that, satellite measurements of sea ice thickness are very uncertain, with sometimes 50 to 100% of measurement error!". The ongoing Year
Of Polar Prediction, a 2-year international programme that will significantly enhance observing systems in the Arctic, is a unique opportunity to better calibrate satellite retrievals by cross-comparing satellite observations and field observations. "Our study", says Massonnet, "suggests that the development of observing systems cannot be undertaken independently from the development of climate models, and vice-versa. While the two communities have been historically distant, they are getting closer for their mutual benefits and that of climate research".

F. Massonnet is a previous BSC employee, a long-term a scientific collaborator of the Earth Sciences Department and worked on the published results as part of a visit funded by the BSC Severo Ochoa Mobility Program.

Reference to the study:


Read UCL press release here (PDF in French)

Caption: "Sea ice is a thin layer of ice floating in the polar oceans. Since 1980, Arctic sea ice has lost approximately 15% of its surface in annual mean, with the strongest reduction in summer months (up to 50%). The blue shading shows the 1980-2010 mean conditions, the white surface is the record low of 2012 and the dashed salmon line shows last summer (2017) conditions."

Barcelona Supercomputing Center - Centro Nacional de Supercomputación