

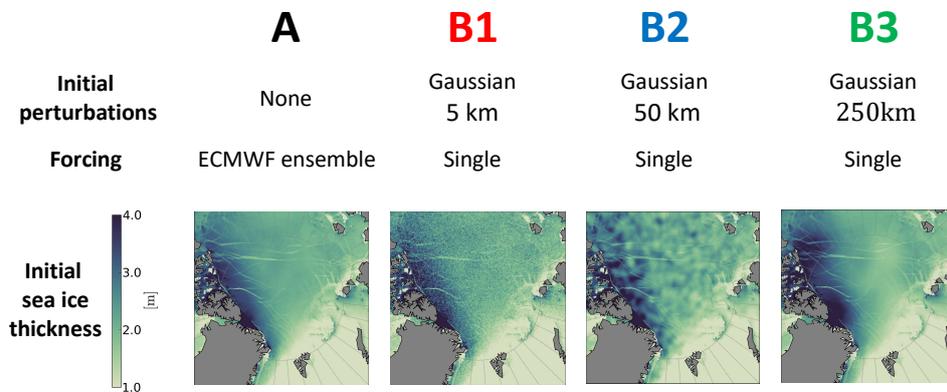
Potential Predictability of Arctic sea-ice linear kinematic features in high-resolution ensemble simulations

Motivation

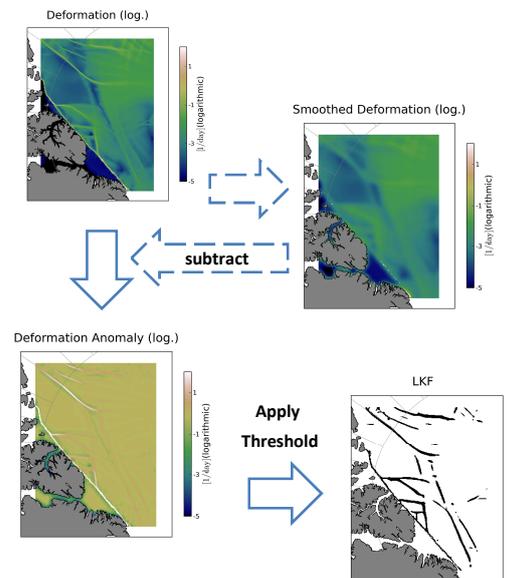
Sea ice forms quasi-linear features of ridges and leads on spatial scales of meter to hundreds of kilometers and on time scales of hours to weeks. Prediction of sea ice conditions and quasi-linear kinematic features (**LKFs**) becomes increasingly important for climate studies, marine traffic, and offshore operations. Our research focuses on the analysis of the short-range potential predictability of LKFs in Arctic sea ice using an ensemble of high resolution coupled sea-ice-ocean model simulations. We analyze the sensitivity of predictability to idealized initial perturbations, resembling uncertainties in sea ice analyses, and to growing uncertainty of the atmospheric forcing caused by the chaotic nature of the atmosphere.

Model and Experimental setup

We use an Arctic-wide MITgcm setup at a spatial resolution of ~4km. Four 15-member ensembles with different initial perturbations and atmospheric forcings are analysed here.



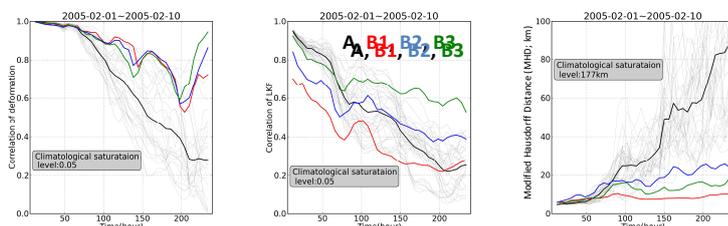
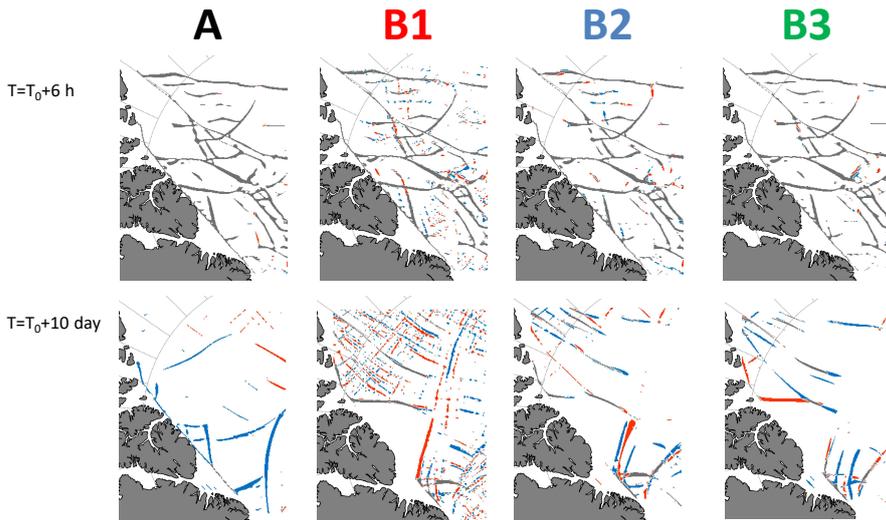
LKF detection



Distance Metrics

Upper two rows: Overlay of LKFs in two ens. members initially (top) & after 10 days (middle).
grey: LKF in both; red/blue: LKF only in one.

Lower row: Evolution of different distance metrics over 10 days



Conclusions

- Forcing uncertainty (due to limited atmospheric predictability) largely determines LKF predictability.
- Naive spatial correlation of deformation is not a good metric for similarity of LKF distributions:
 - * Spatial correlation of LKFs can be small even if LKFs are still similar (e.g. slightly offset)
 - * MHD seems more appropriate, but can be misleading if LKF density is artificially changed (e.g. due to spurious initial perturbations).
- Initial perturbations need to be selected carefully.

Outlook

- We have simulation data for many more forecast cases and additional combinations of initial perturbations and forcings that are waiting to be analysed.
- The sensitivity of the results to the LKF detection method needs to be studied.
- Other possible metrics should be devised, in particular probabilistic scores. For example, the probability to encounter leads with a certain orientation within a given radius might be useful, also from a user perspective.