A new parameterization of dilation using GODAR

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Background

- Sea ice deforms along lines called linear kinematic features (LKFs).
- Continuum models need either high resolutions ($<$10km) or parameterizations to reproduce the observed statistical metrics of LKFs.

Goal: improving the representation of LKFs

LKFs enable large energy fluxes between the atmosphere and the ocean.

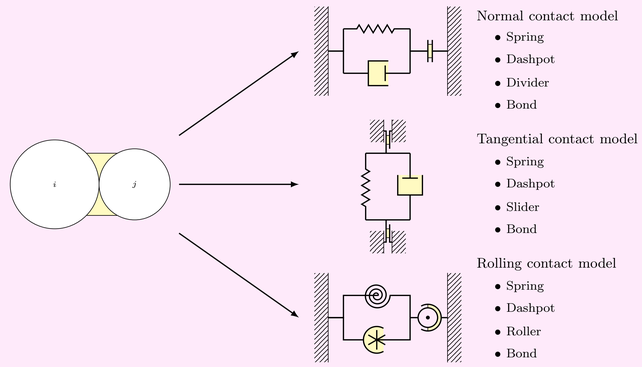
- Shear, divergence, and convergence
- Damage and healing
- Dilation

Pack ice dislocating in the Beaufort Sea.
Credit: NASA Worldview Snapshots.

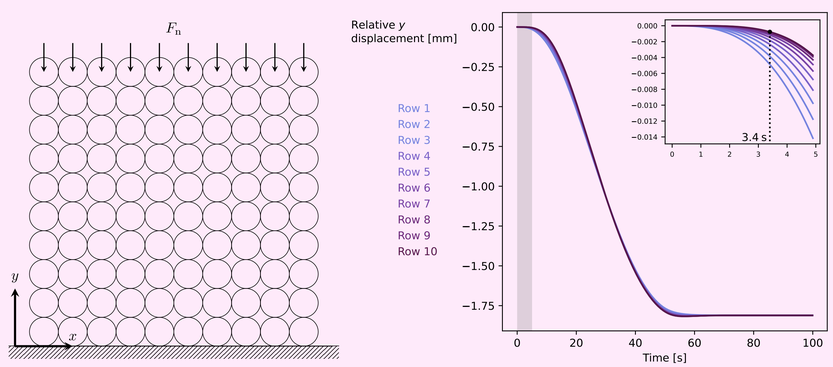
1. Develop a new discrete element model for the pack ice.
2. Use GODAR to parameterize dilation along LKFs in shear.

Granular flOes for Discrete Arctic Rheology (GODAR)

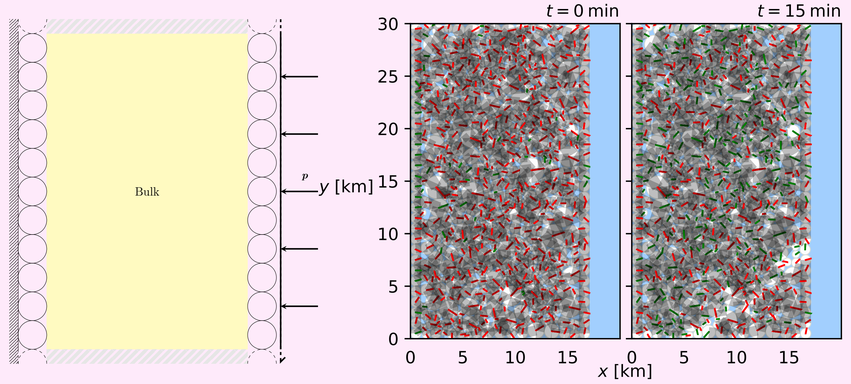
- GODAR is a 2D discrete element model composed of thin cylinders that can be connected by beams to form aggregates.
- Particles interact via damped elastic deformations in compression, shear, and torsion.
- Ridging, sheltering, and forcing schemes are included.



Validation: elastic waves



Validation: fracture lines



Take-home message

GODAR can simulate the temporal evolution of contact normals between floes from which general equations relating dilation to resolved prognostic variables (normal/shear stress, open water fraction, floe size distribution) can be derived.

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