A24 FAMOS Workshop
Woods Hole Oceanographic Institution
October 24-27, 2017

ALFRED-WEGENER-INSTITUT
HELMHOLTZ-ZENTRUM FÜR POLAR- UND MEERESFORSCHUNG

Nils Hutter [1] (✉ nils.hutter@awi.de), Lorenzo Zampieri [1], Martin Losch [1]

Developing a dataset of Linear Kinematic Features (LKFs) for the evaluation of small-scale sea ice deformation

Motivation & Introduction

- Sea ice models start to resolve deformation features with increasing resolution or by adapting the sea-ice rheology
- Evaluation so far is limited to statistics of the continuous deformation field

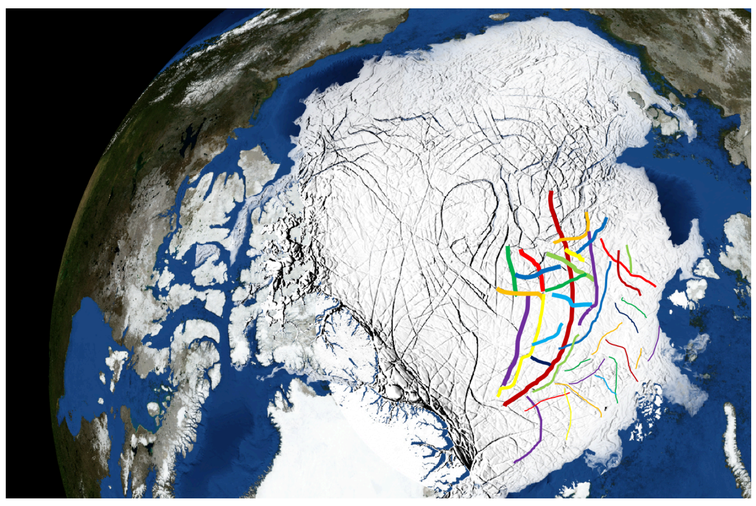


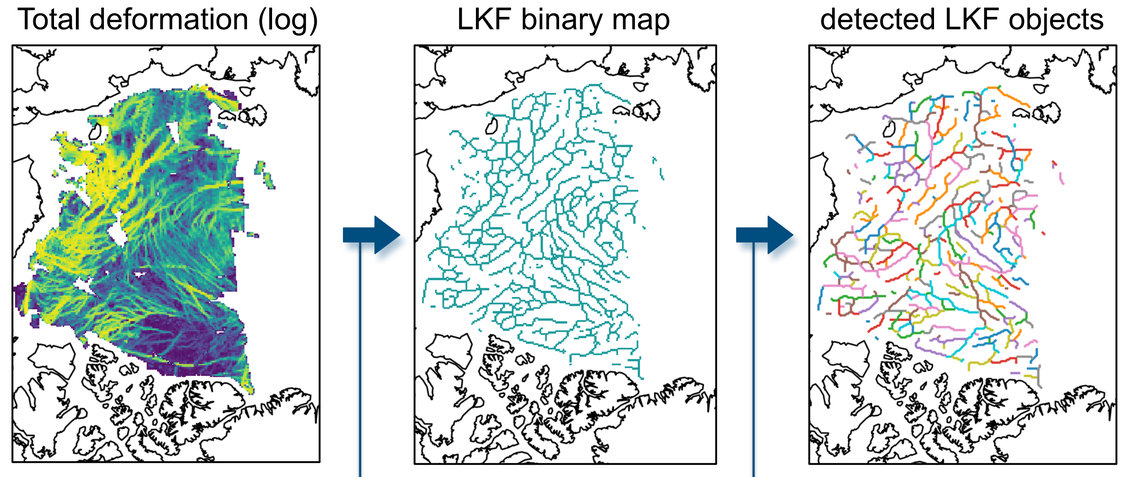
Figure: Sea ice in MITgcm model run with an average horizontal grid spacing of 1km in the Arctic.

Deformation field
↓
Object-based LKF detection
↓
LKF tracking with time
↓
Statistics of LKFs

Research Objectives: Combine the LKF detection algorithm *(Linow & Dierking, 2017)* with a tracking algorithm to produce an object-based data set of LKFs in the Arctic for multiple years.

Object-based LKF detection

Adapted version of *Linow & Dierking, 2017* for RGPS data



Applications for both algorithms

1. Develop a LKF data set using the available sea ice deformation data sets: RGPS, EGPS and DTU-Sentinel
2. Comprehensive description of spatial characteristics (density, length, orientation, intersection angle, curvature) as well as the temporal evolution
3. Running algorithm on model output to evaluate LKF statistics

Examples:

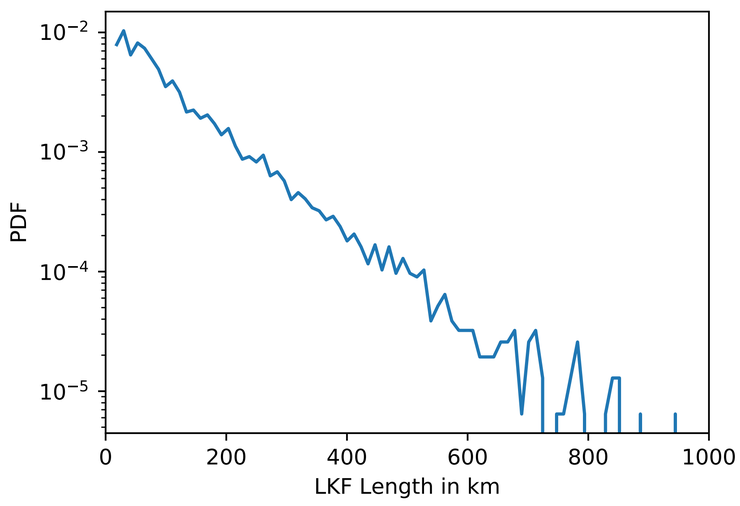
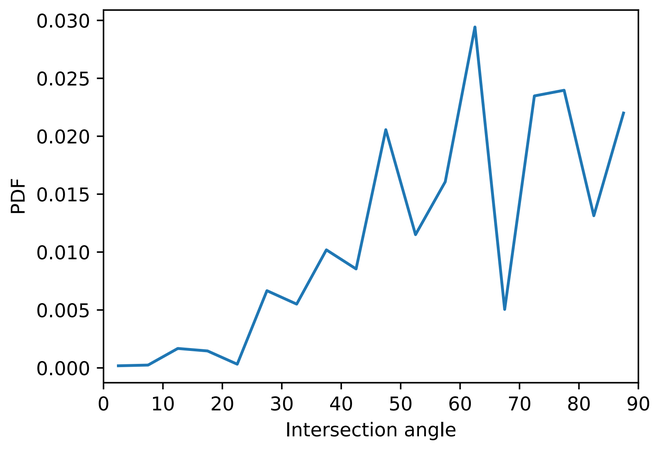


Figure: Probability Density Function (PDF) of the length of detected deformation features in RGPS data of winter 2006.

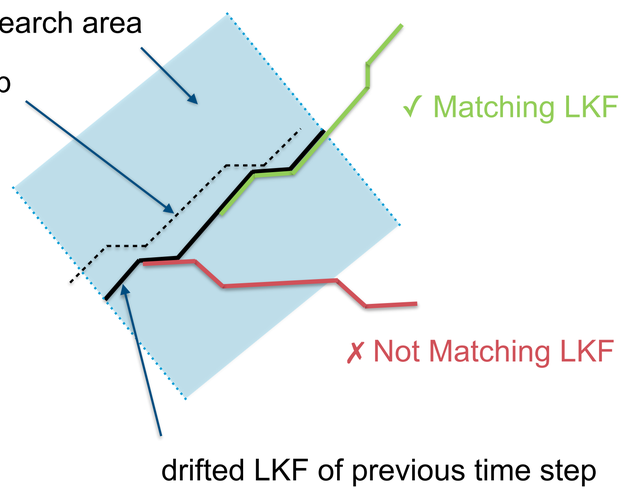
Figure: PDF of the intersection angle of for all intersecting LKFs that were detected in RGPS data of winter 2006



LKF time tracking

LKF in the next time step is considered as a tracking match if:

1. it overlaps partly with one LKF of the previous time step taking the drift of sea ice into account
2. not more than 25% of the LKF overlap with the search area perpendicular to the "old" LKF but not with the "old" LKF itself



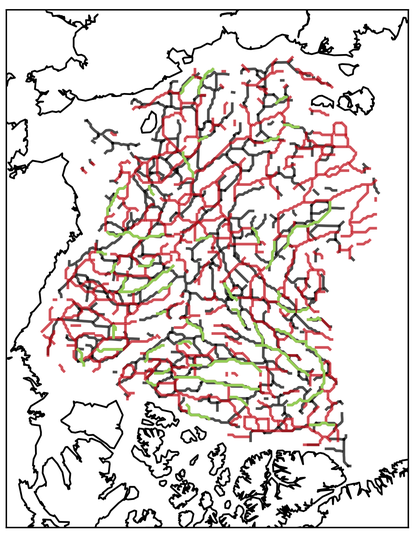


Figure: Deformation features detected in two consecutive RGPS time steps in (color code: "old" LKFs, "new" LKFs, and tracked LKFs).

Conclusions

- The combination of the detection and tracking algorithm offers new ways to explore the characteristics of deformation features
- The algorithm can be applied to sea ice deformation fields derived from satellite observations as well as to modelled deformation fields to evaluate the modelled small-scale deformation
- Preliminary statistics on detected features agree with previous studies but a more thorough evaluation is in progress

References
Linow, S.; Dierking, W. Object-Based Detection of Linear Kinematic Features in Sea Ice. *Remote Sens.* **2017**, *9*, 493.

Acknowledgements
We acknowledge Stefanie Linow and Wolfgang Dierking for help with the implementation of the detection algorithm and the inspiring discussion on the development of the tracking algorithm.

Affiliation
(1) Alfred Wegener Institute, Bussestrasse 24, D-27570 Bremerhaven, Germany

ALFRED-WEGENER-INSTITUT
HELMHOLTZ-ZENTRUM FÜR POLAR- UND MEERESFORSCHUNG
HELMHOLTZ GEMEINSCHAFT

BREMERHAVEN

Am Handelshafen 12
27570 Bremerhaven
Telefon 0471 4831-0
www.awi.de