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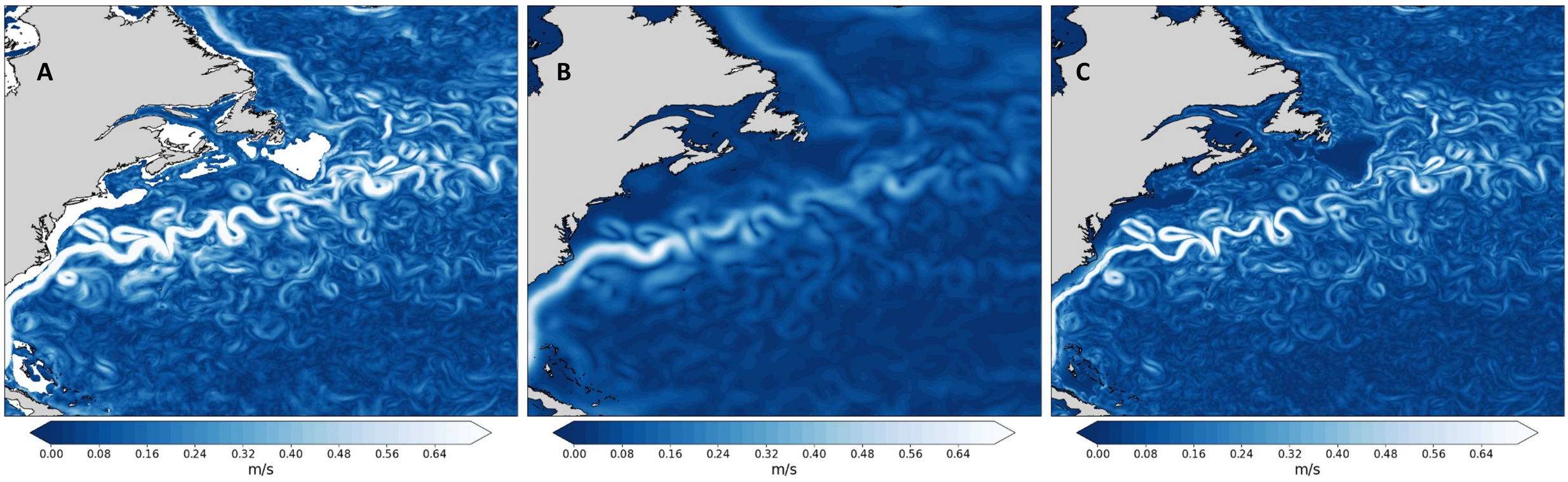
Outstanding Student & PhD candidate Presentation contest

EERIE
European Eddy-Rich ESMs

New filtering method that works on any mesh



Ocean's current speed at the 100 m depth based on FESOM mesh with 5 km resolution. A: original data; B: lowpass filter with 150 km size; C: highpass filter with 150 km size. Plots by N. Koldunov

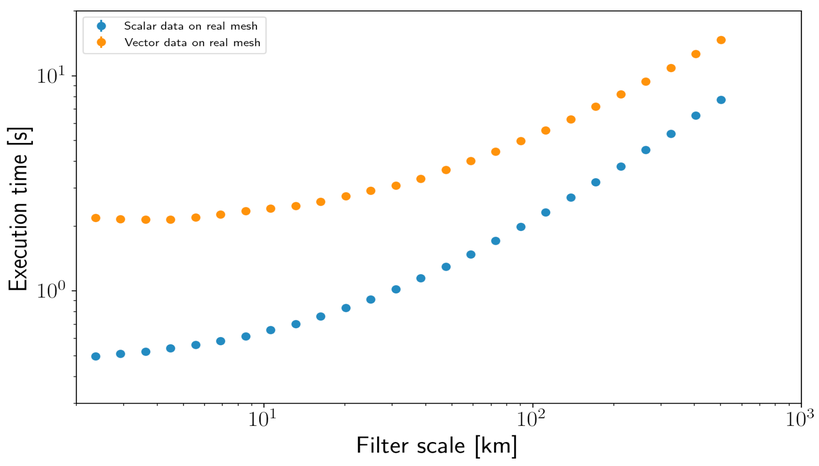
Implementation of implicit filter for spatial spectra extraction

Kacper Nowak[1] Sergey Danilov[1,2]

Scale analysis based on coarse-graining has been proposed recently as an alternative to Fourier analysis. However, for data from unstructured-mesh models it requires interpolation to a regular grid. We present a high-performance Python implementation of an alternative coarse-graining method which relies on implicit filters using discrete Laplacians. Our key features:

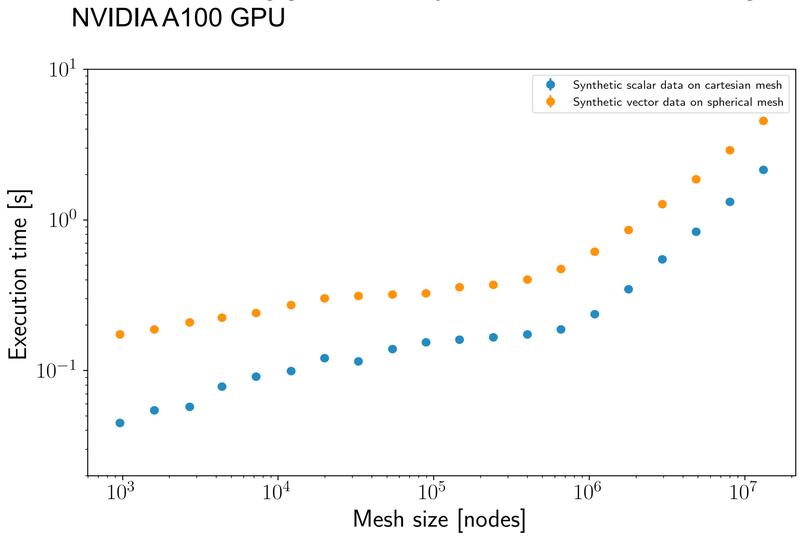
- Working on arbitrary grids, directly on output of ocean circulation and atmosphere models.
- GPU accelerated to achieve unmatched performance and scalability.
- Saving mesh-specific auxilliary arrays for immediate computation.

This results in processing data based on meshes with more than 10M surface vertices in a matter of seconds.



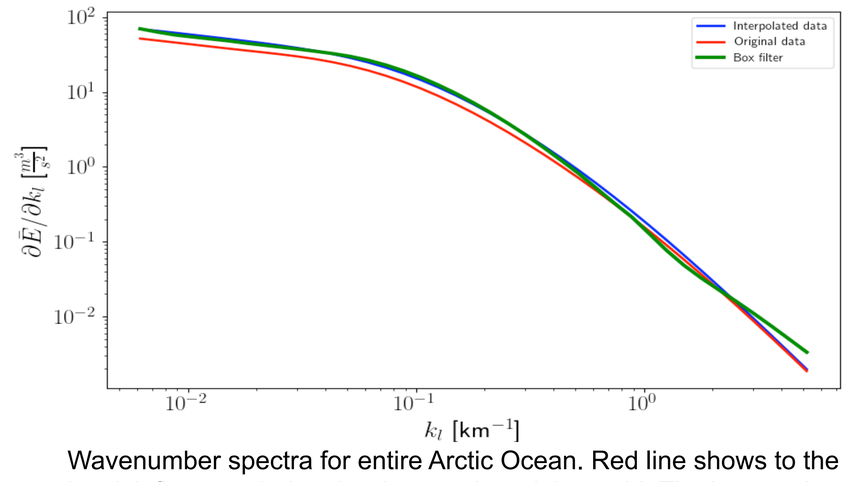
Results of filtering global velocity on 11M nodes mesh using NVIDIA A100 GPU

Read our paper!

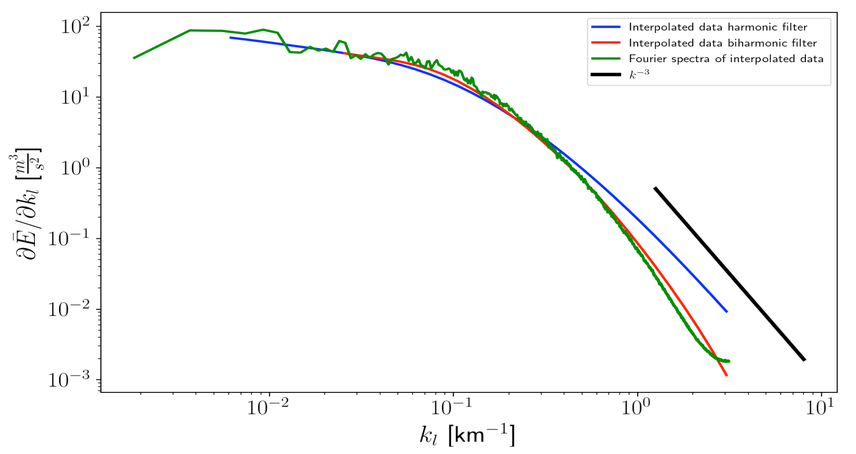


Results of filtering synthetic data with filter scale of 100 km using NVIDIA A100 GPU

Check our code!



Wavenumber spectra for entire Arctic Ocean. Red line shows to the implicit filter applied to the data on the original grid. The blue and green lines correspond to the implicit and explicit box filter applied to the interpolated data.



Fourier energy spectrum compared to the spectra obtained with implicit harmonic and biharmonic filters for the data interpolated to a regular grid.

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FESOM2