

Barents Sea Atlantification Driven by a Shift in Atmospheric Synoptic Timescale

Dynasor Meeting - June 21st 2025

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Meteorological Institute, Oslo ⁶University of Kiel, Germany

Outline

The Barents Sea Opening Flux reproduced by AI (First Version)

A Bouncing Experiment

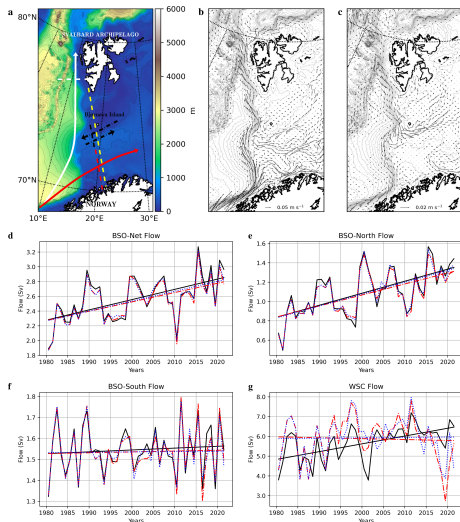
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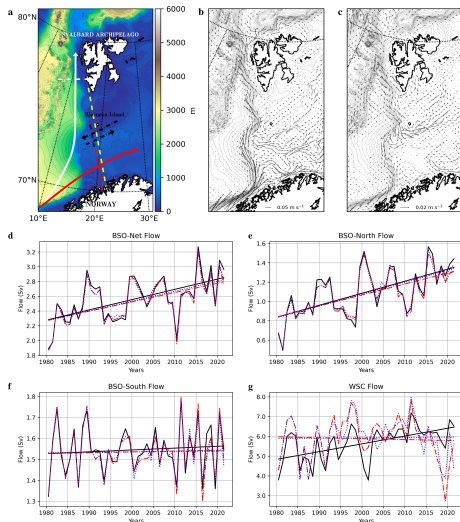
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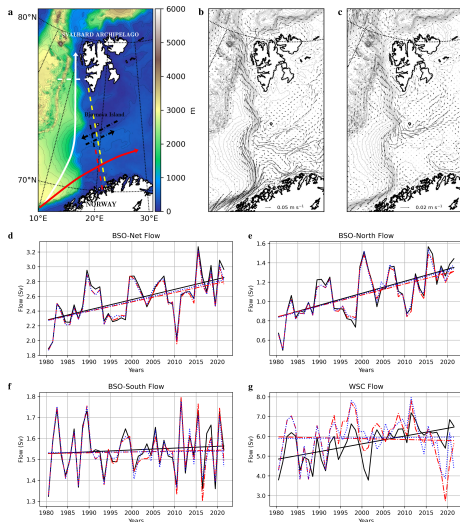
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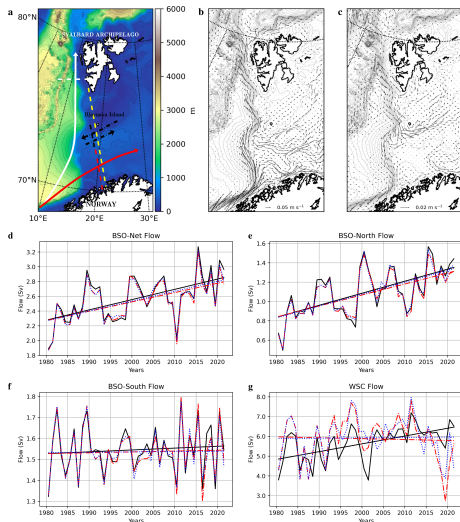
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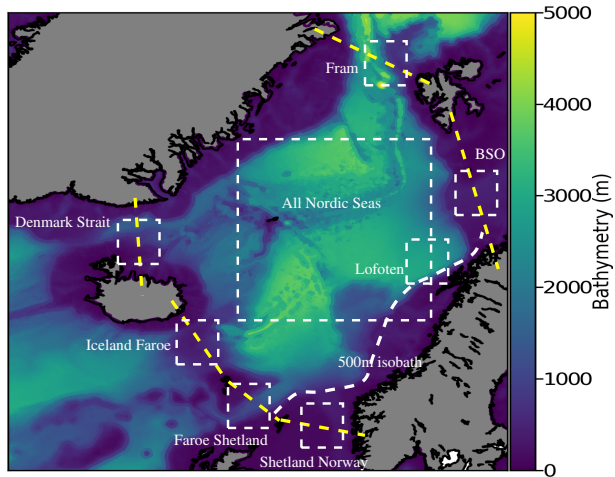
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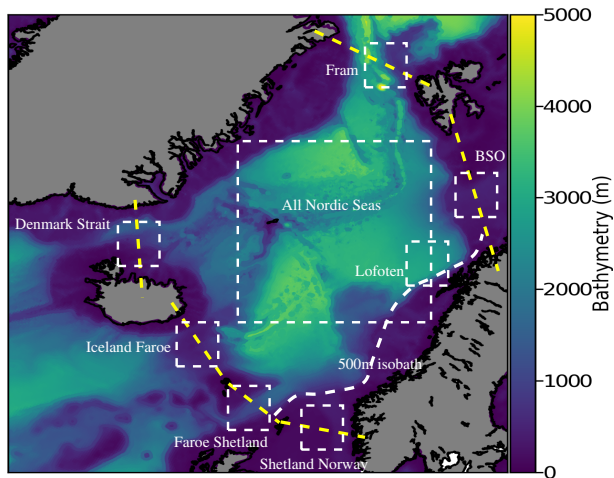
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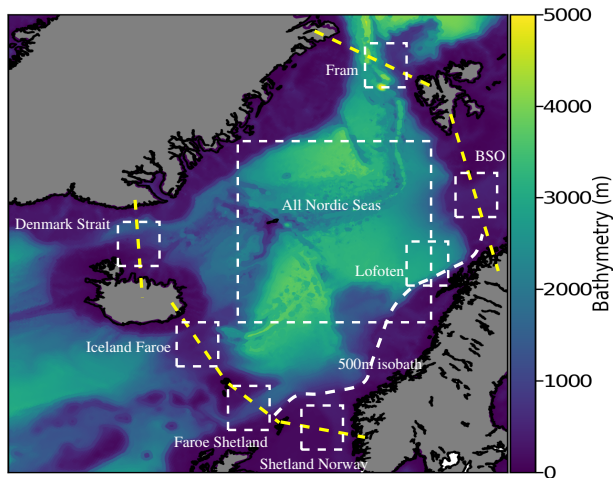
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- What causes this ?
- Polyakov et al. 2023 (Science) say it is the Arctic Dipole
- And since it is in Science, it must be true, come on !
- Well, except of course, if it is not (true)



- We compute wind indexes for each box, based on the Nemo-NAA10km forcing

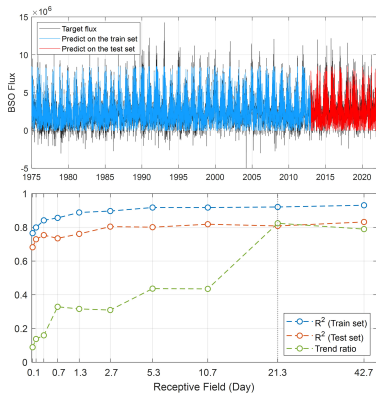


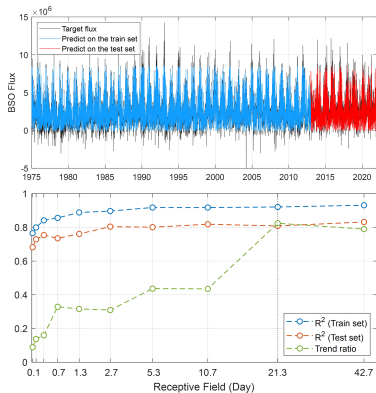
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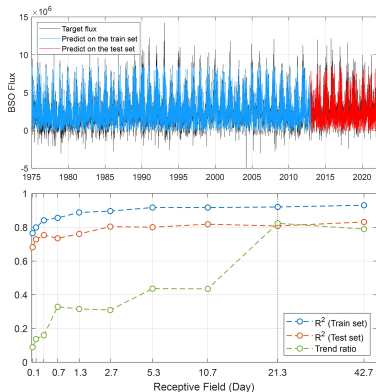
- We compute wind indexes for each box, based on the Nemo-NAA10km forcing
- For each box, we compute stress on u and v , and the theoretical Svedrup transport
- We provide all this data to a deep learning algorithm

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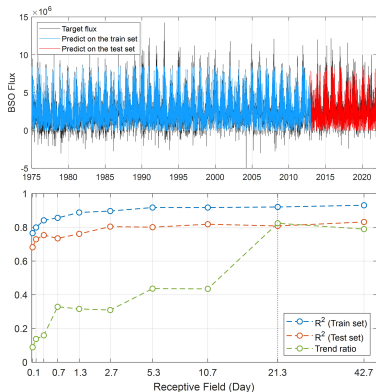




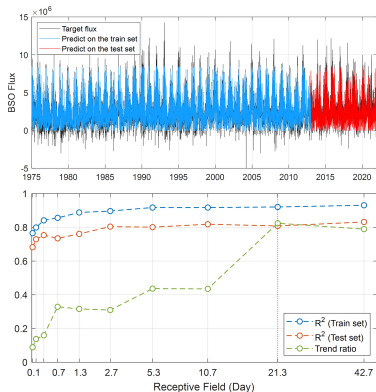
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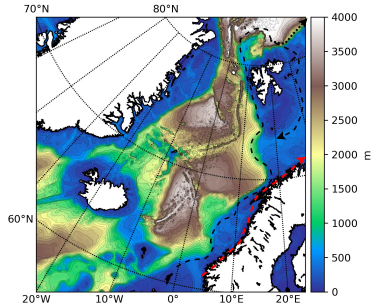
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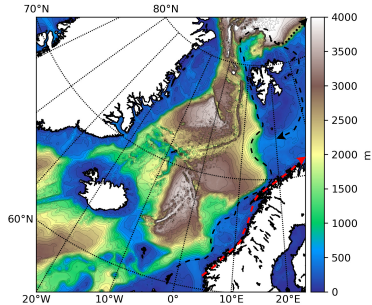
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- The BSO flow trend is driven by something that has a mean value of zero if one considers time periods long enough (i.e.: a lot less than the length of the simulation)
- More details in Jahanmard et al., JGR-Oceans 2024JC021663



- “Something” that carries energy to create currents, but has a mean value of zero ??



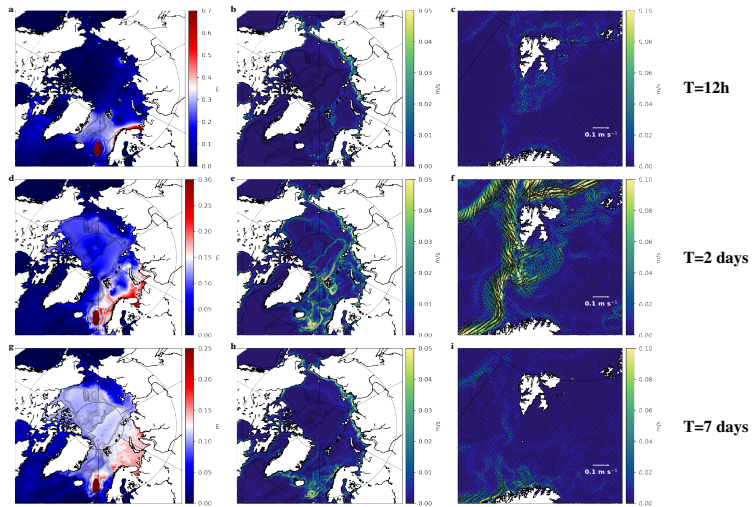
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- What about some waves ?

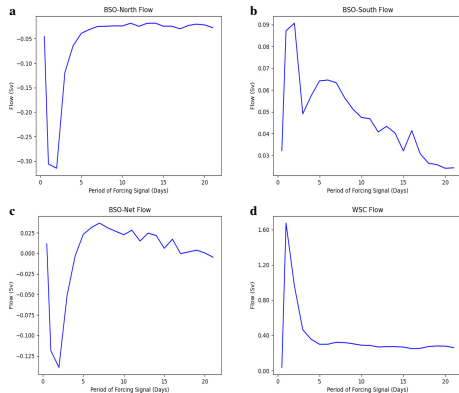
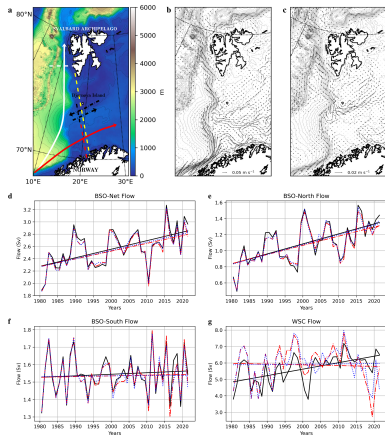
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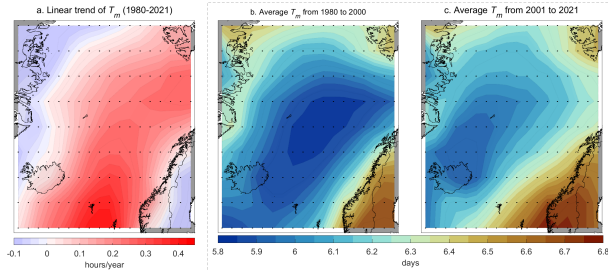


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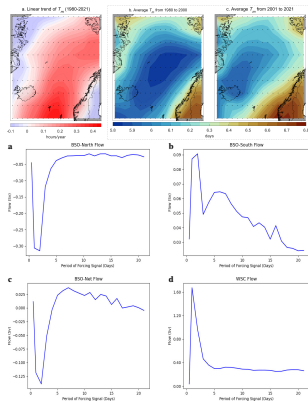
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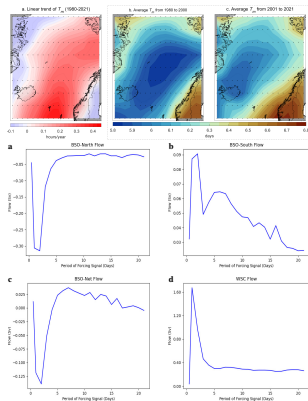
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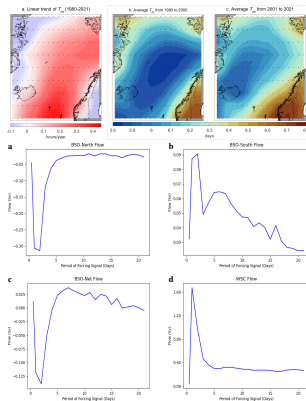
- There is indeed an increase of the synoptic time scale over the Nordic Seas



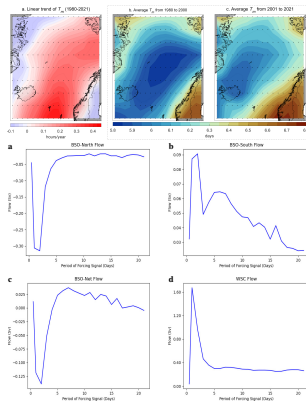
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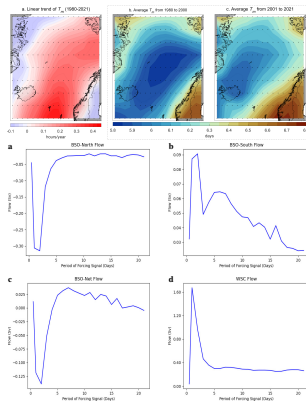
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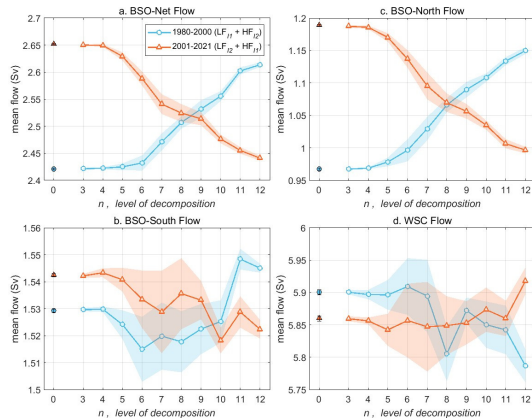
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- By designing a 3D atmospheric forcing in which there are spectrum changes in wind and SLP ? Which sounds like difficult...

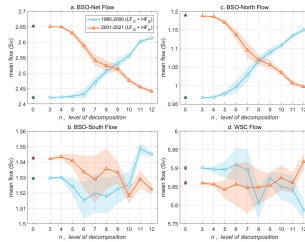


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- We can do a lot smarter using AI !

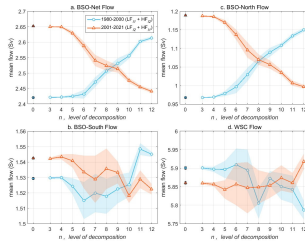


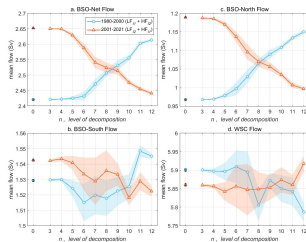
n, level of decomposition	1	2	3	4	5	6	7	8	9	10	11	12
Upper Period of Exchange (in days)	0.16	0.33	0.66	1.33	2.66	5.33	10.66	21.33	42.66	85.33	170.66	341.33

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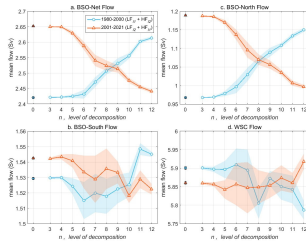


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- Itself linked with a change of mean synoptic time scale
- We cracked the BSO flow trend puzzle using AI...
- ... first by searching for causality links in the forcing, and then by using AI to produce submodels targeted at a specific goal, on which it is easy to make sensitivity experiments
- “Under Consideration” in Nature CC (for 3 months...)