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## Influence of Atmospheric and Oceanic Model Resolution on Volume and Heat Transports through Arctic Gateways

The coupled climate model OASIS AWI-CM = FESOM (ocean/sea-ice)  $\leftrightarrow$  ECHAM (atmosphere)

The experiment (Sein et al. 2018) Six 150-year RCP 8.5 simulations:

- LR ocean (~25km\*) + LR atmosphere (T63)
- LR ocean (~25km\*) + HR atmosphere (T127)



## **Unstructured ocean grids**

- HR ocean (~10km\*) + LR atmosphere (T63)
- HR ocean (~10km\*) + HR atmosphere (T127)
  - + 2 control runs

\* at the Arctic gateways/Nordic Sea



Fig 2: Net volume transport [Sv] through Atlantic gateways, 10-year moving mean

|  | me        | ean*      | Volumo transport in [Sv] |           |      |
|--|-----------|-----------|--------------------------|-----------|------|
| Scenario   | 1990-2015 | 2070-2095 | Obs***                   | 6.6+/-0.4 |      |
| Volume transpor  | + [Sv]    |           | core_T063_scen           | 6.9       | 5.2  |
| Obe**  | 2 0 . / 2 | 7         | core_T127_scen           | 7.5       | 5.5  |
| 005**  | -2.0+/-2. | /         | bold T063 scen           | 6.9       | 6.9  |
| core_1063_scen   | -1.2      | -2.7      | hold T127 scen           | 59        | 6.6  |
| core_T127_scen   | -2.5      | -3.3      | 5010_112/_5001           | 5.5       |      |
| <pre>bold_T063_scen</pre>  | -1.0      | -1.2      | Volume transport         | out [Sv]  |      |
| bold_T127_scen   | -1.5      | -1.4      | core_T063_scen           | -8.1      | -7.8 |
| <pre>* positive into the Arctic Ocean ** Ilical of al 2016</pre> |           |           | core_T127_scen           | -10.0     | -8.8 |
|  |           |           | bold_T063_scen           | -7.9      | -8.1 |
| ·· IIICak et a   | 11. 2010  |           | 1 1 1 7407               | 7 4       | 0.0  |





Fig 3: Net heat transport [TW] through Atlantic gateways, 10-year moving mean

- LR ocean greater future change in absolute net volume transports at both gateways
- At Fram Strait, in LR ocean, decrease in inflow (and outflow), HR ocean little change
- At BaSO, LR ocean greater change in inflow only (not shown)
- BaSO heat transport correlated to volume increase

## bold\_ll2/\_scen \*\*\*Besczynska-Moeller et al. 2012

Tab1: Fram Strait mean volume transports



- Both ocean and atmosphere resolution contribute to AMOC representation in a complex way (see Sein et al. 2018)
- All scenarios show decrease of AMOC strength towards the end of 21<sup>st</sup> century
- HR ocean sees greater decrease of AMOC (here shown at 60°N)
- Fram+BaSO inward transport also downward trend, but correlation with AMOC 60N varies over time









- Besides the large scale NAO-pattern, local wind patterns are also important for transports into the Barents Sea and Fram Strait (see e.g. Chafik et al. 2015)
- E.g. HR ocean shows higher wind stress (curl) over the GIN Sea in present and future scenario and an along-shore wind pattern at the Norwegian coast

Conclusion

- When assessing the exchange between the Nordic Seas and the Arctic Ocean in future scenarios both ocean and atmospheric resolution play a role for volume and heat transport estimates
- Each resolution has complicated impacts on upstream (AMOC) and local (Nordic Seas and Arctic Ocean) conditions
- Not shown here are the SSH pattern for each scenario which are also important for Arctic inflow and outflow

## References

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