

# On the realism of Arctic Ocean transports in CMIP6

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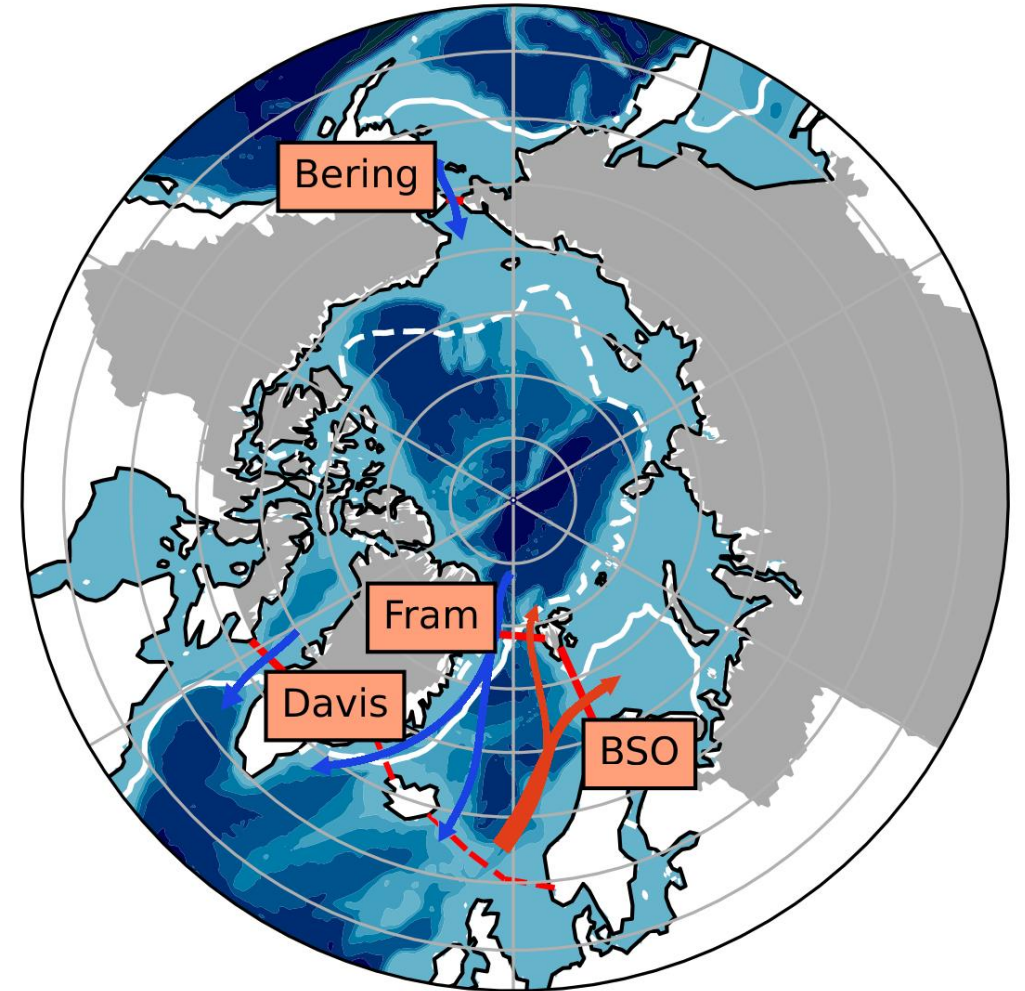
Der Wissenschaftsfonds.



Copernicus  
Marine Service

# Oceanic transports

- Integral part of the Arctic's energy and mass budgets
- Have major impacts on the state and change of the Arctic Ocean and sea ice

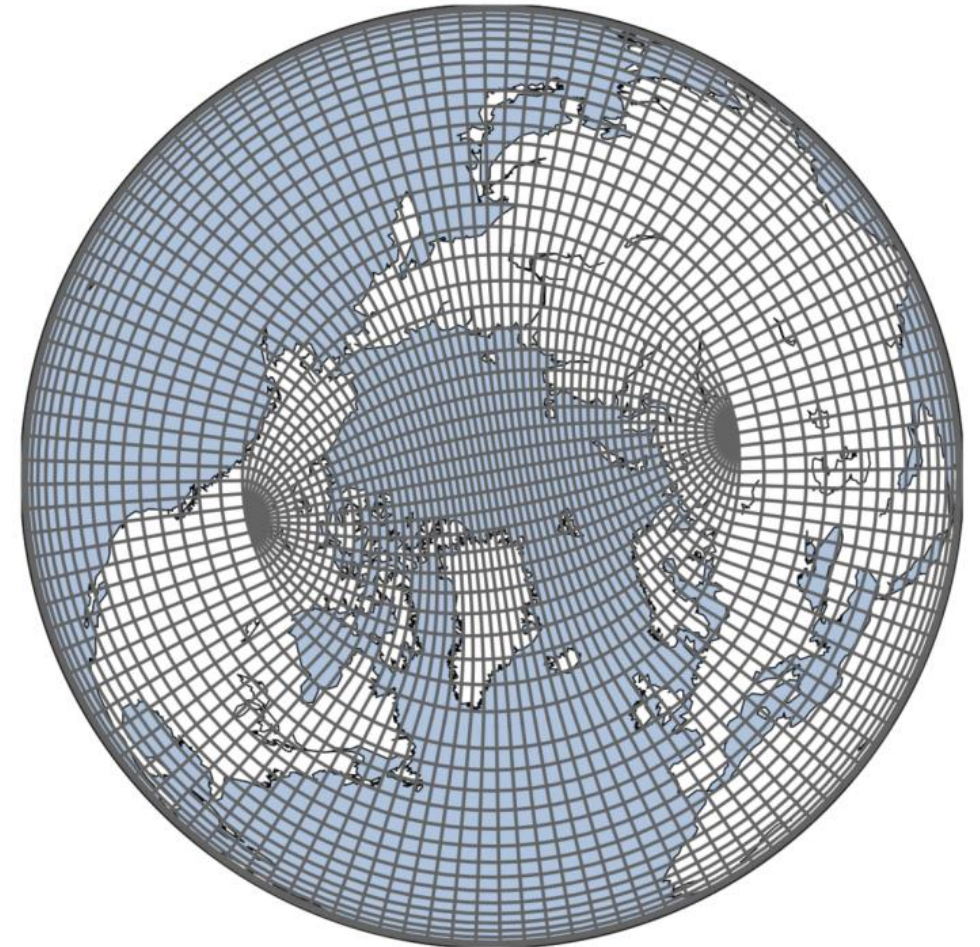


# Oceanic transports in CMIP6

## Challenges:

- **must be calculated on native grids**
- grid orientations and rotations
- signs of velocity components
- Arakawa partitions

Tripolar grid



# Oceanic transports in CMIP6

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→ Development of **StraitFlux**: tools for precise calculations of oceanic volume, heat, salinity and ice transports

- Net transports using line integration methods
- Crosssections of vertical planes using vector projection algorithms

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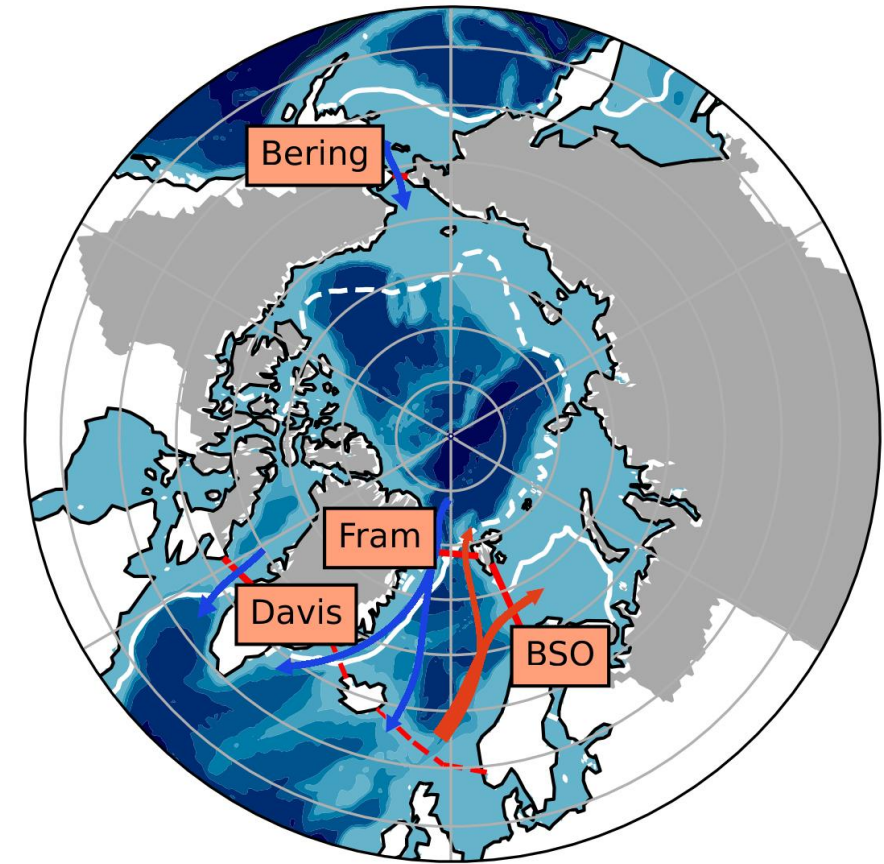
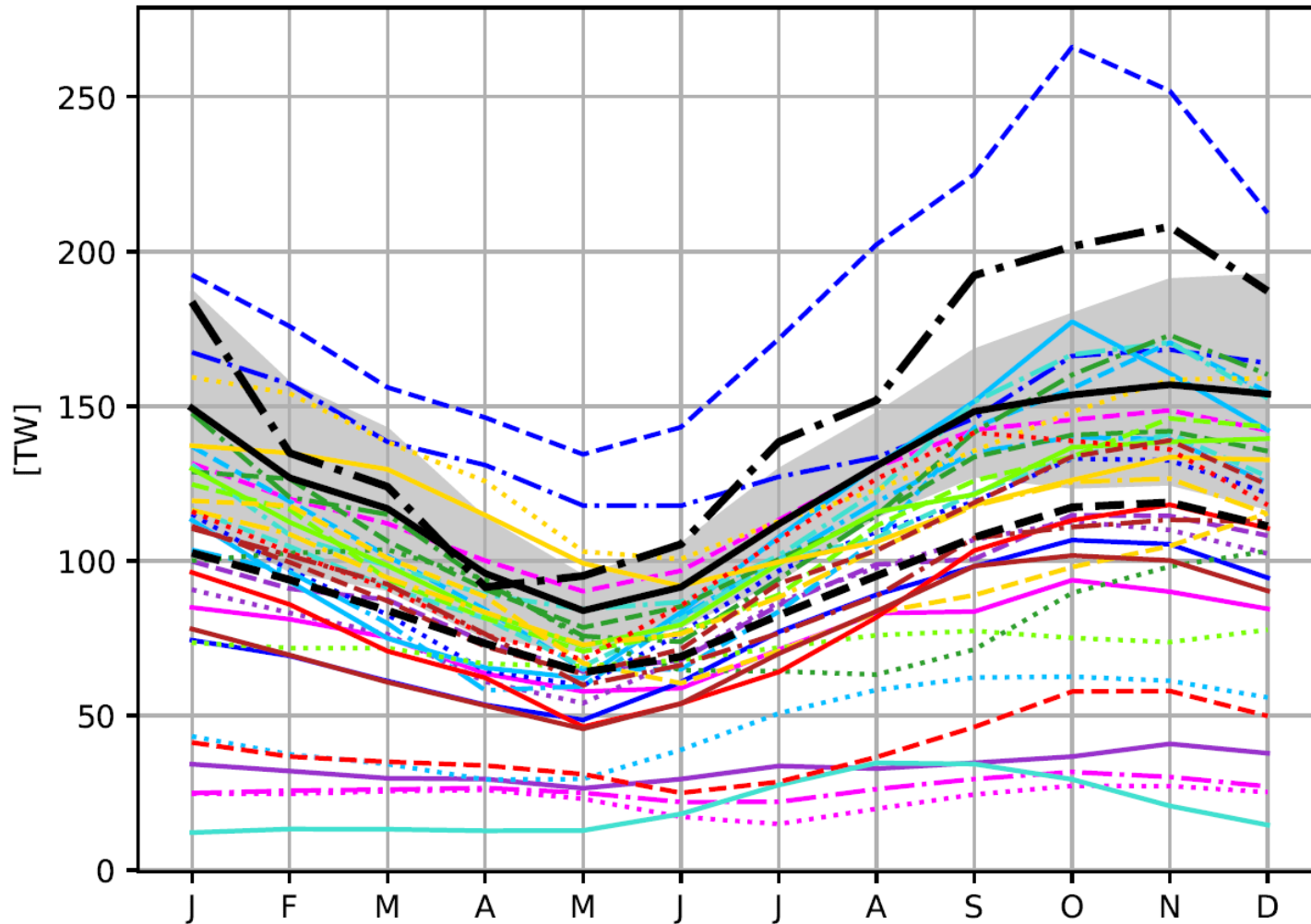
→ Development of **StraitFlux**: tools for precise calculations of oceanic volume, heat, salinity and ice transports

- Net transports using line integration methods
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→ Enables more precise assessments of coupled energy and water budgets

# Net Arctic ocean heat transport

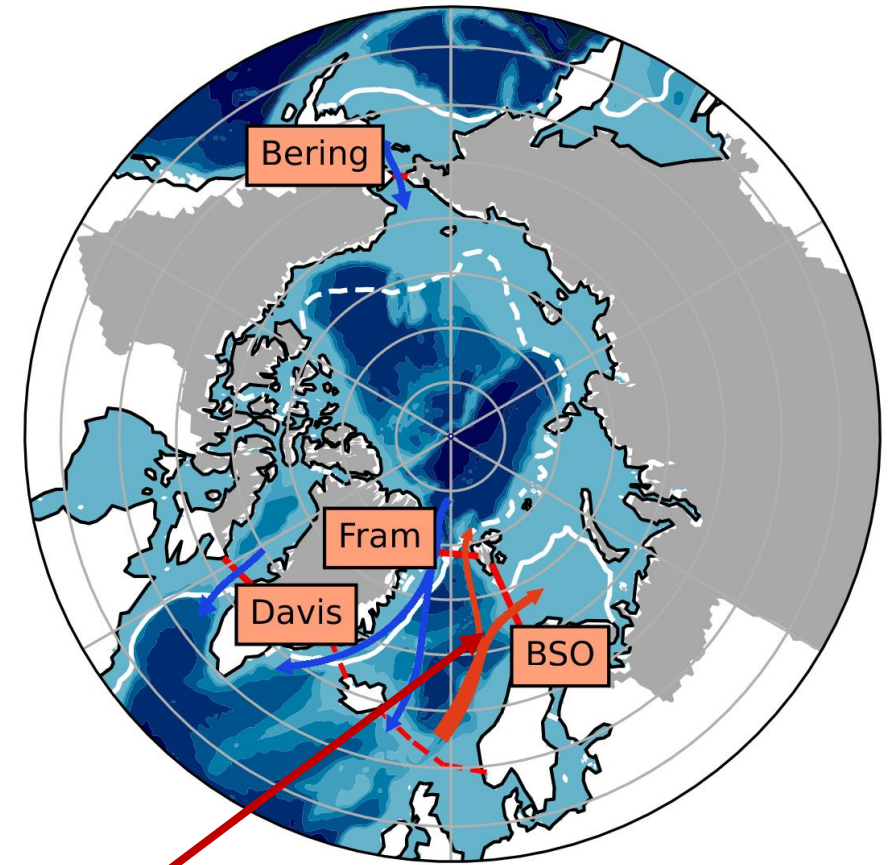
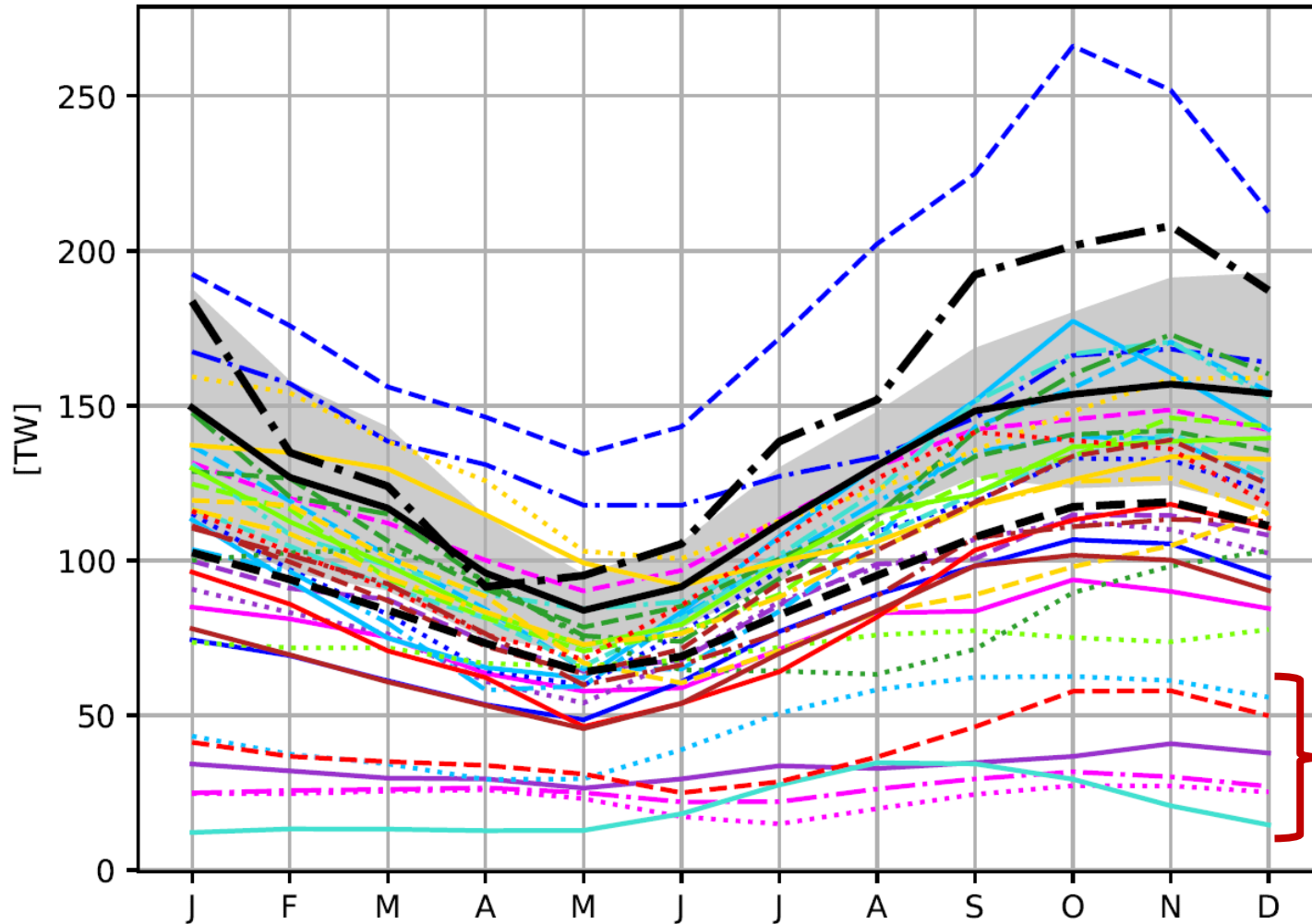
OHT 1993-2014, n=34



- - CMIP6 mean
- Reanalysis
- · Observations

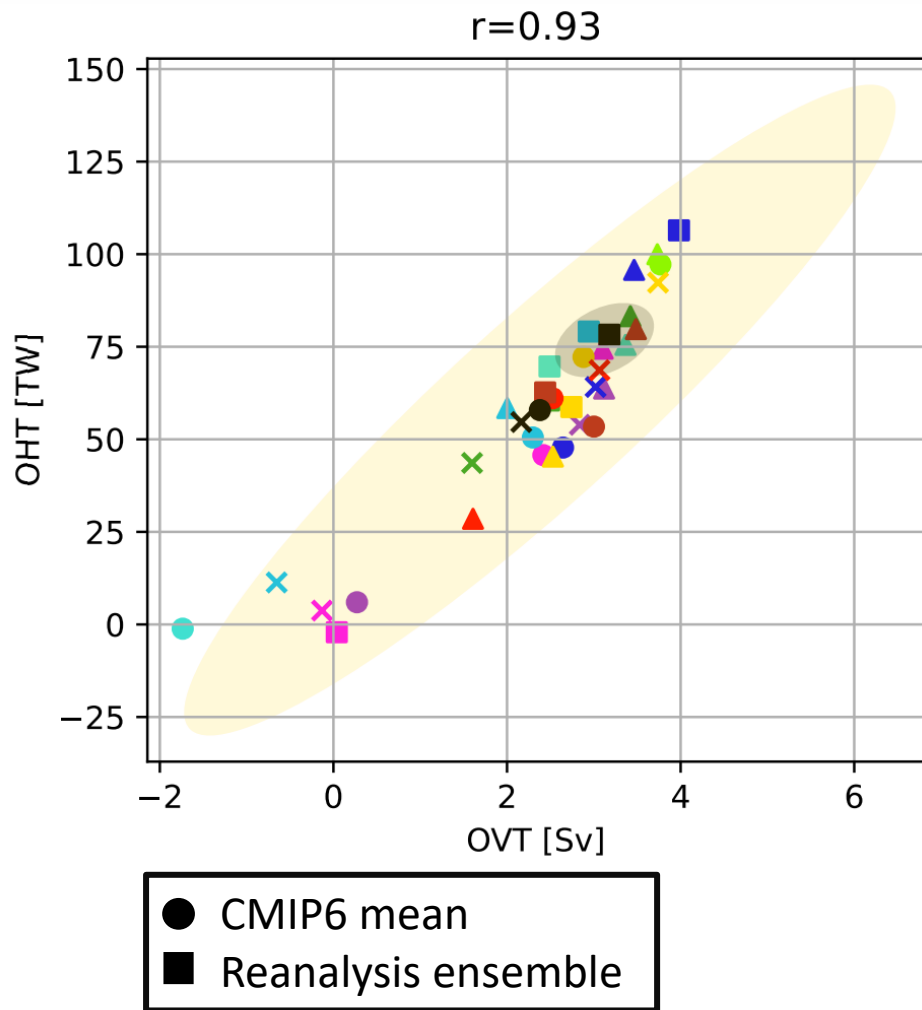
# Net Arctic ocean heat transport

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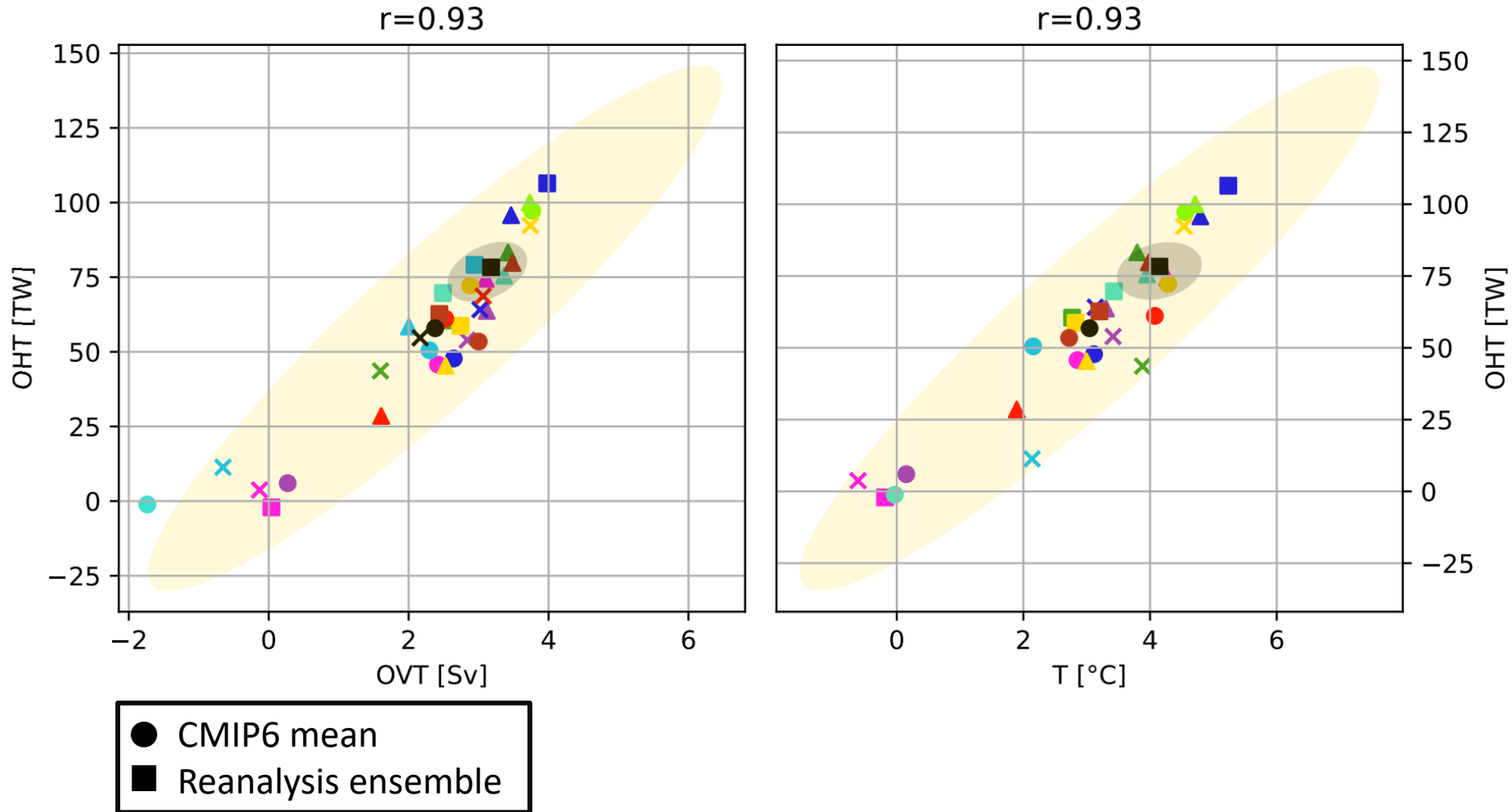
- CMIP6 mean
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# Barents Sea Opening heat transport

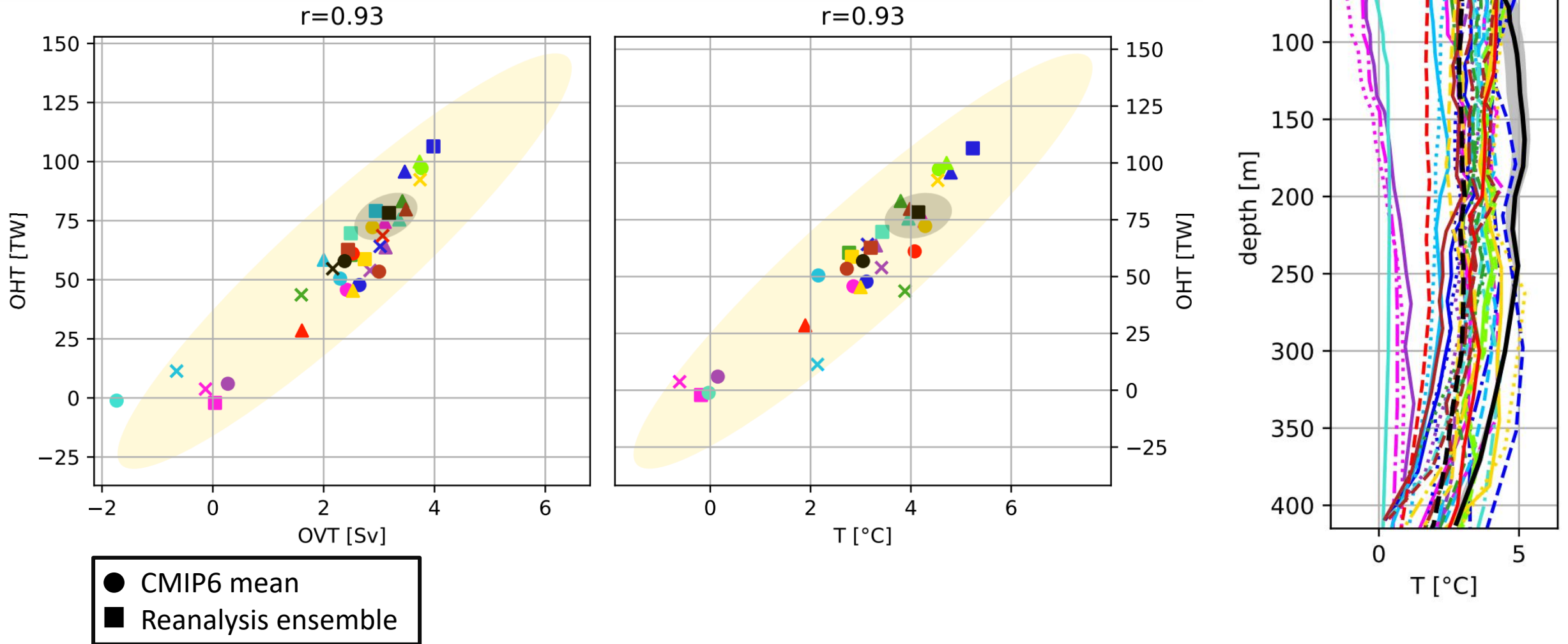




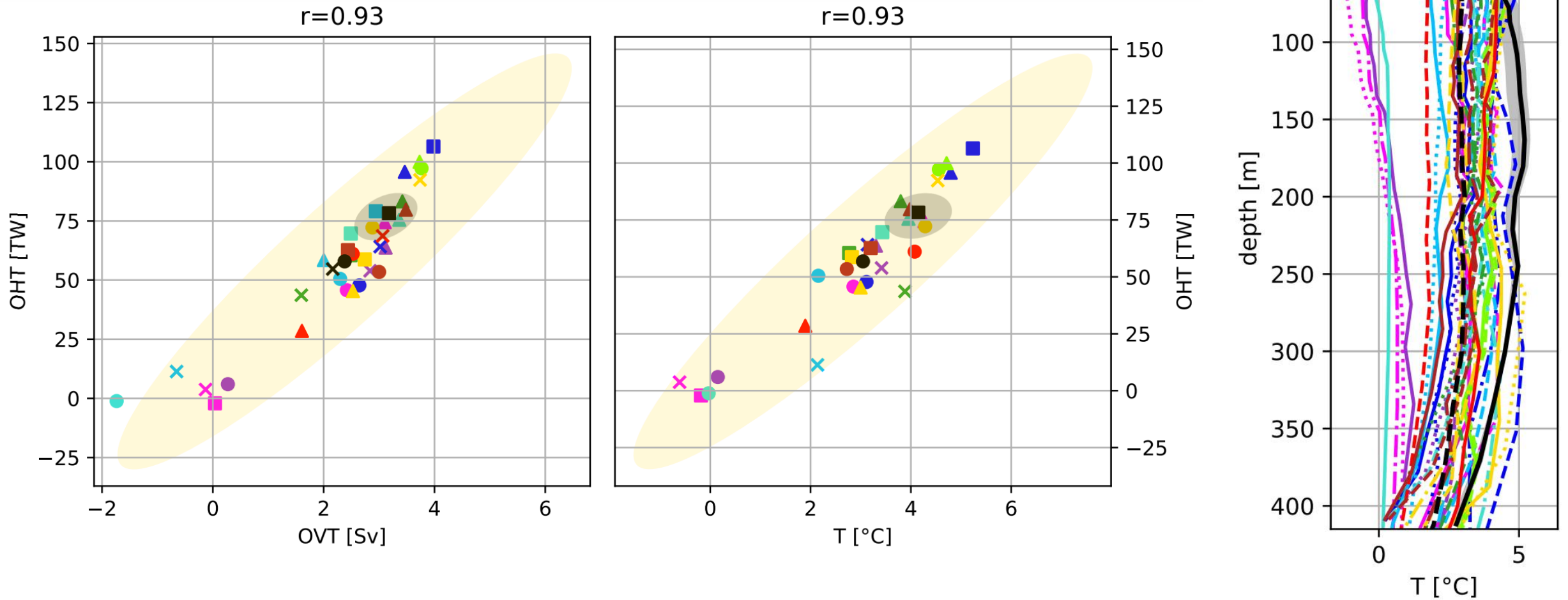
# Barents Sea Opening heat transport



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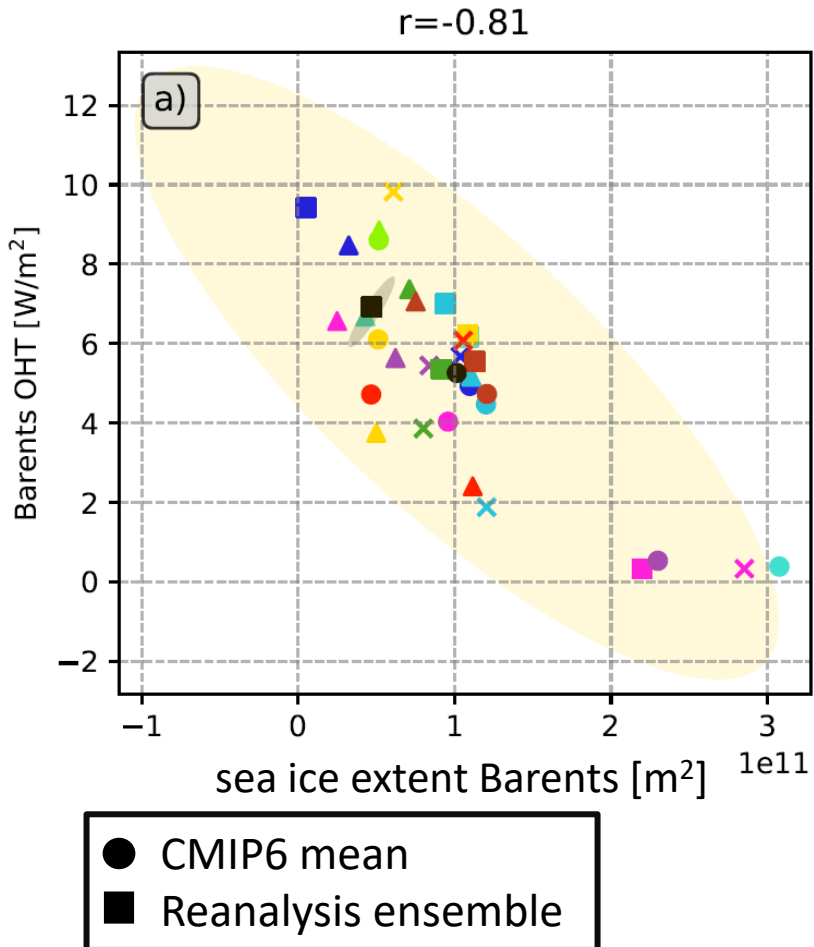


→ BSO OHT biases result of temperature biases and biases in the simulated currents

# Impacts on state and change of the Arctic

## Barents Sea Opening

pan-Arctic



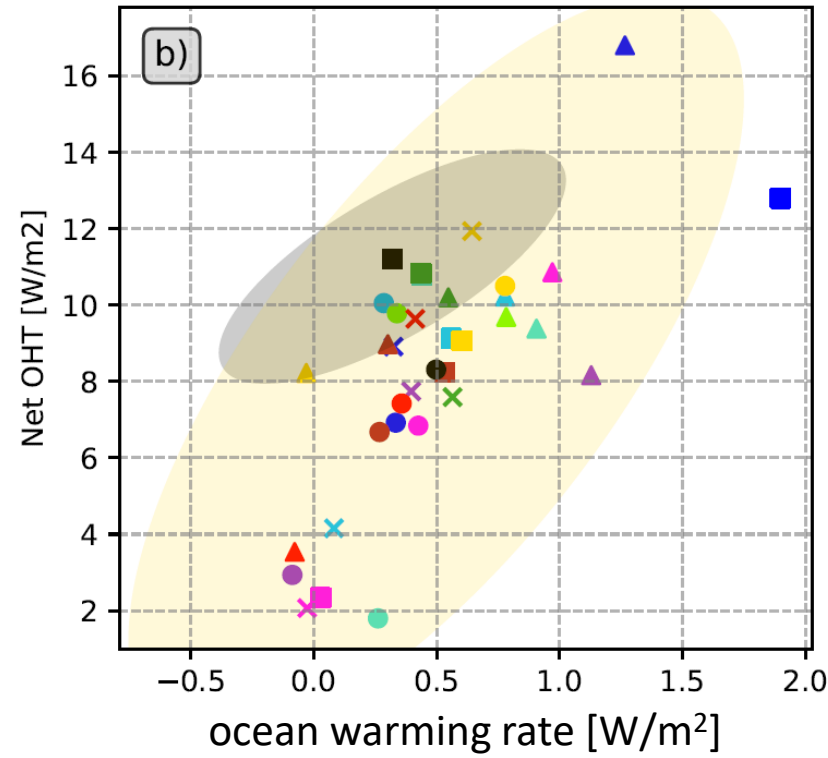
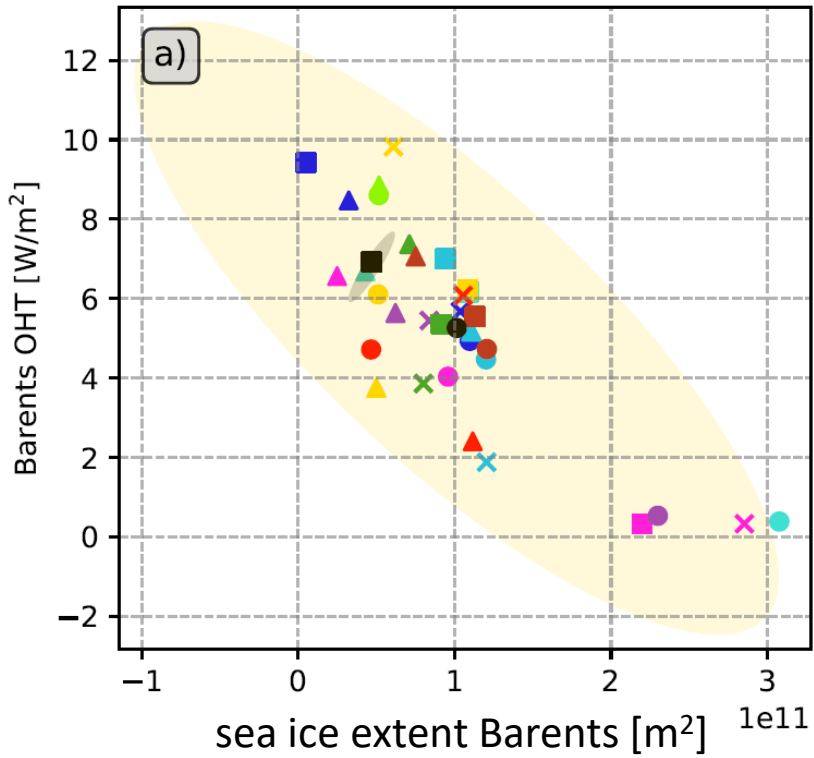
# Impacts on state and change of the Arctic

## Barents Sea Opening

## pan-Arctic

$r=-0.81$

$r=0.72$

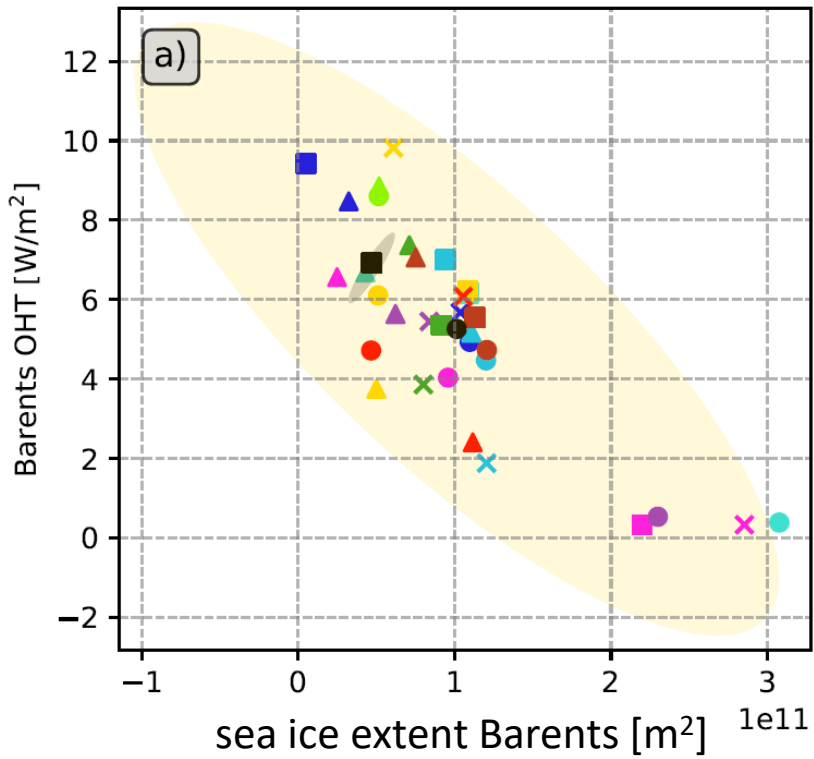


- CMIP6 mean
- Reanalysis ensemble

# Impacts on state and change of the Arctic

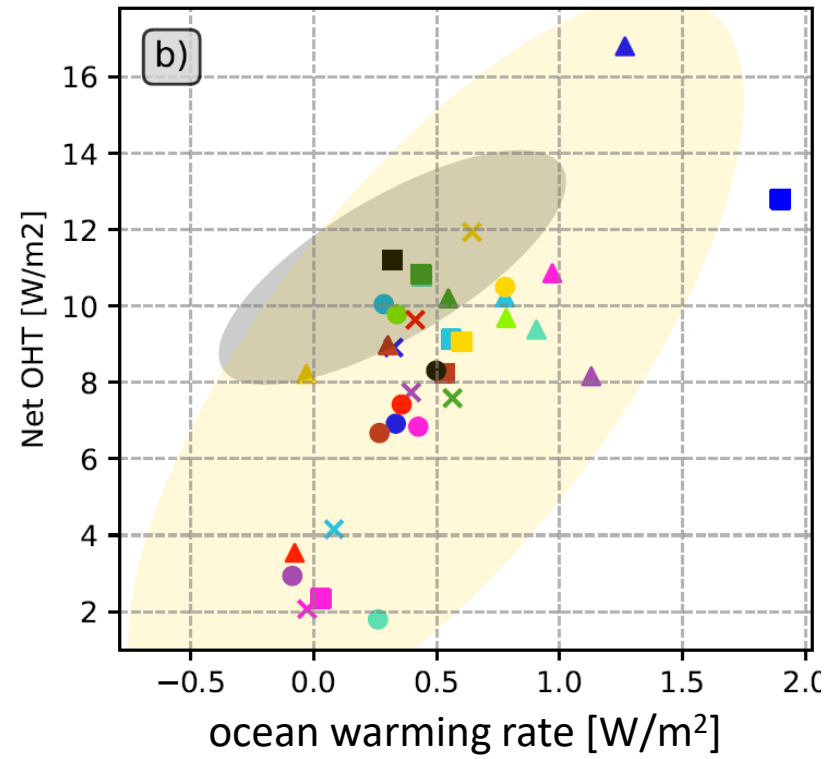
## Barents Sea Opening

$r=-0.81$

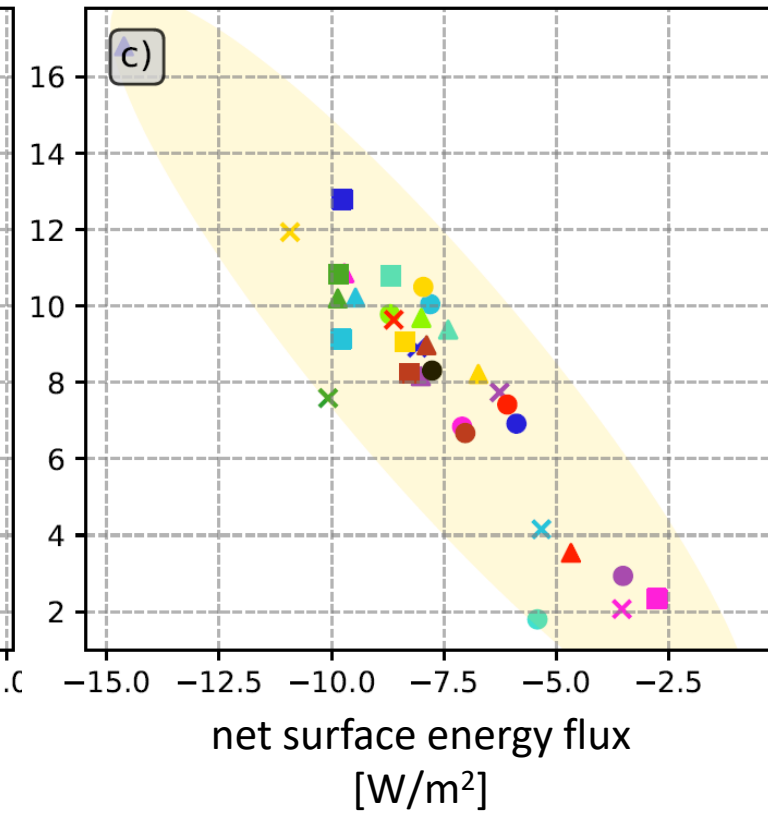


## pan-Arctic

$r=0.72$



$r=-0.91$



# Key points

- Large inter-model spreads and systematic biases in Arctic OHT
  - Major biases in the Barents Sea Opening due to Temperature and Volume Transport biases
- Effects on Arctic system (sea ice, ocean warming rate, surface energy fluxes, etc.)
- More in-depth assessments necessary to specify exact source of biases (e.g., oceanic fluxes)
  - **StraitFlux (available soon!)** should help to simplify the analyses
- Use results to generate physically based metrics to detect outliers from the model ensemble → reduce the spread of future projections of Arctic change
- Systematic biases also in other energy (e.g.,  $F_s$ ) and water budget components (not shown) → **Winkelbauer et al. (in preparation)**

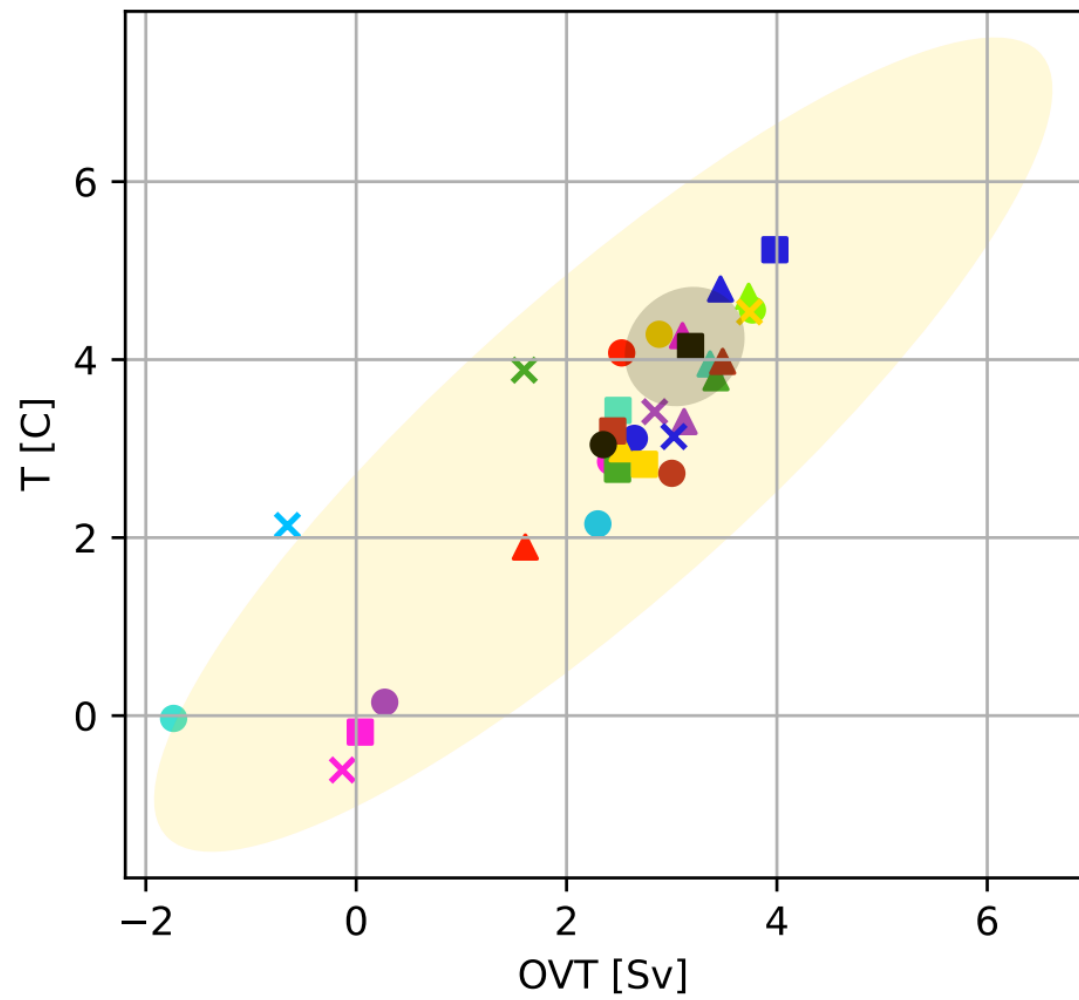
# Literature

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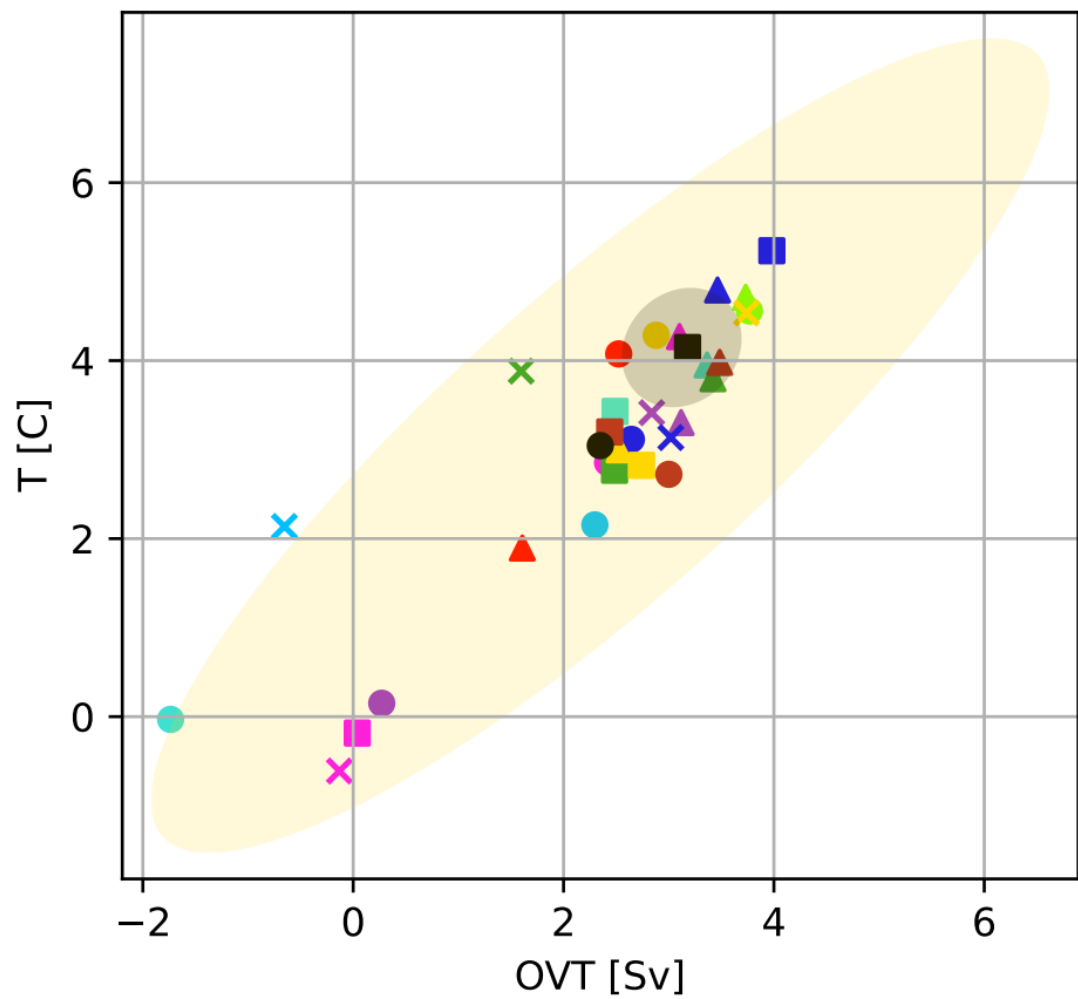
# BSO

$r=0.87$



# BSO

$r=0.87$



# Barents - Fram, $r=-0.72$

