



# Simulated Atlantic Meridional Overturning Circulation in the 20th century with an ocean model forced by reanalysis-based atmospheric data sets

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#### • Objective:

- An extended and improved ocean hindcast simulation for the full 20th Century.
- Comparison of the 20CR and CORE simulations.
- Impact of atmospheric forcings and ocean initial state on AMOCs.
- Provide full 20CR simulations for climate study and prediction.



# 2, Model, Atmospheric Forcing and Experiments

- Model: NorESM
  - MICOM + CICE
  - 1° zonal resolution
- Atmospheric Forcings
  - CORE.v2: 1948-2009
  - 20CRadj: 1871-2009

- Hindcast (ctrl) simulations
  - CORE run: 1948-2009
  - 20CR run: 1871-2009,
- Sensitivity experiments
  - Different atmospheric forcings
  - Different initial ocean states

\*Full descriptions of the 20CRadj are provided in He et al., Ocean Modelling, 2016.

## 3, Simulated evolution of AMOC with CORE a

#### Similarities:

- 5 (10) cycles for 20CR and CORE simulations
- Long-term increasing trend of AMOC for the first three cycles
- The last two cycles of each simulation have small differences
- The last cycle gives a stable AMOC



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- AMOC increases for 20CR but drop for CORE during the 1950s-1970s.



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#### **Question:**

What are the causes for the difference?



### Sensitivity experiments:

- Different atmospheric forcings
- Different initial ocean states





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#### **Conclusions:**

- Initial condition contributes 2 Sv.
- Atmospheric forcing contributes 4 Sv: wind and air temperature
- Initial state determines the AMOC strength while atmospheric forcing determines the variability of AMOC
- Cyclic spin-up procedure leads to a spurious drift in AMOC during the first 20 years.





























# <u>Summary</u>



- An adjusted version of the Twentieth Century Reanalysis (20CRv2) is constructed.
- Model forced by 20CRadj gives a stable Atlantic Meridional Overturning Circulation (AMOC).
- Differences in AMOC between 20CR and CORE-II simulation are mainly caused by the winds.
- Cyclic spin-up procedure leads to a spurious drift in AMOC during the first 20 years.
- The 20CR simulation can provide a balanced ocean initial state for CORE-type experiment.
- The 20CR simulation can be used for ocean climate studies on decadal time scale.

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<u>Thank you!</u>

<u>He et al., 2016:. Ocean Model., 100, 31–48, doi:10.1016/j.ocemod.2015.12.011.</u>

The 20CR simulation data are freely available upon request.