Contribution ID: **19** Type: **Poster**

How good should the initial conditions for decadal climate predictions be in terms of the Atlantic meridional overturning circulation?

Tuesday 18 July 2023 14:57 (3 minutes)

Atlantic meridional overturning circulation (AMOC) is one of the mechanisms for long-term predictability and one of the properties that decadal climate predictions (DCP) are attempting to predict. Yet, verifying the AMOC performance from the DCPs is problematic due to the short observational record as well data assimilation procedures for DCPs struggle to reconstruct the AMOC initial conditions from the historical period (1960-present).

To initialize DCPs, the widespread practice is to introduce separate ocean and atmosphere-only reanalyses (data assimilation products) into a coupled climate model through nudging and then to begin DCPs from the nudged states. Possible inconsistencies that may lead to initialization shocks from introducing external uncoupled reanalyses into ocean and atmosphere components of a prediction system is a known and long-established issue in the seasonal and decadal climate prediction communities. Initialization shocks that result from the following inconsistencies: 'between reanalysis and the prediction system'and 'between ocean reanalysis and atmosphere reanalysis'might lead to the loss of prediction skill at longer lead times. For example, it is known that full-field initialization can result in the disruption of the AMOC cell leading to multiple maxima in the overturning cell structure. However, how critical such AMOC issues are at the assimilation step for the prediction skill, e.g., at the surface of the ocean, has not been fully understood yet.

This study concerns with deriving a coupled reanalysis as a source of coupled ocean and atmosphere initial conditions for DCPs that are dynamically consistent between themselves and the prediction system. The reanalysis is based on the coupled adjoint method with the regularization scheme in the atmosphere designed for the Earth System Model of intermediate complexity CESAM (Centrum für Erdsystemforschung und Nachhaltigkeit Erdsystem Assimilations-Modell). From the test versions of the coupled reanalysis, it is obvious that different settings of the assimilation affect the behaviour of the AMOC. In a model-consistent approach, the study attempts to compare the initialization of the AMOC based on the coupled reanalysis and based on the coupled nudging toward the separate ocean and atmosphere reanalyses, which are also external to the prediction system as well as they are uncoupled. We also analyse the AMOC from the multi-model CMIP6 DCP experiments to identify whether possible flaws in the AMOC assimilations could be linked to the issues with the prediction skill for the important climate indices. The results of this study aim to guide future initialization developments for DCPs with the comprehensive Earth System Models.

Topic

Value of AMOC observing –what have we learned?

Author: Dr POLKOVA, Iuliia (Universität Hamburg, Centrum für Erdsystemforschung und Nachhaltigkeit, Institute of Oceanography, Hamburg, Germany)

Co-authors: SWINGEDOUW, Didier (CNRS-Université de Bordeaux, EPOC, Pessac, France); HERMANSON, Leon (Met Office, Exeter, UK); SMITH, Doug (Met Office, Exeter, UK); KÖHL, Armin (Universität Hamburg,

Centrum für Erdsystemforschung und Nachhaltigkeit, Institute of Oceanography, Hamburg, Germany); STAMMER, Detlef (Universität Hamburg, Centrum für Erdsystemforschung und Nachhaltigkeit, Institute of Oceanography, Hamburg, Germany); LYU, Guokun (Shanghai Jiao Tong University, School of Oceanography, Shanghai, China); SCHUBERT, Silke (Universität Hamburg, Centrum für Erdsystemforschung und Nachhaltigkeit, Institute of Oceanography, Hamburg, Germany); LUNKEIT, Frank (Universität Hamburg, Centrum für Erdsystemforschung und Nachhaltigkeit, Meteorological Institute, Hamburg, Germany)

Presenter: Dr POLKOVA, Iuliia (Universität Hamburg, Centrum für Erdsystemforschung und Nachhaltigkeit, Institute of Oceanography, Hamburg, Germany)

Session Classification: Lightning poster