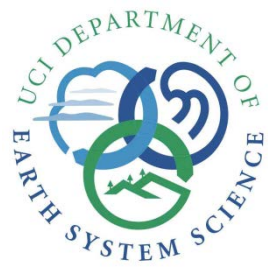# Are 100 ensemble members enough to capture the remote atmospheric response to +2°C Arctic sea ice loss ?

Y. Peings, Z. Labe and G. Magnusdottir

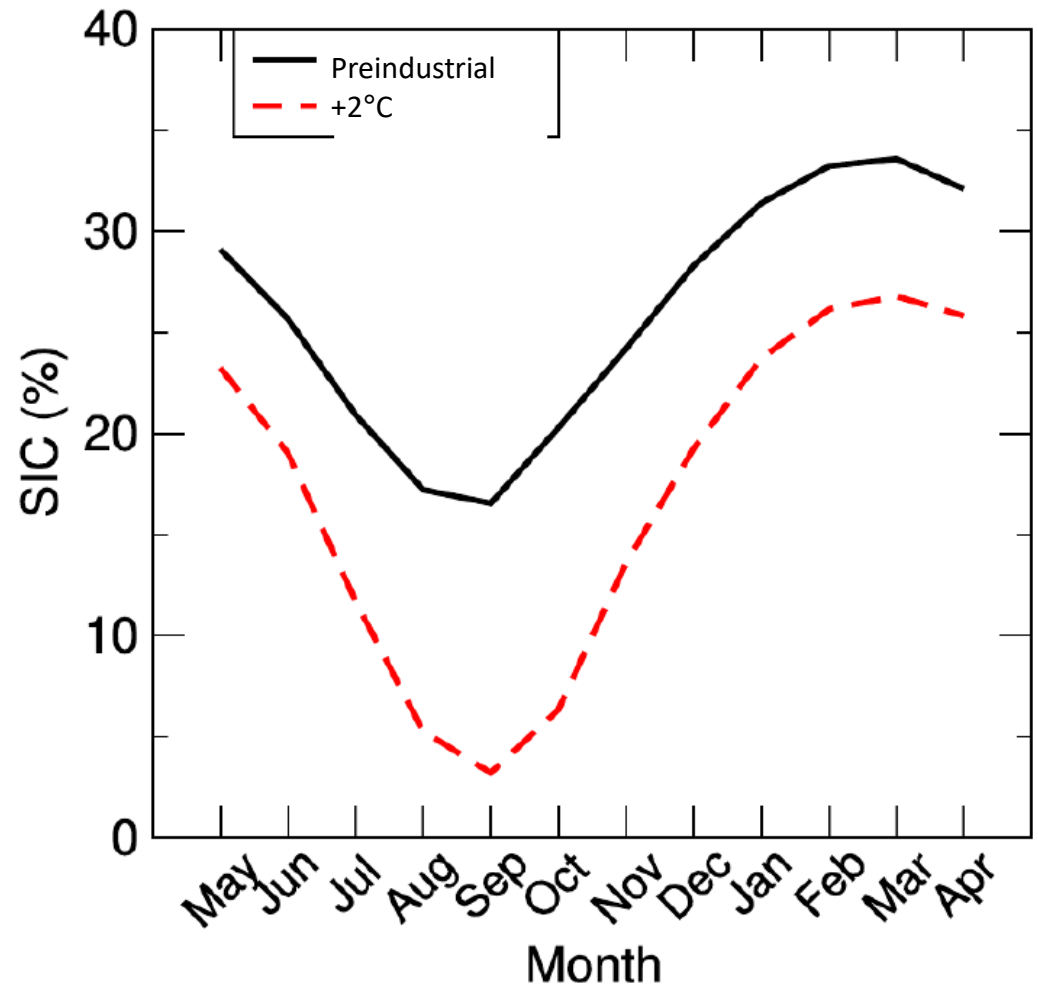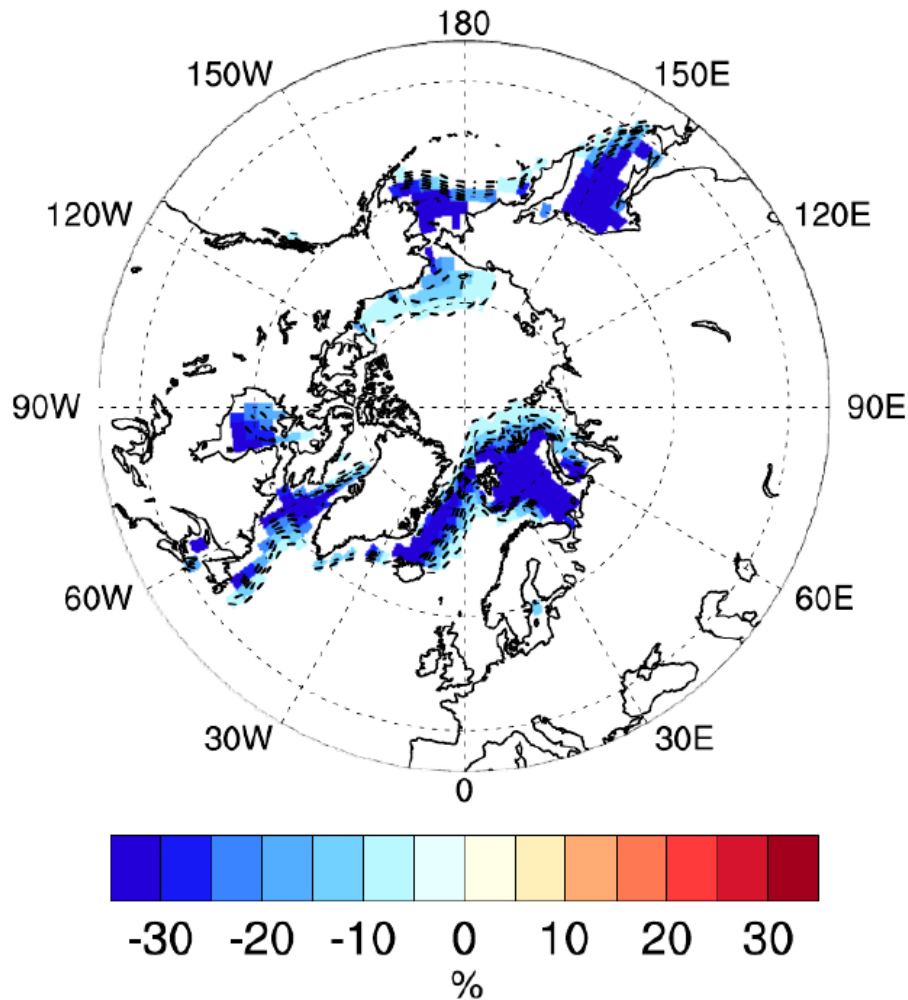Department of Earth System Science, University of California Irvine, Irvine, CA, USA

What is the atmospheric response to +2°C Arctic sea ice loss ?
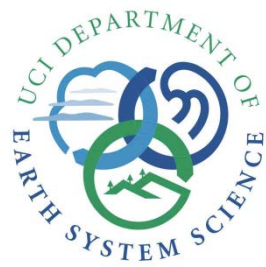
## AGCM and OAGCM PAMIP experiments, with E3SMv1 and SC-WACCM4

(Left) DJFM sea ice concentration anomalies (%) prescribed in the experiments (+2°C Arctic sea ice minus preindustrial Arctic sea ice). (Right) Annual cycle of sea ice concentration (%) in the NH high-latitudes (north of 45°N), in the preindustrial and +2°C Arctic sea ice runs.

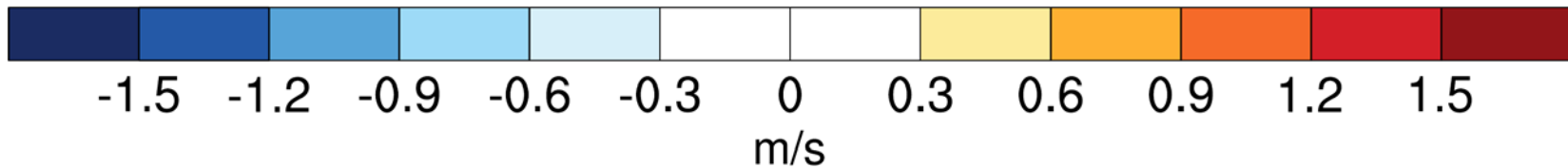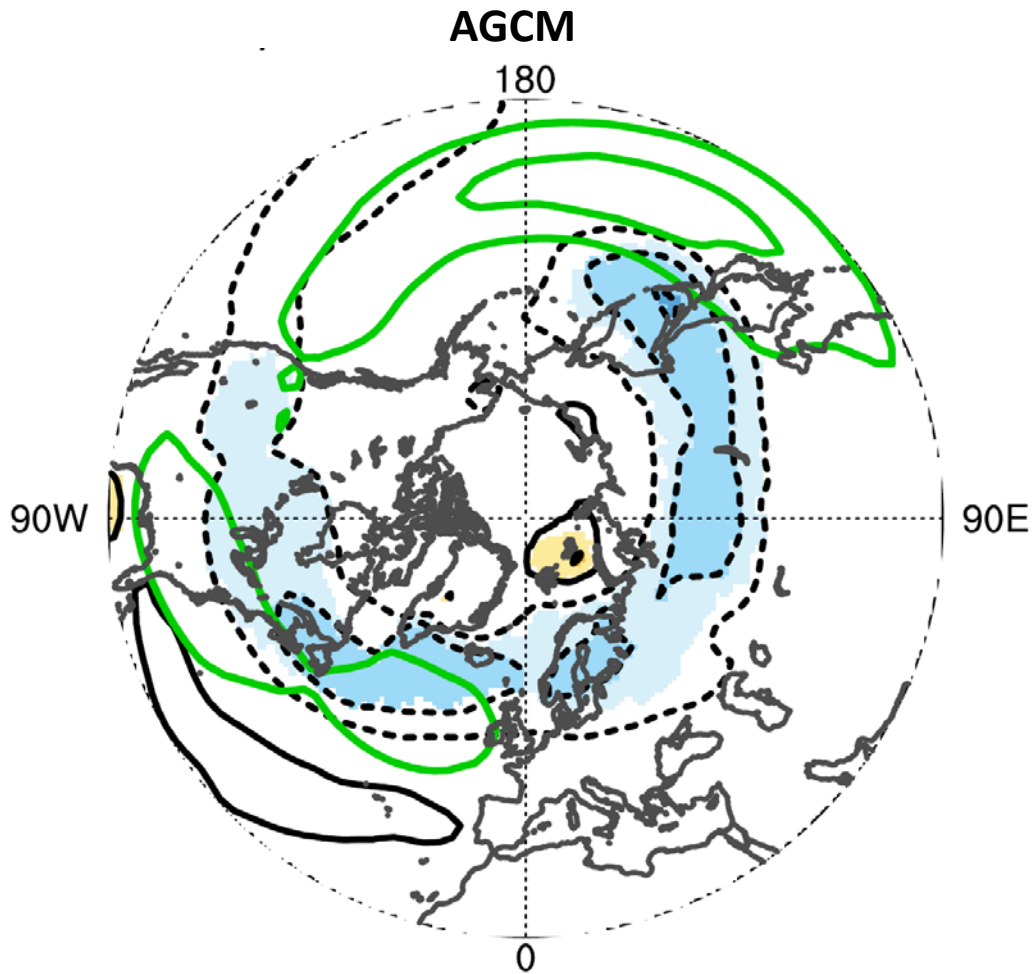# Impact of ocean-atmosphere coupling

CESM (SC-WACCM4)
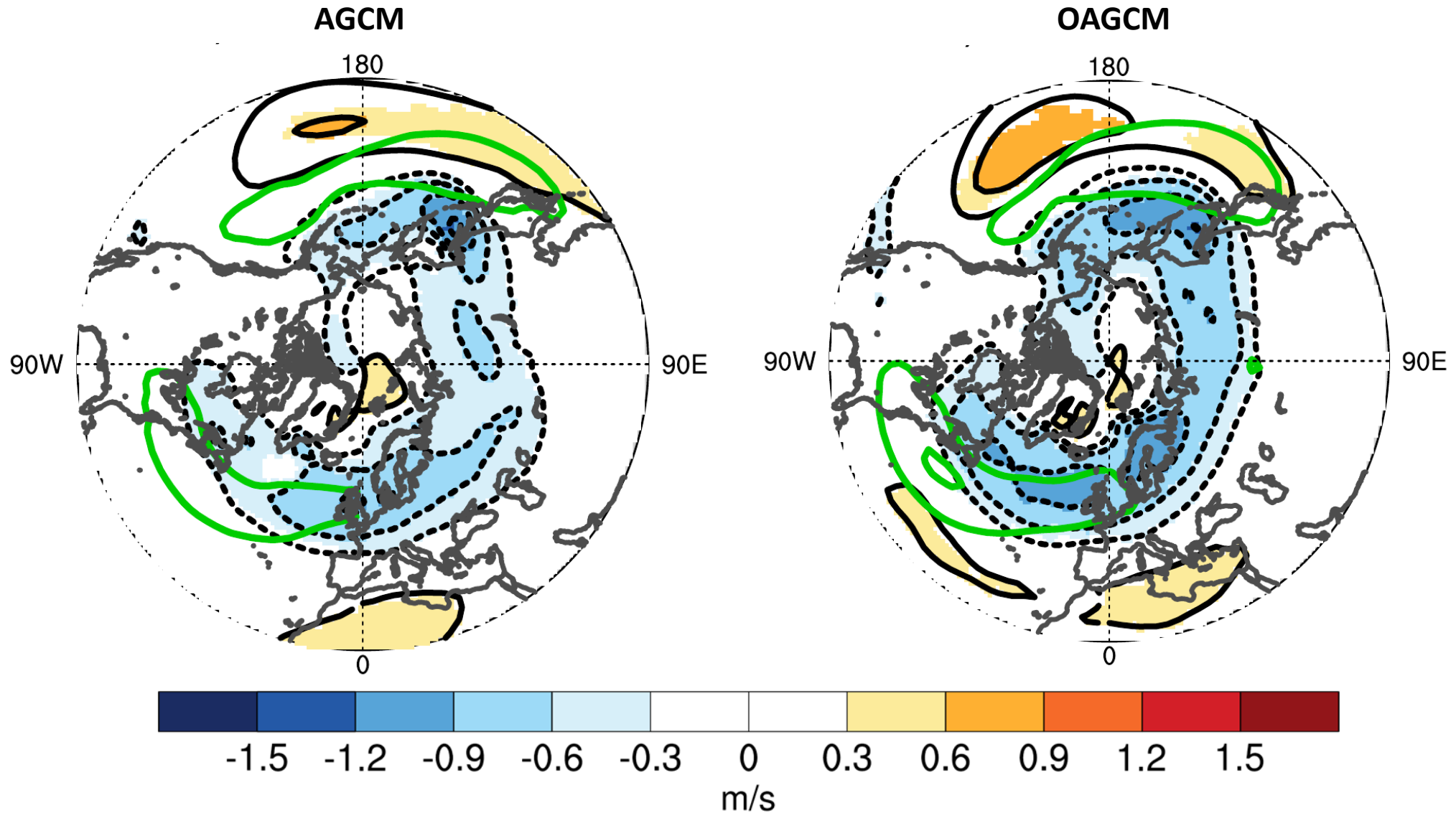
DJFM response of U700 in the AGCM runs (left) and in the OAGCM runs (right) of SC-WACCM4 (300-member ens-mean)

Impact of ocean-atmosphere coupling

E3SMv1

AGCM

OAGCM

DJFM response of U700 in the AGCM runs of E3SMv1 (200-member ensemble mean)

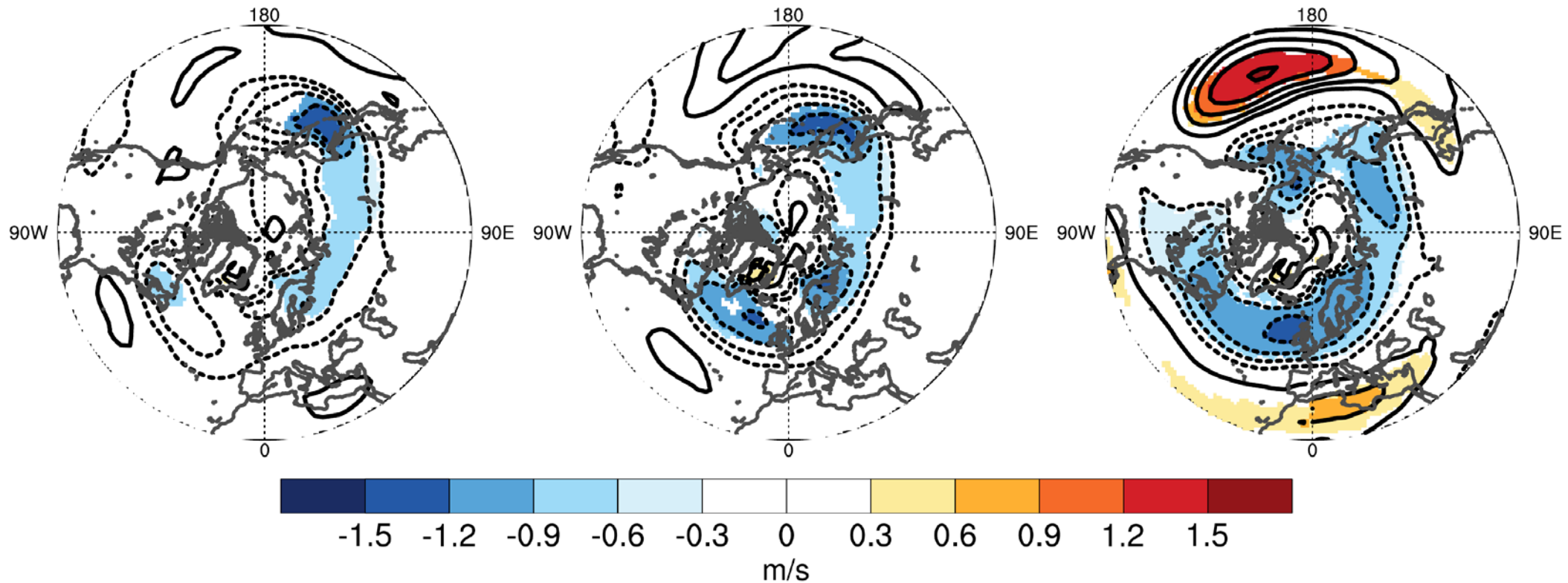# High internal variability and inconsistency in the response
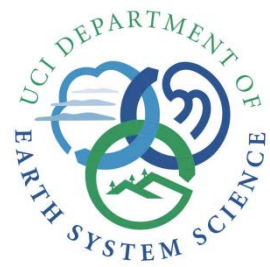
300 independent ensemble members

DJFM response of U700 in the OAGCM runs of SC-WACCM4, for ensemble members 1-100 (left), 101-200 (middle), 201-300 (right).
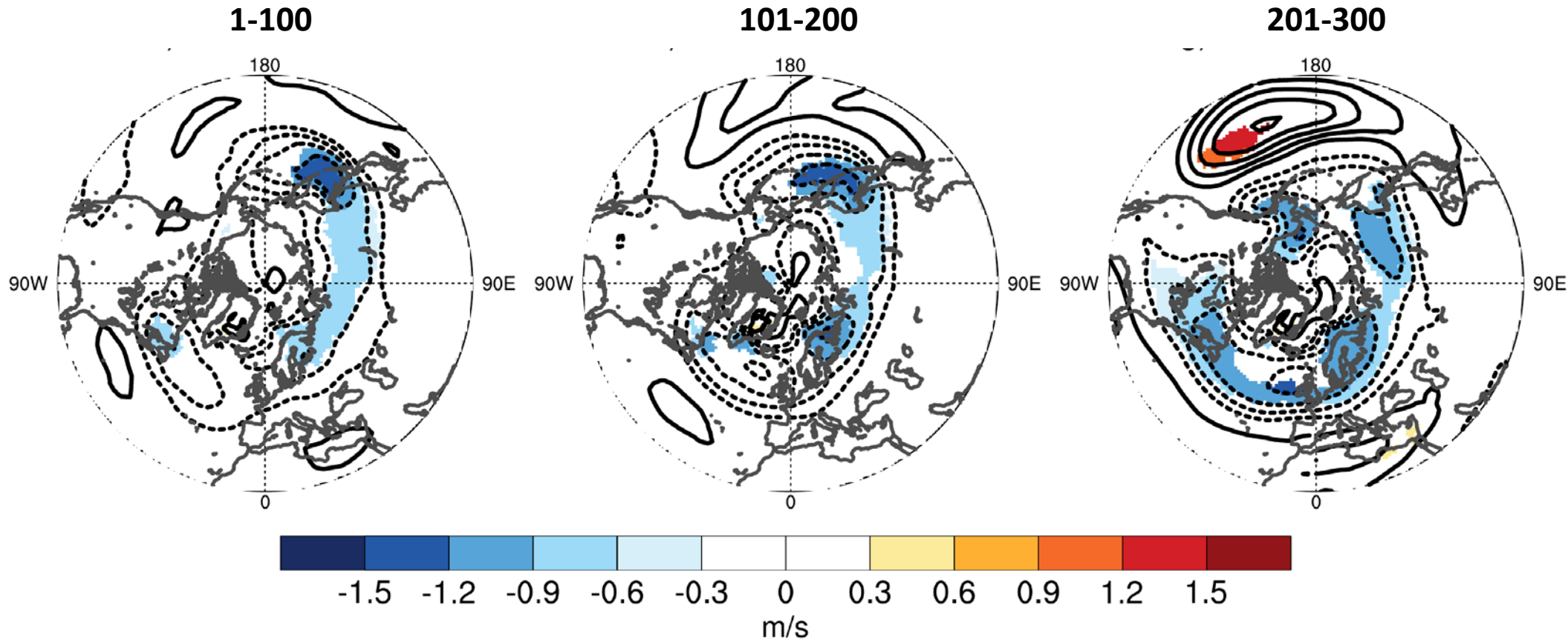
Using a **Student t-test + False Discovery Rate** correction to assess statistical significance

High internal variability and inconsistency in the response

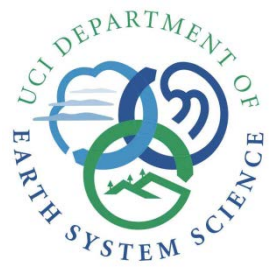**300 independent ensemble members**

DJFM response of U700 in the OAGCM runs of SC-WACCM4, for ensemble members 1-100 (left), 101-200 (middle), 201-300 (right)..

Using a new test, the **Consistency Detection Rate** test.

Main results and prospects

- The atmospheric response to +2°C Arctic sea ice loss consists of weaker westerlies on the poleward flank of the mid-latitude flow.

- Weak amplitude, although reinforced when ocean-atmosphere coupling is included.

- Due to small signal to noise ratio, internal variability can dominate the signal and create inconsistency when trying to reproduce the results. Must be considered when trying to attribute model spread in PAMIP multimodel analyses.

- The AGCM runs with E3SM are done, we are working on implementing ice nudging in the coupled version.

- Next step will be to make the E3SM data available on ESGF (we need help !).