How does internal variability influence the ability of CMIP5 models to reproduce the recent trend in Southern Ocean sea ice extent?

**Background**

- Current GCMs are generally unable to reproduce the observed sea ice extent. Several causes have been identified, including:
  - A poorly constrained sea ice boundary,
  - Different sea ice simulations and feedbacks among individual models,
  - An inadequate internal variability.

- CMIP5 simulations display a variety of sea ice extents, which are generally larger than observations. However, some models provide results that are in good agreement with observations.

**Objectives of this study**

- To test 2 possible explanations for the misrepresentation of the positive trend in sea ice extent by climate models:
  - An unrealistic internal variability
  - An inadequate initialization of the system through the analysis of CMIP5 simulations.

**Take home message**

- According to model results, the trend of observed sea ice extent is compatible with a combination of the forced response and the internal variability.
- Most of the CMIP5 historical simulations respond to the forcing, including those due to the stratospheric ozone depletion, decreasing their sea ice in the Southern Ocean (Fig. 4). Some models can provide a range of trends that encompass the observed positive trend, suggesting that the latter can arise from internal variability.

**Does the models’ internal variability agree with the one of the observations?**

- Most of the models overestimate the interannual variability of sea ice extent (Fig. 3b and 4b), which prevents us from assessing the link between the internal variability and the increase in sea ice extent.

**How does the initialization method impact the simulated trend in sea ice extent?**

- No clear improvement arising from the initialization through current data assimilation methods (Fig. 5).

**References**


**Acknowledgments**

- Virolelle Zunz is Research Fellow with the Fondation pour la formation à la Recherche dans l'Industrie et l'Agriculture (FRIA-Belgium).