EGU2017 Abstract Aaron Spring

**The role of internal variability for decadal carbon uptake anomalies in the Southern Ocean**

**Internal variability governing the decadal variations of carbon uptake in the Southern Ocean**

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The oceans, especially the Southern Ocean, act as a major sink for anthropogenic CO2 emissions and play an essential role in modulating global carbon cycle and climate change. Previous studies based on observations (e.g., Landschützer et al. 2015) show pronounced decadal variations of carbon uptake in the Southern Ocean in recent decades. However, due to large internal and inter-model variability and limited ensemble size of simulations, the variation of this important ocean sink and its response to climate change and variability are still poorly assessed and represented in the state-of-the-art earth system models (ESMs).

In this study, we use 100 ensemble members of historical plus RCP4.5 scenario simulations based on the Max Planck Institute-ESM (MPI-ESM) to investigate the internal variability of the oceanic carbon flux in the Southern Ocean. To identify the underlying processes that govern the variability, we i) detect individual ensemble members that show anomalous decadal trends and ii) assess their unique characteristics with respect to the ensemble mean.

We identify numerous members with patterns of inter-annual variability of the carbon sink. One member shows anomalous negative decadal carbon uptake trend, which resembles the observed anomalous trend. This result suggests that large ensembles successfully reproduce observed internal variability of carbon sink in the Southern Ocean. in regulating the variability of carbon cycle in the Southern Ocean and aim for better understanding of the competing consequences arising from internal variability of primary production and ocean upwelling.