Contribution ID: **91** Type: **Talk**

Mechanisms of the Sea-Air CO2 Flux Seasonal Cycle biases in CMIP5 Earth Systems Models in the Southern Ocean

Tuesday, 5 December 2017 11:50 (15 minutes)

The Southern Ocean forms a key component of the global carbon cycle. Recent studies, however, show that CMIP5 Earth System Models (ESM) disagree on the representation of the seasonal cycle of the CO2 flux (FCO2) and compare poorly to observations in the Southern Ocean. This model-observations bias has important implications on the ability of ESMs to predict century scale CO2 sink and related climate feedbacks. In this study, we used a specialized diagnostic analysis on 10 CMIP5 models in the Southern Ocean to discriminate the role of the major drivers, namely the temperature control and the concentration of dissolved inorganic carbon (DIC). Our analysis shows that the FCO2 biases in CMIP5 models cluster in two major groups . Group A models (MPI-ESM-MR, NorESM2 and HadGEM-ES) are characterized by exaggerated primary production such that biologically driven DIC changes mainly regulate the seasonal cycle of FCO2. Group-B (CMCC-CESM, GFDL-ESM2M, IPSL-CM5A-MR, MRI-ESM, CanESM2, CNRS-CERFACS) overestimates the role of temperature and thus the change in CO2 solubility becomes a dominant driver of FCO2 variability. While CMIP5 models mostly show a singular dominant influence of these two extremes, observations show a modest influence of both, with a dominance of DIC regulation. We found that CMIP5 models overestimate cooling and warming rates during autumn and spring with respect to observations. Because of this, the role of solubility is overestimated, particularly during these seasons (autumn and spring) in group B models, to the extent of contradicting the biological CO2 uptake during spring. Group A does not show this solubility driven bias due to the overestimation of DIC draw down. This finding strongly implies that the inability of the CMIP5 ESMs to resolve CO2 biological uptake during spring might be crucially related to the sensitivity of the pCO2 to temperature in addition to underestimated biological CO2 uptake.

HPC content

Same

Primary author: Mr MONGWE, Precious (CSIR NRE)

Presenter: Mr MONGWE, Precious (CSIR NRE)

Session Classification: Earth Science

Track Classification: Earth Systems Modelling