What have we learned from 5 years of Seasonal – Mesoscale Ocean – Climate Research in the Southern Ocean?

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Over the past 5 years the Southern Ocean Carbon – Climate Observatory (SOCCO) programme has explored the role and relevance of fine scale ocean dynamics to better understanding the climate sensitivities of Southern Ocean. This scope of this approach extended over physics (heat fluxes), biogeochemistry (carbon fluxes) and ecosystem productivity (primary production). This research, which spanned two NRF – SANAP calls, developed and made use of new enabling technologies such as ocean robotics, high-resolution models, higher resolution satellite products and a new polar research ship.. The methodology that integrated across these platforms was the Southern Ocean Seasonal Cycle Experiment (SOSCEX)(Swart et al., 2012), which over 3 years of sampling, has provided unprecedented resolution observations of seasonal dynamics of physics, biogeochemistry and productivity, which lead to a better understanding of their links and sensitivities.

Here we review this progress though a number of publications that highlight the new learning in sub-mesoscale dynamics of upper ocean physics (Swart et al., 2016), the role of summer storms in enhancing the iron supply that explains the elevated productivity in the SAZ (Nicholson et al., 2016; Thomalla et al., 2015), hitherto underestimated sampling scale sensitivities for CO2 flux estimates (Monteiro et al., 2015), significant biases in ocean and earth system models in respect of CO2 exchange with the Southern Ocean (Mongwe et al., 2016; Mongwe et al., 2016).

Much of this learning is being incorporated into the CSIR Variable Resolution Earth Systems Model (VR-ESM), which will be Africa's only contribution to the 6th Assessment Round (AR6) of the IPCC in 2018-2019. In this way we hope to reduce the SO biases of the 21st century model projections. We are also interested in exploring how our learning and methodologies can contribute to the wider SANAP community's research goals as well as proposing for discussion an experimental initiative that