



## **The role of ocean physics in controlling the climate response and carbon cycle feedback to carbon emissions**

Richard G Williams (1), Anna Katavouta (1), and Philip Goodwin (2)

(1) Liverpool University, School of Environmental Sciences, Earth, Ocean & Ecological Sciences, Liverpool, United Kingdom (ric@liv.ac.uk), (2) School of Ocean and Earth Sciences, University of Southampton, UK

The ocean provides an important role by sequestering the excess heat and carbon supplied to the climate system. This ocean response involves the ventilation mechanism, where heat and carbon are taken up by the mixed layer and then transferred to the thermocline and deep ocean. The effect of ocean physics in determining the climate response and the feedbacks to carbon forcing is explored using simplified conceptual models of the atmosphere and ocean. The feedback of the ocean carbon cycle is usually represented in terms of a dependence on atmospheric carbon dioxide and surface temperature changes, the latter providing a crude representation of physical effects of climate change. Here we explore the ocean carbon cycle response and feedbacks to a range of physical processes altering the mixed-layer thickness and the strength of the meridional overturning, as well as changing the surface temperature. The ocean carbon cycle response and feedback turns out to be sensitive to all of these physical changes affecting ocean ventilation, but their importance varies on different timescales: the mixed layer effects dominating on a decadal timescale and the overturning dominating on multi-decadal to centennial timescales.