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Investigating the feedbacks between land surface cover and the Atlantic Meridional Overturning Circulation (AMOC) in a coupled climate model

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The strength and variability of the AMOC has important implications for North Atlantic climate, including sea surface temperature (SST), surface air temperature (SAT) and precipitation. Numerous studies have investigated how the AMOC may respond to climate perturbations, including CO_2 and freshwater flux, however the feedbacks between the land surface and the AMOC have not been examined to the same degree. It is important to investigate if and how the AMOC is sensitive to land surface cover, the associated feedback mechanisms and how these may change in a warming climate.

This study will use the HadCM3 climate model coupled with the DGVM TRIFFID to investigate the feedbacks between vegetation distribution and the strength and variability of the AMOC at increasing CO_2 concentrations. We include both the role of fixed and dynamic vegetation and the possible impact of crops. There are two key aims, firstly to examine how sensitive vegetation distribution is to the AMOC, and secondly to determine the significance of including a DGVM or crops in modelling AMOC variability.

Each simulation will be run for 2000 years in order to provide a clear statistical signal and the AMOC decomposed with multichannel singular spectrum analysis (MSSA) and empirical orthogonal functions (EOFs). We aim to elucidate feedbacks between the land surface, ocean and atmosphere in a coupled climate model and the potential implications for climate variability.