

Inferring past ocean circulation and AMOC from proxies/fingerprints

David Thornalley

University College London

The circulation of the North Atlantic plays a key role in climate through its redistribution of heat and the ocean uptake of carbon dioxide. Changes in its circulation, including both the horizontal gyre circulation and the meridional overturning circulation can impact climate on a variety of timescales, with varying mechanisms and coupling to other climate components. Despite its importance for regional and global climate, there are still large gaps in our knowledge of the recent history of North Atlantic circulation. Much of this stems from the relatively short time span of instrumental datasets. Therefore alternative constraints on past circulation are being used such as proxy and fingerprint reconstructions. Outstanding questions include: What are the fingerprints of different mechanisms of circulation change? What is the role of internal variability versus anthropogenic forcing in so-called Atlantic Multi-decadal Variability (AMV)? Were historical events such as the Little Ice Age linked to changes in the meridional overturning or horizontal subpolar gyre circulation? And observations of meridional overturning strength suggest a decline over the last ~10 years, but to what extent is this the declining phase of natural multi-decadal variability or part of a longer-term (anthropogenic?) reduction? I will present an overview of the varying approaches that can be taken to extend our instrumental records of Atlantic circulation (and specifically AMOC). This will range from traditional paleoceanographic techniques to reconstruct major changes in geological time, up to more recent implementation of temperature and sea-level fingerprints of AMOC variability. Some key recent findings from late Holocene reconstructions will be presented to demonstrate the potential of these approaches, yet outstanding issues are also highlighted.