

EXTRACTION OF A COMMON SIGNAL FROM SEVERAL TIME SERIES WITH APPLICATION TO ESTIMATION OF TIPPING TIMES IN THE CLIMATE

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Several records of Atlantic sea surface temperatures and sea salinities integrated over different areas have been proposed as fingerprints of the Atlantic Meridional Overturning Circulation (AMOC). A fingerprint is assumed to contain information about the AMOC, however, contaminated by unrelated processes. A statistically more powerful fingerprint can be constructed, combining the information from several fingerprints. We present statistical models for extracting the most probable common signal to obtain the best AMOC proxy and compare with direct AMOC measurements for the recent past. Co-integration analysis is a powerful time series tool to find stationary relationships among non-stationary processes. It is particularly suitable for separating short- and long-term dependencies, thus, separating the long term AMOC variations from short term climatic variations.

If two AMOC fingerprints are not strongly correlated, they can obviously not both be trustworthy representations of the AMOC. Thus, if significant early warning signals (EWS) are found in both of such records, at least one is spurious. In that case, it is questionable if EWSs for a forthcoming collapse can be trusted at all since it is observed for unrelated reasons in (at least) one record. It is therefore essential to extract such common signal, to avoid spurious results. The method still works if some of the fingerprints do not carry any information on the AMOC.

This is joint work with Peter Ditlevsen, Anders Rahbek and Gabriel Niels Damsholt.