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Relationship of local and regional variability in a coupled climate model

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Comparing in-situ observations or palaeoclimate proxy data to model simulations includes the issue of comparing different spatial scales. While coupled climate models typically have grid cells spanning several hundred kilometres proxy records sample local points. A straight forward comparison would assume that proxy records are representative for a larger region while neglecting possible small-scale variability. In addition, only specific locations are suitable to retrieve high-resolution palaeoclimate records. Marine sediments, for instance, are often taken close to shores due to a beneficial high sediment rate. This could cause sampling biases of local variance estimates making them non-representative of regional variability in general.

In a first step we conducted a case study by analysing model output of the AWI-CM (FESOM coupled with ECHAM). The ocean component is based on an unstructured mesh with variable spatial resolution allowing to increase resolution in coastal as well as dynamical relevant regions. With respect to local-to-regional scales spatial degrees of freedom estimations are carried out for sea surface temperature variability getting an expectation of possible local dependencies. First results could show higher degrees of freedom in regions of surface currents, ocean upwelling, or transition regions of sea ice edges. This encouraged for an extended investigation of specific regions of interest in terms of potential biases of variance estimates carried out in both, time and spectral domain. A sensitivity study with respect to local sampling biases in the model world gives a first estimate of their potential magnitude.