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Dynamical dependencies at monthly and interannual time scales in the Climate system: Study of the North Pacific and Atlantic regions

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The directional dependencies of different climate indices are explored using the Liang-Kleeman information flow in order to disentangle the influence of certain regions over the globe on the development of low-frequency variability of others. Seven key indices (the sea-surface temperature in El-Niño 3.4 region, the Atlantic Multidecadal Oscillation, the North Atlantic Oscillation, the North Pacific America pattern, the Arctic Oscillation, the Pacific Decadal Oscillation, the Tropical North Atlantic index), together with three local time series located in Western Europe (Belgium), are selected. The analysis is performed on time scales from a month to 5 years by using a sliding window as filtering procedure.

A few key new results on the remote influence emerge: (i) The Arctic Oscillation plays a key role at short time (monthly) scales on the dynamics of the North Pacific and North Atlantic; (ii) the North Atlantic Oscillation is playing a global role at long time scales (several years); (iii) the Pacific Decadal Oscillation is indeed slaved to other influences; (iv) the local observables over Western Europe influence the variability on the ocean basins on long time scales. These results further illustrate the power of the Liang-Kleeman information flow in disentangling the dynamical dependencies.