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# What do we know about Holocene climate patterns and modes?

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The Holocene can be considered in three phases: 1) the “Preboreal” and “Boreal” chronozones, lasting from about 11,600 to about 9000 yr BP; 2) the “Atlantic” chronozone covering the period from about 9000 to about 5-6000 yr BP, also called “Hypsithermal”, “Altithermal” or “Holocene Climatic Optimum”, referring to warm conditions, mainly in the northern mid- to high latitudes; 3) the “Subboreal” and “Subatlantic” chronozones covering the period from about 5-6000 yr BP to pre-industrial time, and also called “Neoglacial”, referring to a series of glacier advances. At the millennial timescale those phases can be mainly understood in terms of the time course of orbital forcing, above all the strong summer insolation in the Northern Hemisphere at around 11,000 yr BP, which declined until the present time, causing a progressive southern shift of the Northern Hemisphere summer position of the ITCZ. In contrast, the diagnosis of processes being responsible for decadal to multi-century climate variability is much more complex. The often cited existence of a global cyclicity in form of the Bond Cycles is likely restricted to the North Atlantic area and its surroundings. Rapid shifts in the climate system are detectable in timeseries as well as in long model runs, but their origin and temporal coincindence is still questionable. One of the challenges of future research will be to investigate the possible connections and feedbacks between the North Atlantic dynamics (including the North Atlantic Oscillation and the Atlantic Multidecadal Oscillation) and the dynamics in the Indian Ocean – Pacific area (including the dynamics related to the Indian Ocean – Pacific Warm Pool, the Asian monsoon and the ENSO). How far were the fluctuations of these phenomena influenced by natural forcing factors, such as low solar activity and series of tropical volcanic eruptions?