



Frequency of extreme daily temperatures (HadEX2) over Eurasia documented in a northern Red Sea coral oxygen isotope record during the last century

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The potential of a bimonthly-resolved northern Red Sea coral $\delta^{18}\text{O}$ record as an archive for the occurrence of extreme daily temperature phenomena over Eurasia during Northern Hemisphere winter is investigated for the 1901-1995 period using extreme indices provided by the HadEX2 dataset (e.g., frost days, ice days, cold nights and cold days). The coral $\delta^{18}\text{O}$ record reflects a combined signal of temperature and salinity variations in the surface waters of the northern Red Sea, and has been previously shown to provide a proxy for atmospheric circulation changes over the Northern Hemisphere mid-latitudes at interannual to decadal time scales. Here we show, by applying composite analysis, that cooler/more arid (warmer/less arid) winter conditions in the northern Red Sea region, indicated by positive (negative) coral $\delta^{18}\text{O}$ anomalies (January-February), are related to a strong (weak) Northern Hemisphere polar vortex and, as a consequence, to a decreased (increased) number of days characterized by very cold temperatures and frost over Scandinavia and Central Europe. This situation is associated with an increased (decreased) number of days characterized by very cold temperatures and frost over the Balkan region. The occurrence of these daily temperature extremes is modulated by the frequency of atmospheric blocking over the British Isles and Central Europe, and a shift in the direction of the North Atlantic storm tracks. Importantly, coral records provide a bimonthly to monthly resolution, compared to other high-resolution proxy records which have either an annual resolution (e.g., ice cores, varved sediments) or an annual resolution with a signal that is biased towards a specific season that in most cases is not winter (e.g., tree rings). We argue that bimonthly-resolved northern Red Sea coral $\delta^{18}\text{O}$ records provide an archive of interannual to decadal variations in the occurrence of extreme daily temperature events over wintertime Eurasia prior to the start of instrumental observations.