



Earlier onset of spring: quantifying from temperature series in Stockholm and northern China

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Changes in the timing of seasons, especially the spring season, have gained much attention worldwide in recent decade or so. In this presentation, changes in the spring onset, quantified from temperature series, as well as its possible causes will be reported from both long-term and short-term perspectives. We used a new adaptive time-series analysis tool – the ensemble empirical mode decomposition (EEMD) to adaptively and temporally locally determine climatic spring onset from homogenized daily surface air temperature series (SAT), which can be easily available and comparable across large areas.

(1) The analysis from one of the longest observational climate series in the world – daily SAT at Stockholm (Sweden) for the period 1756–2000 shows a clear turning point of secular trend in spring onset around 1884/1885, from delaying to advancing. The winter NAO indices were found to be correlated with the spring onset at Stockholm at an interannual timescale only for some decades, but unable to explain the change of the long-term trends. The secular change from cooling to warming around the 1880s, especially in terms of spring temperature, might have led to the secular change of spring onset (Qian et al. 2009 GRL). (2) The analysis from one of the most prominent warming regions – northern China for the period 1955–2003 shows that the spring onset has advanced all over northern China, but more significant in the east than in the west part of the region, which can be explained by opposite changes in the spring phase of the SAT annual cycle (the yearly period component, which is the dominant component in the SAT series outside the tropics). Change in the spring phase of annual cycle explains 40-60% of the spring onset trend and is attributable to a weakening Asian winter monsoon (Qian et al. 2011 Adv. Atmos. Sci.).

Conclusions: in the long run, the secular trend of earlier onset of spring is attributed mainly to the warming trend; but in recent decades, change in atmospheric circulation, e.g. Asian winter monsoon/cold surges (in terms of China) also played a role, through altering trend in the spring phase of SAT annual cycle.

References:

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