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Shifts of seasons at North-Hemisphere mid-latitudes: Natural fluctuations correlated with the North Atlantic Oscillation

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One model based and three complex demodulation techniques (Hilbert transform, singular system analysis and wavelet transform) have been applied by Palus et al. [Geophys. Res. Lett. 32, L12805, 2005] to daily mean near-surface air temperature series from several mid-latitude European stations in order to obtain reliable estimates of instantaneous phases of the annual cycle as an objective measure of timing of seasons. The consistency of the estimates was checked by comparing independent methods, their reliability by comparison with actual annual temperature profiles. The previously reported advancement of spring seasons in 1990's has been confirmed, however, these changes did not depart from the range of natural phase fluctuations observed in the historical temperature records. Significant, geographically dependent correlations of the phase fluctuations with the North Atlantic Oscillation index, as well as weaker, negative correlations with the El Nino Southern Oscillation index have been observed.
Here we extend the study using monthly NCEP/NCAR and ERA40 near-surface air temperature series. No statistically significant trends in the phase of the annual cycle have been observed, however, both the reanalysis datasets provide consistent patterns of areas with marked, statistically significant correlations between the phase fluctuations and the North Atlantic Oscillation index. Shifts of seasons are probably caused by a process of natural fluctuations. Underlying mechanisms of this dynamical process, as well as its couplings with global circulation phenomena should be understood. In particular, a level of deterministic dynamics in, or couplings of this process with more predictable phenomena should be established, since potential skills in prediction of onsets of seasons could have significant socioeconomic impacts, while an unpredictable phase in the climate may be a more serious problem to society than changes in the amplitude of the annual cycle or even of the mean temperature [D.J. Thomson, Science 269, 59-68, 1995].

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