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Decadal climate regimes and the "hiatus"

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Yearly overlapping decadal segments of the HadCRUT (versions 3 and 4) hemispheric surface air temperature (SAT) time series (deseasonalized) have been analyzed, starting before the mid-20th century stagnation period until the most recent data delivery (for March 2017), in order to gain insight into the system's dynamic organization at this time scale. The two-dimensional (2D) SAT view (presented as so called "phase plots", where the time is running as parameter along the curve) is supplemented by corresponding analyses of the common dynamic indices of both North Atlantic and Southern Oscillation (NAO, SO), thus generating a four-dimensional (4D) data perspective. In the 2D SAT (NH vs. SH) view, several slow dynamics are found which call into mind pictures that display motions of much simpler dynamic systems, notably apparent "horseshoe" structures as well as related homoclinic and heteroclinic orbits which may be attributed to the system's extreme excursions. The 'dynamic dimensions' of the 4D view reveal stretches of surprisingly linear relationships within the context of El Nino / La Nina episodes.
Entry and exit behavior of the 1940s to 1970 stagnation period are studied in detail, as is the entry into the "hiatus" regime which appears to have happened as a result of the 1997/98 ENSO episode. A similar SAT 'shove' might be the result of the most recent, 2015/16 extreme thermal excursion and its (only partial?) return. The present estimate is +0.3 K in NH SAT and +0.1 K in SH SAT - but these dynamics did not yet come to an end, and it is thus not yet clear whether or not the "hiatus" regime of the past ca. 20 years has been left now.
Method of analysis is the Matching Pursuit technique, using a dictionary of frequency-modulated harmonic elementary signals, supported by Wavelet filtering to separate the slow (>15 months period) motions from mixed data components. Methodological uncertainties are addressed using the overlapping of data segments, and data uncertainties are discussed by means of analyses of the two HadCRUT series, as well as of an older one from the same source.

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A worm's-eye view on intraseasonal climate dynamics

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Aimed at offering a view on, and qualitative understanding of, regional climate dynamics at the (intra-) seasonal timescale which is useful and tractable to both farmers and public authorities, climate data of station Lindenberg (Mark Brandenburg, Germany) have been analyzed for each boreal summer since the beginning of the record in 1906. Here we focus on the surface air temperature (SAT) series, and notably on two exceptional years of the most recent past, namely 2013 and 2016. Method of analysis is the Matching Pursuit (MP) procedure of data decomposition, equipped with an overcomplete dictionary of "Gaussian logons", i.e. frequency-modulated (FM) Gabor wavelets, where the harmonic kernel of this Gaussian-enveloped wavelet becomes harmonically modulated to form a very flexible data model (or "analyzing wavelet"). We are interested at present in leading MP-FM components of the system's 'slow' dynamics.
Aside of the first component, depicting the summer segment of a kind of seasonal harmonic as expected, intraseasonal modes of the 30-60 days band, corresponding to the major activity cycle of the planetary monsoon system, are often dominant in these Central European midlatitude SAT data. In 2013, the summer of severe flooding across the Elbe river basin, this sort of monsoon signature occupies ranks 2 and 3 in the hierarchy of local temperature modes, where the component at rank 3 organizes an apparent period doubling of that at rank 2. Together with the intraseasonal frequency drift observed, this feature confirms in an unexpectedly clear manner the qualitative dynamics seen in a low-resolution GCM that simulates the intraseasonal boreal summer monsoon dynamics – a notoriously difficult matter – in a qualitatively correct way. The slow climate dynamics of 2013, as seen in the SAT data, is almost completely captured by these three leading modes. The question is addressed by means of data experiments, how early within the season these – predictable – motions can be identified; that is, how early it might help adapting regional agricultural activity to the specific run of the season, notably the change between westerly wind regimes and blocking highs.
Another case of predictable subseasonal dynamics happened in 2016, where the system appeared to have difficulties late in spring with internal synchronizations (between planetary waves) that lately make up the monsoon activity cycle. The 30-60 days SAT mode at station Lindenberg developed later and ran into a late summer dynamics to which the early seasonal transition in autumn 2016 was borne. Premature termination of the season and early transition into the winter circulation was predictable, from out of an 'informed' worm's-eye view, in mid-August. Again, data experiments are presented that address this predictability issue with a view on information that might be given in advance to farmers and other stakeholders.