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Modes of atmospheric variability and their interactions

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Extraction of quasi-oscillatory dynamical modes from instrumental records of meteorological variables, climatological proxies or other geophysical data became a useful tool in analysing variability of observed phenomena reflected in complex, multivariate geophysical signals. Recent development in nonlinear dynamics, namely in chaotic synchronization brought a possibility of novel ways to study relations between and among such modes representing a part of atmospheric variability. Palus & Novotna (Nonlin. Proc. Geophys. 13, 2006, 287-296) used the enhanced Monte Carlo Singular System Analysis to prove a presence of oscillatory modes in the frequency range of the Quasi-biennial oscillations in the surface air temperature and in the NAO index and showed that these modes were phase-synchronized. Mokhov & Smirnov (Geophys. Res. Lett. 33, 2006, L03708) used a wavelet transform to extract modes with a 32-month period from the NAO index and the El Niño index T(Niño 3,4) and demonstrated a causal relation according to which El Niño-Southern Oscillation drives North Atlantic Oscillation. In this paper we discuss both theoretical and technical issues encountered in detection of interactions among modes of atmospheric variability and between the modes of atmospheric variability and variability of solar and geomagnetic activity.

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