Cross-wavelet analysis of coherence and time lags between El Niño and Atlantic equatorial mode

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An observational-based analysis of time lags between equatorial Pacific mode (El Niño–Southern Oscillation or ENSO) and equatorial Atlantic mode (EAM) is performed. EAM (Zebiak, 1993) is similar to ENSO (see (Keenlyside and Latif, 2007)).

We used several monthly mean indices for El Niño (EN) and EAM based on the HADISST data set (Rayner et al., 2003) for sea surface temperature (SST) since January 1870 till May 2006: Niño3 (5S-5N, 150W-90W) and Niño3.4 (5N-5S, 170W-120W) in the Pacific and Atlantic3 (20W-0, 3S-3N) in the Atlantic (see also (Keenlyside and Latif, 2007)).

Interaction between EN and EAM was studied with the use of different cross-wavelet analyses (CWA) of time series for SSTs and SST anomalies (SSTAs): CWA-1 (Bezverkhny, 2001; Mokhov et al., 2005) and CWA-2 (Jevrejeva et al., 2003; Grinsted et al., 2004).

The CWA results display differences in the local coherence and phase lags between SSTAs in regions Niño3/Niño3, 4 and Atlantic3 for different periods during 1870-2006. Figure 1 shows local coherence between SSTAs for Niño3 and Atlantic3 obtained with the use CWA-1. According to Fig.1, positive values of coherence dominate for short-term cycles (with periods about 1-2 years). At the same time, for a significant part of the total analyzed interval 1870-2006, regimes with the El Niño lagging the EAM are displayed. For cycles with large periods (from about 3-5 years) there are time intervals with positive and negative coherence and phase lags.

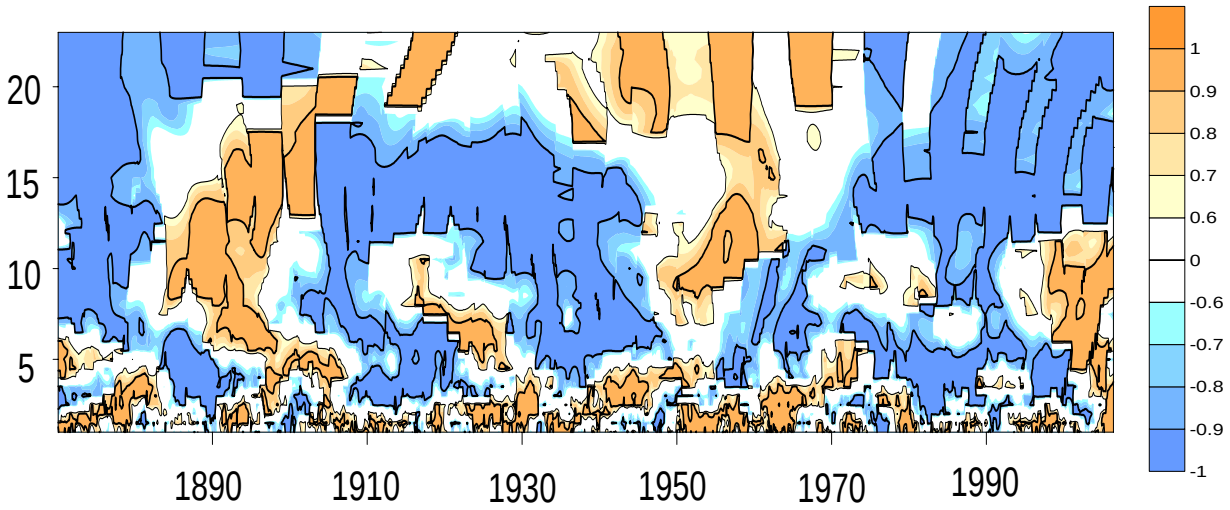

Figure 1. Local coherence between SSTAs for Niño3 and Atlantic3.

It will be interesting to compare these results with results of corresponding analysis with the use of methods based on phase dynamics modeling and nonlinear "Granger causality" applied by Mokhov and Smirnov (2006a,b) to the analysis of mutual dynamics of ENSO and North Atlantic Oscillation.

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