Link of the Arctic and Antactic sea ice extent with El Niño phenomena

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The most rapid current climate changes are detected in the Arctic. One of key features of the contemporary changes is the rapid reduction of the Arctic sea ice extent. Very diverse variations were detected during the last decades for Antarctic sea ice extent with significant changes in behavior during the recent years. The strongest interannual variations of the global climate are associated with El-Niño phenomena, and it is natural to expect the manifestation of El-Niño effects in different latitudes, including high latitudes [1,2]. Here we estimate the relationship of changes of the Arctic (ArcSIE) and Antarctic (AntSIE) sea ice extents since 1980s (http://nsidc.org) and their links with El-Niño phenomena of various types characterized by different indices (Niño3 and Niño4) with the use of cross-wavelet analysis.

Figure 1 shows local coherence of Arctic and Antarctic sea ice extent from monthly-mean satellite data for the period 05.1988-04.2019. According to Fig. 1, the correlation for interannual variations of ArcSIE and AntSIE since 2000s is displayed, along with their anti-correlation in the annual cycle. The most significant coherence between ArcSIE and AntSIE is noted for the variations with the periods of about 5 years, characteristic for El Niño phenomena. It is worth to note positive correlation of ArcSIE and AntSIE for intra-annual (semi-annual) variations.

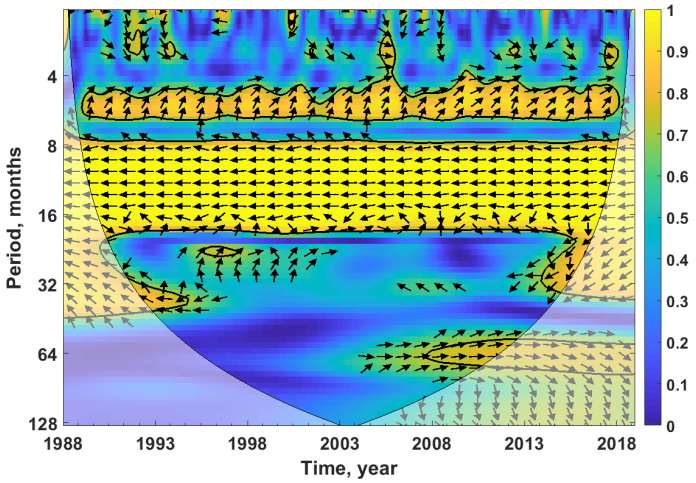

Fig. 1. Local coherence of Arctic and Antarctic sea ice extent by monthly-mean satellite data for the period 05.1988-04.2019.

Figure 2 shows local coherence of Arctic sea ice extent with El Niño indices Niño3 and Niño4 by monthly-mean satellite data for the period 05.1988-04.2019. During the last decade, the significant positive correlation between ArcSIE and both El Niño indices variations for intra-decadal variations with the periods of about 5 years (characteristic for El Niño phenomena) is observed. On the other hand, the significant differences in coherence of decadal and interdecadal ArcSIE variations with Niño3 and Niño4 are

displayed. The decadal and interdecadal AntSIE variations show negative correlation with El Niño indices (significant with Niño3 and insignificant with Niño4) during last decades.

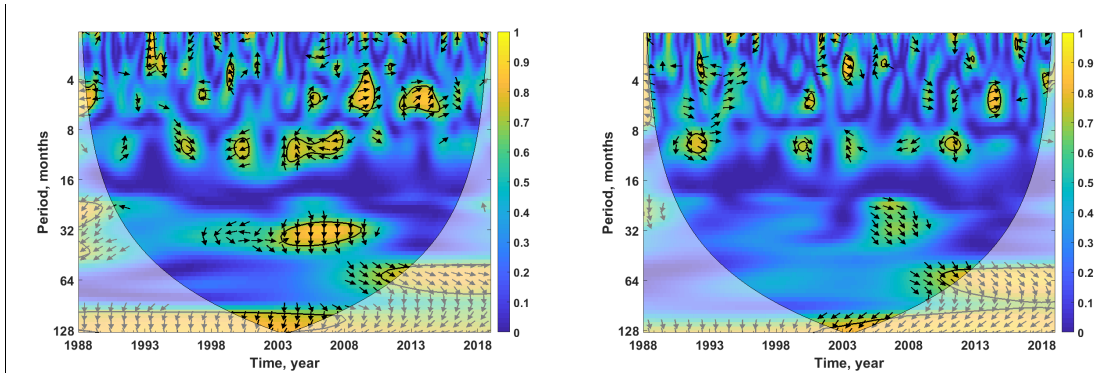

Fig. 2. Local coherence of Arctic sea ice extent with El Niño indices Niño4 (left) and Niño3 (right) by monthly-mean satellite data for the period 05.1988-04.2019.

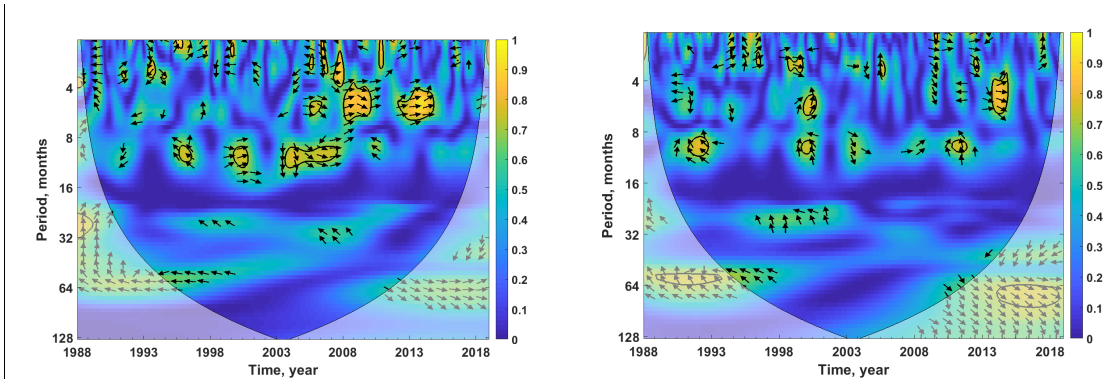

Fig. 3. Local coherence of Antarctic sea ice extent with El Niño indices Niño4 (left) and Niño3 (right) by monthly-mean satellite data for the period 05.1988-04.2019.

Figure 3 shows local coherence of Antarctic sea ice extent with El Niño indices Niño3 and Niño4 by monthly-mean satellite data for the period 05.1988-04.2019. According to Fig. 2 and Fig. 3, the AntSIE coherence with El Niño indices is overall less significant than the ArcSIE coherence. The coherence of AntSIE interannual variations with El Niño indices (especially with Niño3) is displayed during last years.

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References

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