Geophysical Research Abstracts, Vol. 9, 02474, 2007
SRef-ID: 1607-7962/gra/EGU2007-A-02474

The atmospheric circulation characteristics associated with sea ice temporal variability over the Weddell Sea.

S. Barreira (1) and R. Compagnucci (2)

(1) Argentine Navy Meteorological Service, Bs. As., Argentina, (2) Universidad de Buenos Aires, Departamento de Cs. de la Atmósfera y los Océanos, Bs. As., Argentina

Principal Components Analysis (PCA) in S-Mode (correlation between temporal series) was performed on pre-processed sea ice data (monthly anomalies from which have been removed continent and perennial open water), in order to investigate which are the main temporal patterns, where they are homogenous and how they are coupled to different atmospheric variables. This analysis provides 9 patterns (4 in the Amundsen and Bellingshausen Seas and 5 in the Weddell Sea) that represent the most important temporal features that dominate sea ice variability in the Weddell, Amundsen and Bellingshausen Seas for the 1979-2000 period.

Monthly Polar Gridded Sea Ice Concentrations data set derived from the Nimbus-7 Scanning Multichannel Microwave Radiometer (SMMR) and the Defence Meteorological Satellite Program's (DMSP) DMSP-F8, F11 and F13, Special Sensor Microwave/Imager (SSM/I) generated by NASA team algorithm were used. This data were acquired from the National Snow and Ice Data Center (NSIDC) and are gridded on the SSM/I polar stereographic grid (25 x 25 km) provided in two-byte integer format.

The temporal patterns that have their influence over the Weddell Sea will be described. The area where the first pattern series is homogeneous is located at the external region of the Weddell and Bellingshausen Seas and Drake Passage, mostly north of 60˚S. The second region clusterized by the PCA, in decreasing variance order, is centered in 30˚W and located at the bottom of the Weddell. The third area is localized east of 30˚W and north of 60˚S. South of the first area, at the western portion of the Weddell Sea, the fourth PC series has its homogenous region, between 30˚ and 60˚W. The last homogeneous area is centered at 0˚ W and south of 60˚S.

Correlation charts between the five PC series and different atmospheric variables were performed (sea surface temperature, 850 hPa height, meridional surface wind, zonal 200 hPa wind, etc.) and cross-correlograms with different atmospheric indexes. For the first PC, the greatest positives values of correlation with Tropical sea surface temperature (TSST) corresponded to lags +6 to +11 months, meaning that positive TSST that occurs half year or more before are related with positive anomalies of sea ice concentrations at the northwest area of the Weddell. There is a strong negative correlation for leads -22 to -20 and -10 -8 months indicating that after the occurrence of a positive sea ice anomaly there could be a decrease of the TSST almost a year and two year later. Positive correlations with 850 hPa are significance at high latitudes for lags +2 to +5 over the Amundsen Sea and negative correlations over the Weddell Sea. The large anticyclonic anomaly at the Amundsen together with the cyclonic anomaly at the South Atlantic generate an important northward wind component over the external occidental sector of the Weddell Sea that promote the positive sea ice anomalies between 2 and 5 months later. This high pressure anomaly is located in the same area of the Antarctic Oscillation (AAO) centre of action. Therefore, positive values of AAO are associated with negative pressure anomalies over the Amundsen and a decrease of sea ice concentration north of 60˚S over the west Weddell and east Bellingshausen. The meridional surface wind shows dipole behaviour for lags +2 to +5. This means that previously to the sea ice positive (negative) anomaly over the external Weddell there will be wind from the south (north) in sea ice in the Bellingshausen and Weddell Seas and the opposite will happens over the Amundsen. The 200 hPa jet shows positive correlation values for leads -2 and -1 over South America indicating an increase of jet intensity after the occurrence of the positive sea ice anomaly over the external Weddell. Over the Atlantic Ocean there is a wave train for lags +4 y +6 with positives values at the equatorial region, negatives at mid latitudes (jet over the Atlantic) and positives at the South Atlantic.

The results obtained for the other four PC will be described at the presentation.