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On the statistical contribution of cloud fraction cover to the summer sea-ice extent of 15 Arctic sub-regions, 1982-2015

Mauro Boccolari (1) and Flavio Parmiggiani (2)

(1) Università di Modena e Reggio Emilia, Dipartimento di Scienze Chimiche e Geologiche, Modena, Italy (mauro.boccolari@unimore.it), (2) ISAC-CNR, Bologna, Italy

Sea ice is one of the most important components of the polar climate system. The decline of the Arctic sea-ice extent (SIE), particularly during the melting season (Aug.-Oct.), is widely observed. Important roles in the melting process are played by the changes in thermodynamics and radiation forcing, in particular in relation to surface temperature and cloud cover, and also by the ocean and atmospheric circulation. Even if several studies already analysed the behaviour of SIE in the Arctic using standard linear and non-linear regression methods, this work aims to investigate the correlation between cloud fraction cover (CFC) and summer SIE in 15 Arctic sub-regions. CFC, together with surface temperature and u- and v- wind components, are also used as predictor variables in multiple regression equations for a statistical forecast of SIE for each one of the 15 sub-regions.

The data used are: i) monthly SIE, obtained from the sea ice concentration (SIC) dataset over the Arctic as provided by the National Snow and Ice Data Center (NSIDC) and computed using the Nasa Team (NT) algorithm; ii) monthly CFC (for all, high, middle and low clouds) available from the CLARA-A2 dataset produced by the EUMETSAT Climate Monitoring Satellite Application Facility (CM SAF), the data being on a 25km x 25km regular grid; iii) monthly air temperatures and u- and v- wind components at sigma 0.995 collected from NCEP/NCAR R1. All data are given on a global regular lat-lon grid with resolution 2.5°x2.5° and refer to the period 1982-2015; they were also seasonally and spatially averaged over each sub-region.

As expected, the contribution of cloud fraction cover to the SIE variability is lower of that due to thermodynamic forcing through the ‘surface’ temperature and the ‘surface’ wind. However, for some sub-regions (e. g. Greenland Sea, Beaufort Sea) the cloud cover contribution to SIE became relevant. For most sub-regions, the largest contribution seems to come from the middle clouds (440hPa - 680 hPa).