Geophysical Research Abstracts
Vol. 17, EGU2015-4040, 2015
EGU General Assembly 2015

Intercomparison of surface heat transfer in the Arctic for multiple reanalyses, satellite data and field observations

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This study evaluated surface heat fluxes from reanalyses (ERAInterim, NCEP/NCAR, ASR) in the Arctic Ocean during summer and fall. Several types of surface conditions are compared: very new ice cover during a period of low temperature, ice-free conditions, ice with leads and melt ponds, pack ice and marginal ice zone. Meteorological and micrometeorological observations were used to validate the temperature profiles and surface heat fluxes in the major reanalyses. We use data from Nansen and Amundsen basins observation system (NABOS) project to evaluate the performance of reanalyses forin the Arctic Ocean. The NABOS field experiment was carried out in the central part of the Arctic and in the eastern Arctic seas during summer and fall period of 2004-2009 and 2013. Compared data arrays are independent and sufficiently detailed to perform trustworthy evaluations. With the explicit treatment of the ice concentration, ERA-Interim generally reproduces the surface heat transfer, while NCEP/NCAR, based on a 55% concentration threshold, shows obvious disagreement with the observations in highly ice-covered and ice-free situations. The spatial and temporal patterns of the resulting flux fields are investigated and compared with those derived from satellite observations such as HOAPS, from blended data such as AOFLUX (in the open water cases). A computation of the sensible heat flux at the surface is formulated on the basis of spatial variations of the surface temperature estimated from satellite data. Based on the comparison of field experiments data, satellite-derived data and reanalysis the causes of underestimation of the values of turbulent heat fluxes in the Arctic modern reanalysis are investigated. Obtained differences are related to the temperature and structural inhomogeneity of the surface and the development of space-organized convection fields. Reanalyses data are sometimes used to calculate the surface heat budgets over polynyas to estimate ice production in polar/sub-polar oceans. In particular, the near-surface air temperature and wind fields, which are difficult to observe using satellites or with in-situ measurements, are key parameters for estimating turbulent heat fluxes. If the sea-ice concentration and SST in reanalyses are not treated appropriately, careful attention is needed when using the resultant air temperature for such calculations.
The study was supported by RSF grant # 14-37-00053.