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Comparing momentum and mass (aerosol source function) fluxes for the North Atlantic and the European Arctic using different parameterizations

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Wind speed has a disproportionate role in the forming of the climate as well it is important part in calculate of the air-sea interaction thanks which we can study climate change. It influences on mass, momentum and energy fluxes and the standard way of parametrizing those fluxes is use this variable. However, the very functions used to calculate fluxes from winds have evolved over time and still have large differences (especially in the case of aerosol sources function).

As we have shown last year at the EGU conference (PICO presentation EGU2015-11206-1) and in recent public article (OSD 12,C1262-C1264,2015) there is a lot of uncertainties in the case of air-sea CO_2 fluxes. In this study we calculated regional and global mass and momentum fluxes based on several wind speed climatologies. To do this we use wind speed from satellite data in FluxEngine software created within OceanFlux GHG Evolution project.

Our main area of interest is European Arctic because of the interesting air-sea interaction physics (six-monthly cycle, strong wind and ice cover) but because of better data coverage we have chosen the North Atlantic as a study region to make it possible to compare the calculated fluxes to measured ones. An additional reason was the importance of the area for the North Hemisphere climate, and especially for Europe. The study is related to an ESA funded OceanFlux GHG Evolution project and is meant to be part of a PhD thesis (of I.W) funded by Centre of Polar Studies "POLAR-KNOW" (a project of the Polish Ministry of Science).

We have used a modified version FluxEngine, a tool created within an earlier ESA funded project (Ocean-Flux Greenhouse Gases) for calculating trace gas fluxes to derive two purely wind driven (at least in the simplified form used in their parameterizations) fluxes. The modifications included removing gas transfer velocity formula from the toolset and replacing it with the respective formulas for momentum transfer and mass (aerosol production) while using the wind parameterizations and interpolation procedures used in FluxEngine to integrate fluxes over a region. This allowed us to develop quickly a tool where different parameterizations of drag coefficient and aerosol source function could be tested and the resulting monthly and annual fluxes compared.