Ocean Sci. Discuss.,
https://doi.org/10.5194/os-2018-61-AC1, 2018

Ocean Science
Discussions

Interactive comment on "Air-sea momentum flux climatologies: A review of drag relation for parameterization choice on wind stress in the North Atlantic and the European Arctic" *by* Iwona Wrobel-Niedzwiecka et al.

Iwona Wrobel-Niedzwiecka et al.

iwrobel@iopan.gda.pl

Received and published: 4 October 2018

Thank you for the reviews. We would ask you to reconsider our article for publication, because we have introduced a number of significant changes, following suggestion from reviewer no. 1, thanks to which the article is now better consulted, more understandable. You are right that Brunke et al., have done a lot of study in air-sea interaction, but their research are more extensive and concern a larger area. We have done our research by following among one of their conclusion, which is: Finally, a further investigation of the differences in the parameterization of the exchange coefficients in

the various algorithms would help in understanding some of the differences between the computed fluxes seen here. The aim of the manuscript is to evaluate how much the average monthly and annually momentum transfer values depend on the choice of CD parameterizations, in other words how the selected parameterization affects the total value of momentum fluxes for large reservoirs. This allows constraining the uncertainty caused by the parameterization choice. In order to achieve this, we used observed wind field for the regions of interest, namely the North Atlantic and the European Arctic, areas where European and Americans oceanographers, including us, operate. This is where most of studies that were basis of the parameterizations we use were performed. We did some comparisons to sub-tropical basins to see the difference in uncertainty caused by the formula choice between the main study regions and less studied subtopics. In our calculations, we do not clearly indicate which formula should be used in the future (impossible without new data) in the NA and the EU, but the simple fact that none of the parameterizations used now is final. We don't want to suggest end users any conclusions, because the differences in the parameterizations used are small, and our goal was to help them make an intelligent and deliberate decision about which parameterizations to use. We have chosen those 7 parameterizations as, in our opinion, they are the most commonly used in the literature during the last decade.

Please see the supplement material. We cointained there all the respond as well as corrected manuscript

Please also note the supplement to this comment:
https://www.ocean-sci-discuss.net/os-2018-61/os-2018-61-AC1-supplement.pdf

Interactive comment on Ocean Sci. Discuss., https://doi.org/10.5194/os-2018-61, 2018.

Figure 1. The drag coefficient parameterization used in the study (Eqs. 7-13) as a function of wind speed U_{10} (m s^{-1}).

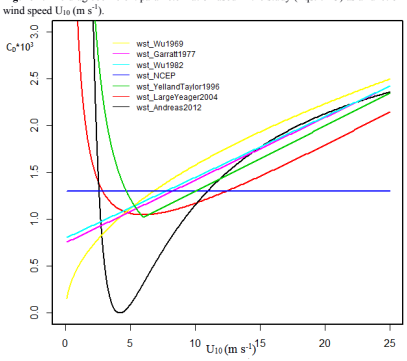


Fig. 1. Figure 1

Figure 2. Annual mean wind speed U_{10} (m s^{-1}) in the study area—the North Atlantic and the European Arctic (north of the red line).

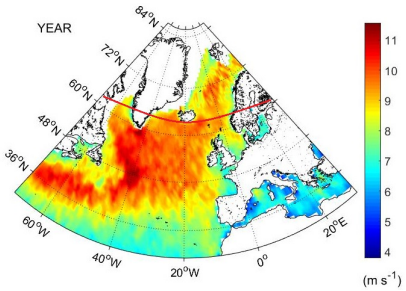
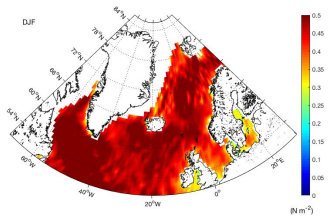


Fig. 2. Figure 2

Figure 3. Maps of momentum flux [N m^{-2}] across the sea surface (wind stress) for boreal winters ((**a**) and (**c**)) and summers ((b) and (**d**)) for Wu (1969) and A12 drag coefficient parameterizations (the two parameterizations with the highest and lowest average values, respectively).

a) Wu, (1969)

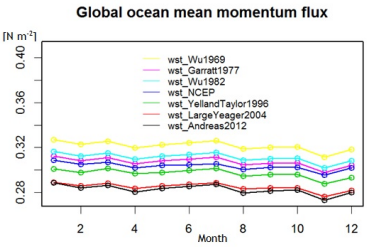


b) Wu (1969)

Fig. 3. Figure 3

Figure 4. Monthly average momentum flux values [N m^{-2}] for (**a**) global ocean, (**b**) North Atlantic, (**c**) European Arctic, and (**d**) Tropical ocean. The regions are defined in the text.

a)



b)

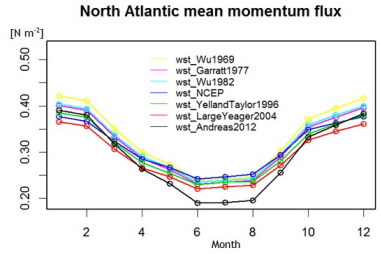
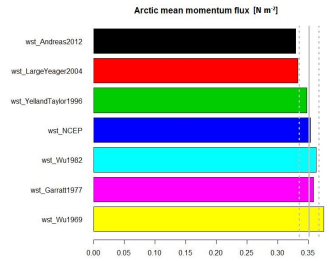


Fig. 4. Figure 4

Figure 5. Area annual average momentum flux values for (**a**) European Arctic and (**b**) Tropical ocean. The vertical solid line is the average of all seven parameterizations and the dashed lines are standard deviations for the presented values. Global and the North Atlantic results are not shown because the relative values for different parameterizations are very similar (see Table 1), scaling almost identically between the basins.

a)



b)

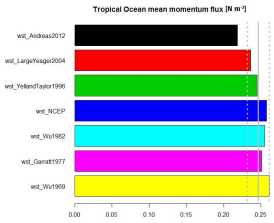


Fig. 5. Figure 5

Table 1. Area average annual mean values of momentum flux (wind stress) [N m^{-2}] for all the studied regions and parameterizations. In each column the percentage values are normalized to A12, the parameterization that produced the smallest average flux values.

	Global	North Atlantic	Arctic	W. Spitsbergen	Tropics
Wu (1969)	0.322 (114 %)	0.330 (114 %)	0.375 (114 %)	0.360 (114 %)	0.261 (119 %)
Garratt (1977)	0.307 (109 %)	0.316 (109 %)	0.358 (109 %)	0.344 (110 %)	0.251 (115 %)
Wu (1982)	0.311 (110 %)	0.320 (110 %)	0.363 (110 %)	0.349 (111 %)	0.255 (117 %)
NCEP/NCAR	0.303 (107 %)	0.312 (107 %)	0.353 (107 %)	0.341 (108 %)	0.258 (118 %)
Yelland & Taylor (1996)	0.297 (105 %)	0.306 (105 %)	0.348 (106 %)	0.335 (107 %)	0.245 (112 %)
Large & Yeager (2004)	0.285 (101 %)	0.293 (101 %)	0.333 (101 %)	0.320 (102 %)	0.236 (108 %)
Andreas et al., (2012)	0.283 (100 %)	0.290 (100 %)	0.329 (100 %)	0.314 (100 %)	0.219 (100 %)

Fig. 6. Table 1