Geophysical Research Abstracts
Vol. 17, EGU2015-9098, 2015
EGU General Assembly 2015

A review of the sources of uncertainties when estimating global-scale turbulent air-sea fluxes

Laurent Brodeau (1) and Bernard Barnier (2)

(1) Department of Meteorology, Stockholm University, Sotckholm, Sweden (laurent@misu.su.se), (2) Laboratoire de Glaciologie et Géophysique de l'Environnement, CNRS-Université Grenoble Alpes, Grenoble, France bernard.barnier@legi.grenoble-inp.fr)

Bulk formulae are used to estimate turbulent air-sea fluxes needed to provide surface boundary conditions to most of present-day OGCMs, AGCMs and coupled Earth systems. This study aims at making an inventory of the major sources of uncertainties and errors made when estimating turbulent air-sea fluxes with the bulk method, namely wind stress, evaporation (latent heat flux) and sensible heat flux. We use 6-hourly near-surface atmospheric fields and daily SST of ERA-Interim to compute global estimates of these fluxes during the last three decades. Those fluxes are computed using different bulk routines and different types of physical and numerical simplifications widely used within the GCM community. Moreover, to assess the sensitivity of these flux estimates to possible errors in the input atmospheric fields and SST, user-controlled biases are applied to each of these fields prior to bulk computation. As a result, a quantification of the potential sources of uncertainties related to the accuracy of both the parametrization and input fields is proposed. Any parametrization-related approximation can also be expressed in terms of a bias on a given input field. We find that the largest source of flux uncertainties is the choice of the bulk algorithm used to estimate the bulk transfer coefficients. The resulting disagreement in terms of globally-averaged heat flux and evaporation is 8 W/m2 and 1 Sv. In mid latitudes, this heat flux disagreement is about 10 W/m2, which independently compares to a bias of 1 m/s in surface wind speed, 3º in SST, 0.5º in surface temperature, or a modification of 5% in the surface humidity. Our study also underlies the relative importance of the accuracy of the estimate of the air density and the specific humidity at saturation.