Extreme turbulent air-sea heat fluxes over the global World ocean and their climate variability

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We developed a new probability density distribution for surface turbulent fluxes of heat and moisture over the global ocean. This distribution is called the modified Fisher-Tippett (MFT) distribution and is based on the family of the Fisher-Tippett distributions. Application of this distribution allows for accurate estimation of surface flux statistics and quantifying extreme fluxes at sea surface. We present accurate estimates of different surface turbulent flux statistics derived from reanlayses (NCEP and ERA-40) as well as from the VOS-based fluxes. Our approach allows also for the estimation of extreme fluxes quantified through the high percentiles (99^{th}, 99.9^{th}, 99.99^{th}) of turbulent fluxes. These estimates cannot be accurately derived form the raw data and require analysis of the theoretical PDFs. Extreme turbulent fluxes estimated from the MFT distribution may amount to 2000-3000 W/m2 for the latent heat flux and up to 2000 W/m2 for the sensible flux. For the VOS fluxes MFT distribution allows for the minimization of sampling errors in climatologically averaged estimate through the application of the theory of the censored samples to MFT distribution. This procedure reduces sampling errors in subpolar and high latitudes by 2-8 times and provides more accurate estimates of VOS-based surface fluxes. Analysis of climate variability of extreme surface fluxes allowed for identification of trend patterns and interannual variability modes which are different from those in the mean flu values. This implies long-term changes in the character of probability distributions of fluxes. Some examples of variability of surface turbulent fluxes based on VOS for the period from 1880 to 2008 are presented.

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