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Comparative assessment of surface fluxes from different sources using probability density distributions

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Surface turbulent heat fluxes from modern era and first generation reanalyses (NCEP-DOE, ERA-Interim, MERRA NCEP-CFSR, JRA) as well as from satellite products (SEAFLUX, IFREMER, HOAPS) were intercompared using framework of probability distributions for sensible and latent heat fluxes. For approximation of probability distributions and estimation of extreme flux values Modified Fisher-Tippett (MFT) distribution has been used. Besides mean flux values, consideration is given to the comparative analysis of (i) parameters of the MFT probability density functions (scale and location), (ii) extreme flux values corresponding high order percentiles of fluxes (e.g. 99th and higher) and (iii) fractional contribution of extreme surface flux events in the total surface turbulent fluxes integrated over months and seasons. The latter was estimated using both fractional distribution derived from MFT and empirical estimates based upon occurrence histograms. The strongest differences in the parameters of probability distributions of surface fluxes and extreme surface flux values between different reanalyses are found in the western boundary current extension regions and high latitudes, while the highest differences in the fractional contributions of surface fluxes may occur in mid ocean regions being closely associated with atmospheric synoptic dynamics. Generally, satellite surface flux products demonstrate relatively stronger extreme fluxes compared to reanalyses, even in the Northern Hemisphere midlatitudes where data assimilation input in reanalyses is quite dense compared to the Southern Ocean regions.