Geophysical Research Abstracts
Vol. 16, EGU2014-9050, 2014
EGU General Assembly 2014

Validation of HOAPS and ERA Interim latent heat fluxes against parameterizations applied to RV Polarstern data for 1995-1997

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Latent heat fluxes (LHF) represent a crucial component of the global energy cycle. As LHF provide one of the upper boundary conditions for the oceanic component of coupled atmosphere-ocean circulation models, it is desirable to rely on one consistent LHF data source with sufficient spatial and temporal resolution. Remotely sensed LHF, particularly the Hamburg Ocean Atmosphere Parameters and Fluxes from Satellite Data (HOAPS) climatology, are considered to fulfil this criterion.
However, the validity of HOAPS LHF needs to be investigated to assess its potential of reliably representing an essential part of the global freshwater cycle. Within this study, a validation of HOAPS-3.0-based LHF at pixel-level resolution for 1995-1997 is performed over the Atlantic basin. A recently developed bulk flux algorithm termed OCEANET (Bumke et al., 2013), derived from turbulence measurements onboard R/V Polarstern by inertial dissipation method, is applied to hourly bulk measurements obtained during 19 Atlantic cruises of R/V Polarstern. Its LHF output serves as the in-situ validation data source, which is supplemented by ERA-Interim reanalysis data. By means of the nearest-neighbor approach, a collocation of HOAPS- to OCEANET- and ERA-Interim data is carried out.
Bias analyses suggest that HOAPS LHF are on average significantly underestimated compared to OCEANET and ERA-Interim (-8 W/m^2). A sub-division into latitudinal bands resolves absolute biases exceeding -20 W/m^2 in the tropics.
As the minor differences between the HOAPS- and OCEANET-based transfer coefficients lie within the uncertainty range inherent to bulk flux parameterizations, it is suggested that the significant LHF deviations for the most part arise from deviations among the bulk input variables. Investigations of bulk input parameters reveal that the observed negative LHF biases within the HOAPS record are mainly associated with an overrepresentation of air specific humidity for 20°S – 60°N. Latitudinal averages identify biases in air specific humidity exceeding 1 g/kg within the subtropical northern hemisphere. To the contrary, misrepresentations of wind speeds among HOAPS exhibit less priority. Southern hemispheric extratropics represent an exception, in as much as positive LHF biases are associated with a concurrent overestimation of HOAPS wind speeds. Away from coastal waters, where especially wind speed is fraught with uncertainty, it is presumed that HOAPS surface air temperature estimates largely contribute to this deficiency, as relative humidities and air-sea temperature differences are prescribed to be 80% and 1K, respectively, which may represent an area-wide tropical bias source.
Comparing ERA-Interim reanalysis data with OCEANET it was found that ERA-Interim wind speeds are generally too low, while specific humidities tend to be too low in the tropics. This results in an underestimation of latent heat fluxes at high latitudes and an overestimation at low latitudes.

Reference

Bumke, K., M. Schlundt, J. Kalisch, A. Macke, and H. Kleta, 2013: Measured and Parameterized Energy Fluxes for Atlantic Transects of R/V Polarstern. J. Phys. Oceanogr. doi:10.1175/JPO-D-13-0152.1, in press.