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Accounting for observational uncertainties in the evaluation of low latitude turbulent air-sea fluxes simulated in a suite of IPSL model versions

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Turbulent momentum and heat (sensible and latent) fluxes at the air-sea interface are key components of the whole energetic of the Earth's climate and their good representation in climate models is of prime importance. In this work, we use the methodology developed by Braconnot & Frankignoul (1993) to perform a Hotelling T2 test on spatio-temporal fields (annual cycles). This statistic provides a quantitative measure accounting for an estimate of the observational uncertainty for the evaluation of low-latitude turbulent air-sea fluxes in a suite of IPSL model versions. The spread within the observational ensemble of turbulent flux data products assembled by Gainusa-Bogdan et al (submitted) is used as an estimate of the observational uncertainty for the different turbulent fluxes. The methodology holds on a selection of a small number of dominating variability patterns (EOFs) that are common to both the model and the observations for the comparison. Consequently it focuses on the large-scale variability patterns and avoids the possibly noisy smaller scales.
The results show that different versions of the IPSL couple model share common large scale model biases, but also that there the skill on sea surface temperature is not necessarily directly related to the skill in the representation of the different turbulent fluxes. Despite the large error bars on the observations the test clearly distinguish the different merits of the different model version. The analyses of the common EOF patterns and related time series provide guidance on the major differences with the observations.
This work is a first attempt to use such statistic on the evaluation of the spatio-temporal variability of the turbulent fluxes, accounting for an observational uncertainty, and represents an efficient tool for systematic evaluation of simulated air-seafluxes, considering both the fluxes and the related atmospheric variables.

References

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