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Spatial variability of multi-annual seasonal surface heat flux patterns of Lake Geneva

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The dynamics of the spatiotemporal surface heat flux (SurHF) of Lake Geneva (Switzerland/France) was estimated for a 7-y period. Data sources included hourly maps of over-the-lake assimilated meteorological data from a numerical weather model and Lake Surface Water Temperatures (LSWT) from satellite imagery. Analysis results indicate an average spatial SurHF range of > 40 Wm^{-2}, mainly due to wind sheltering over parts of the lake. The difference between the time variation of the heat content in western and eastern parts of the lake derived from the SurHF estimates was consistent with the spatial heat content variation obtained from long-term temperature profile measurements in those parts.

Our analyses also indicate a noticeable temporal change of the main controlling forcing when comparing heat fluxes in spring to the rest of the year. Such regime change can be explained by the atmospheric thermal boundary layer dynamics that were unstable except in spring (March to early June). This resulted in much less spatial variability during springtime.

The results emphasize that spatial variability in the meteorological and LSWT patterns will cause spatiotemporal SurHF variability that should be taken into consideration when assessing the time evolution of the heat budget of large water bodies.

Keywords: Surface heat flux, meteorological forcing, spatial variability, Lake Geneva, atmospheric boundary layer stability, heat content, lake surface water temperature