Statistical modelling of atmospheric radiosoundings

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Statistical analysis of atmospheric profiles and their uncertainty may be conveniently developed using methods for functional data analysis. This talk discusses two case studies related to the GAIA-CLIM Horizon 2020 research project.
The first case study considers co-location mismatches araising in the comparison of satellite and radiosonde observations. Satellite profiles are known to have a strong vertical smoothing. Hence, the vertical smoothing mismatch uncertainty is defined as the difference between the natural radiosonde profile and its harmonised version. In particular, the radiosonde profiles are harmonised with the satellite counterparts using a smoothing kernel based on the generalised extreme values probability density function with parameters depending on altitude. To do this, functional data properties and the maximum likelihood approach are used, thus exploiting the measurement uncertainties in a natural way.
The second case study is related to geographic gaps of radiosonde monitoring networks. In particular, a gap region is defined as an atmospheric region where the spatial prediction uncertainty is high. To do this global bi-daily radiosonde profiles are modelled as a spatio-temporal process with functional values and a functional kriging variance is used to identify the gaps. Adaptation of maximum likelihood for large data sets is considered