Extending an operational meteorological monitoring network through machine learning and classical geo-statistical approaches

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This study introduces the set-up and characteristics of a meteorological station network on the southern slopes of Mt. Kilimanjaro, Tanzania. The set-up follows a hierarchical approach covering an elevational as well as a land-use disturbance gradient. The network consists of 52 basic stations measuring ambient air temperature and above ground air humidity and 11 precipitation measurement sites. We provide in depth descriptions of various machine learning and classical geo-statistical methods used to fill observation gaps and extend the spatial coverage of the network to a total of 60 research sites. Performance statistics for these methods indicate that the presented data sets provide reliable measurements of the meteorological reality at Mt. Kilimanjaro. These data provide an excellent basis for ecological studies and are also of great value for regional atmospheric numerical modelling studies for which such comprehensive in-situ validation observations are rare, especially in tropical regions of complex terrain.