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Application of suitable measurement strategies depending on the scales of atmospheric processes

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The vertical and horizontal structure of the atmosphere and the typical timescales of atmospheric phenomena and processes largely determine the design and performance of atmospheric measurement techniques. Each meteorological process can be characterized by typical spatial and temporal scales. This is based on the spectral organization of atmospheric turbulence and on wavelike processes, where relevant wavelength ranges (spatial dimensions) relate to distinct durations (frequencies). The development of a suitable measurement strategy for any observational task should therefore be based on a careful consideration of the specific processes to be described and resolved. This should govern the decision on, e.g., the measurement range, the measurement levels / range resolution, the horizontal spacing of sensors or sites, the measurement frequencies and averaging times, and sensor characteristics such as response time, resolution, accuracy, sensitivity etc. When using in-situ technologies, a wide variety of measuring platforms can be used, from the classic weather station arrangements, masts, and towers to balloons or controlled airborne platforms (including both manned and remotely piloted aerial vehicles). With remote sensing technology, various measurement systems (both passive and active) are available in terms of measured variables, pointing and scanning options, altitude range, spatial and temporal resolution. It will be shown that the extensive overview tables in the recently published Springer Handbook of Atmospheric Measurements can provide guidance on how in-situ and remote sensing techniques can be optimally used for both routine observations and process studies (field campaigns) for a large variety of applications and how measurement concepts, strategies and networks can be designed.