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Ultra-high-resolution turbulence, flux, and wind profiles using new acoustic profiler designs

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We give an overview of new developments in acoustic remote sensing of the lowest 150m of the atmosphere. These developments are driven by requirements for higher resolution continuous profiling in more demanding environments than traditionally addressed by SODARs. In wind energy applications there is a need for more accurate wind measurement for wind turbine monitoring, and measurements in a shear environment for wind farm site evaluation in complex terrain. More accurate wind measurement requires better specification on instrument design as well as accounting for spatial coherence variations between the sampling volumes used to derive the wind vector components at each height. These requirements give rise to new hardware and software approaches. A new bi-static design overcomes problems arising in complex terrain due to spatial variation in the wind components between sampling volumes in conventional SODARs. In studies of urban environments, profiling must be done at high spatial resolution, starting within a few meters of the ground and extending to around 100m, so that the structure within the street canyon canopy and the transition to the overlying boundary layers can be sampled. We describe extensions of the bi-static SODAR development for this purpose and the upcoming UK field campaigns in London. As a third example, we describe the exciting outcomes of the European/Australian SNODAR/PLATO high resolution astronomy at Dome C in the Antarctic, in which very high quality optical imaging is supported by 1m resolution turbulence measurements in the lowest 50m. Finally, we discuss new methodologies for obtaining continuous flux profiles from a bi-static design.