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Improved Eddy Flux Measurements by Multipath Sonic Anemomtery

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The bias of eddy covariance fluxes caused by sensor-induced flow distortions, and approaches for mitigation and correction are topics of on-going discussions since sonic anemometers-thermometers are used in long-term observation programs like ICOS, EUROFLUX or AMERIFLUX. According to these discussions there is no one sensor head geometry that meets simultaneously various requests including wide flow acceptance angle, low distortion of the vertical wind component (the primary variable for eddy covariance application) and insensitivity with respect to precipitation. Consequently, a variety of head designs emerged representing individual trade-offs between contradicting requests. A common feature of traditional design of 3D-sonic anemometers is the use of three pairs of sound transducers that span three non-coplanar measuring paths. We show that the above-mentioned requests are no longer contradictory, if the rigid scheme of transducer pairs is dropped in favor of communicating transducer groups. In addition to reconciling contradicting requests, this multipath concept offers a high degree of redundancy and thus improved accuracy, reliability and automatic failure detection procedures. The main signal processing steps, expected advantages and first experiences with multipath sonics will be presented.