DS-2 Decasonic Background

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Eddy covariance techniques for measuring fluxes of water vapor and other gases in the atmosphere have become quite popular in recent years. The foundations for these measurements were laid more than 50 years ago. Those efforts were severely hampered, though, by the lack of adequate instrumentation. The technique requires a very fast response measurement of the vertical wind vector. Propeller and vane anemometers were available then, and attempts were made to make them light enough to have fast response, but those were not completely successful. Pressure and drag measurements were also used, but, again, without great success. There were a few reports in the literature of sonic anemometers, and a Japanese company had commercialized one version in the 60's, but it was very expensive.

I had used vertical propeller anemometers for flux measurements in the late 60's at White Sands Missile Range in New Mexico. They left a lot to be desired, so I was motivated to find a better solution. I did a sabbatical leave at University of Nottingham in England in 1977-78, and had some time to work on an anemometer for vertical wind measurements. I found some inexpensive ultrasonic transducers that were used in consumer electronics (TV remote) and was able to come up with a way to measure the phase difference between the transmitted and received sonic signal that was proportional to wind speed. That combination made a good vertical sonic anemometer. The results of that work were published in Journal of Applied Meteorology. In the summer of 1979 I spent time at Campbell Scientific in Logan improving the design, and that became the CSI 1-D sonic anemometer.

During that summer my brother, Wayne saw the vertical sonic and started thinking about how it could be used to measure horizontal wind speed. He suggested bouncing the sound off of a reflector. We made a crude prototype to test, and saw that it likely would work, but got no farther that summer. Since that time I have wanted to see if we could make a horizontal sonic anemometer along the lines of his suggestion. The DS-2 uses the same principles that we published in 1979 and Wayne's idea of a reflector to measure wind. Microprocessors were not available for use in sensors when the original sonic was made. Having them available now has been critical to the success of the DS-2. Even though sound travels pretty slowly compared to light, measurements still need to be timed to a few nanoseconds for a successful measurement.

The DS-2 finally provides a low-cost, accurate, no-moving-parts anemometer for wind measurements in microenvironments where wind speeds can be very low and variable, as well as out in the open where conventional anemometers are used.

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