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The Sky Arrow ERA, an innovative airborne platform to monitor mass, momentum and energy exchange of ecosystems

B. Gioli, F. Miglietta, F. P. Vaccari, A. Zaldei, B. De Martino

Abstract

Substantial worldwide efforts are underway aimed at identifying the spatial and temporal distribution of the global sources and sinks of atmospheric carbon dioxide (CO₂). The sink/source strength of vegetated surfaces at ground sites can now be estimated with reasonable accuracy and micrometeorological techniques are now well established, while difficulties exist in up scaling these figures to the regional and global scales. Airborne measurement of mass, momentum, and energy fluxes for boundary layer research has been available for decades requiring the use of large aircraft to carry instruments and dedicated support facilities. The advent of compact, lowpower instruments and high speed, high-capacity digital data acquisition systems has recently allowed small research aircraft to perform such measurements with high accuracy. This paper first describes the Sky Arrow ERA (Environmental Research Aircraft), a small research aircraft that has been recently developed in Italy, in the frame of an international scientific collaboration. This aircraft can be operated to measure fluxes of mass, momentum and energy while flying at low altitude and reduced ground speed. The fluxes are computed with the airborne eddy correlation technique. The basic theory at the basis of the flux measurement technique is also described in the paper, and two application examples are discussed to illustrate the quality and the accuracy of the measurements that can be made using this research platform. Potential applications of those data to parametrize land surface schemes, validate simulation models and provide extensive and reliable ground truthing for satellite remote sensing applications are highlighted.

Keywords

aircraft flux measurements;airborne eddy correlation;terrestrial and marine ecosystems

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References

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