

# **THE USE OF GNSS-AIRCRAFT LINKS TO DETECT/DIAGNOSE ATMOSPHERIC TURBULENCE**

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A feasibility study regarding the use of GNSS-aircraft occultations to detect or diagnose turbulence has been performed. Preliminary results of this work were presented at OPAC-1, and demonstrated the utility of the methodology when applied to GPS/MET occultation data. Since then, the focus has been on the application of these techniques to a satellite transmitter - airborne receiver scenario. The concept is to use these measurements to augment operational turbulence nowcast/forecast algorithms in order to provide better information for the aviation community. Using weak-scattering wave propagation theory, methods for estimating the turbulence intensity and the location of the turbulence along the line-of-sight have been developed. A detailed theoretical and Monte Carlo simulation analysis of these methods has revealed some of the successes, pitfalls, and ambiguities in the parameter estimation problem. Calculating the turbulence intensity is a relatively straightforward linear estimation problem, whereas the determination of the location of the turbulence is a more complicated non-linear problem. It has been found that the relative motion of the transmitter and receiver has a significant impact on the parameter estimation. Furthermore, the effects of background and ionospheric fluctuations in the index of refraction field must be addressed. Tests for the validity of the weak-scattering assumption and the presence of ionospheric effects (given two transmitter frequencies) have also been developed.