Geophysical Research Abstracts
Vol. 18, EGU2016-481, 2016
EGU General Assembly 2016

Mode S and ADS-B as a Source of Clear-Air Turbulence Measurements

Jacek Kopeć (1,2), Kamil Kwiatkowski (2,4,5), Siebren de Haan (3), and Szymon Malinowski (1)

(1) Institute of Geophysics, Faculty of Physics, University of Warsaw, Warszawa, Poland, (2) Interdisciplinary Centre for Mathematical and Computational Modelling, University of Warsaw, Warsaw, Poland, (3) Royal Netherlands Meteorlogical Institute, De Bilt, the Netherlands, (4) Institute of Theoretical Physics, Faculty of Physics, University of Warsaw, Warsaw, Poland, (5) University Centre for Environmental Studies and Sustainable Development, University of Warsaw, Warsaw, Poland

Clear-Air Turbulence (CAT) beside being the most common cause for commercial aircraft incidents in the cruise phase is a complex physical phenomenon. CAT is an effect of various underlying physical mechanisms such as different kinds of hydrodynamic instabilities or large scale forcing. In order to properly understand and correctly forecast it one needs a significant amount of observation data. Up to date the best available observations are the in-situ EDR (from eddy dissipation rate - a measure of turbulence intensity). Those observations are reported every $\sim$1 min of flight (roughly every 15 km). Yet their availability is limited by the willingness of the airlines to cooperate in adjusting on-board software. However there is a class of data that can be accessed more freely.

In this communication we present and discuss a feasibility analysis of the three methods of processing Mode S/ADS-B messages into viable turbulence measurements. The Mode S/ADS-B messages are unrestricted navigational data broadcast by most of the commercial aircraft. The unique characteristic of this data is a very high temporal resolution. This allows to employ processing which results in obtaining turbulence information characterized by spatial resolution comparable with the best available data sources. Moreover due to using Mode-S/ASS-B data, the number of aircraft that are providing observations increases significantly. The methods are either using simple positioning information available in the ADS-B or high-resolution wind information from the Mode S.

The paper is largely based on the results of the methods application to the data originating from DELICAT flight campaign that took place in 2013. The flight campaign was conducted using NLR operated Cessna Citation II. The reference Mode-S/ADS-B data partly overlapping with the research flights were supplied by the KNMI. Analysis shows very significant potential of the Mode-S wind based methods.

J. M. Kopeć, K. Kwiatkowski, S. de Haan, and S. P. Malinowski, Retrieving clear-air turbulence information from regular commercial aircraft using Mode-S and ADS-B broadcast,
Atmos. Meas. Tech. Discuss., 8, 11817-11852, doi:10.5194/amtd-8-11817-2015, 2015