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An Automated System to Quantify Convectively induced Aircraft encounters with Turbulence over Europe and North Atlantic

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It is well known that encounters with moderate or severe turbulence can lead to passenger injuries and incur high costs for airlines from compensation and litigation. As one of two World Area Forecast Centres (WAFCs), the Met Office has responsibility for forecasting en-route weather hazards worldwide for aviation above a height of 10,000 ft.

Observations from commercial aircraft provide a basis for gaining a better understanding of turbulence and for improving turbulence forecasts through verification. However there is currently a lack of information regarding the possible cause of the observed turbulence, or whether the turbulence occurred within cloud. Such information would be invaluable for the development of forecasting techniques for particular types of turbulence and for forecast verification.

Of all the possible sources of turbulence, convective activity is believed to be a major cause of turbulence. Its relative importance over the Europe and North Atlantic area has not been yet quantified in a systematic way: in this study, a new approach is developed to automate identification of turbulent encounters in the proximity of convective clouds.

Observations of convection are provided from two independent sources: a surface based lightning network and satellite imagery. Lightning observations are taken from the Met Office Arrival Time Detections network (ATDnet). ATDnet has been designed to identify cloud-to-ground flashes over Europe but also detects (a smaller fraction of) strikes over the North Atlantic. Meteosat Second Generation (MSG) satellite products are used to identify convective clouds by applying a brightness temperature filtering technique. The morphological features of cold cloud tops are also investigated.

The system is run for all in situ turbulence reports received from airlines for a total of 12 months during summer 2013 and 2014 for the domain of interest. Results of this preliminary short term climatological study show significant intra-seasonal variability and an average of 15% of all aircraft encounters with turbulence are found in the proximity of convective clouds.