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The study of the evolution of aerosol concentrations at altitudes of civil aviation

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Clear Air Turbulence refers to turbulences in air without cloud, usually located in high troposphere and low stratosphere. Those CAT are a serious issue for inflight plane security and are responsible for numerous injuries or even reported deaths every year. Planes crossing such CAT can be strongly vertically shaken and passengers with security belt unfastened can be seriously injured. There is nowadays no alert system able to detect CAT at typical flight height. Indeed, onboard weather radars are blind to clear air turbulence. Today, Clear Air Turbulences are a serious flight security problem because there exists no ground or onboard detection devices. Besides, the physical phenomenon is far from being clearly understood. The understanding of CAT phenomenon is poor because:

1) is difficult to measure the CAT atmospheric parameters in situ
(relatively low occurrence)
2) the simulations are complex.

Therefore, this original project intends to
1) obtain a complete measured data set by remote sensing from the ground
2) join two different know-how to address the theoretical simulation
aspects of CAT.

Archive for the research was obtained in the performance of the European research program DELICAT (Demonstration of LIDAR based Clear Air Turbulence detection), which was a fullfledged performer IAP RAS(Obukhov Institute of atmospheric physics of Russian Academy of Science. The task of the flight test project DELICAT was to demonstrate the effectiveness of the proposed methods of lidar detection of turbulence. Flight tests were conducted using aircraft lidar instrument on board aircraft research vessel Cessna Citation II. Flight tests have given not only the information necessary to take into account the properties of airborne noise, but also provided us with data on atmospheric aerosol along the flight path. Questions aerosol scattering and the resulting data in this direction have not been claimed by European participants DELICAT.
In practice many hours continuous recording of lidar response proportional to the intensity of the scattered radiation is observed, broke for further processing of measured data into segments lasting 1 minute. For the analysis of selected segments of the flight with constant values: height, direction and speed of the aircraft. An exploratory analysis of a small number of selected flights. Created data archive, a method of constructing 2D distributions have experience highlight areas free from congestion and provide estimates of the aerosol extinction. It should also be noted that the publication of lidar observations from the aircraft in the direction of the flight path we have not found, and their absence lends even greater urgency in the research.