

## Radiation detectors response by altitude in a commercial aircraft

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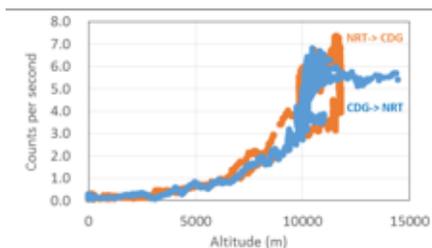
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The dose level caused by the cosmic radiation is elevated with both altitude and solar activity. With the improvement of the GNSS (Global Navigation Satellite System), it has become possible to measure the position information of the terminal accurately and easily. In this study, we showed the radiation counts per unit time obtained by a Geiger Muller (GM) tube and a CdTeZn detector by the flight altitude of the aircraft with high accuracy.

Position measurement was obtained by a hand-made GNSS (GLONASS and QZSS satellites). A GM tube and CdTeZn detector were used for the measurement of  $\beta(\gamma)$  and  $\gamma$ -ray, respectively. The time constant was 10 seconds, and position information (latitude, longitude, altitude) and count rate per second (CPS) were recorded every 3 seconds. The measurement position was always the economy seat by the window near the main wing, and measurement period was from May to August 2017. For all measurements, the maximum error in altitude by the flight-recorder and GNSS was about 10 m, and the error was negligible.

Figure showed the altitude over CPS in Tokyo (NRT) – Paris (CDG) flight. There was almost no change in CPS up to about 3,000 m (9840 ft). After that, CPS raised with altitude, reaching a maximum around 11,000 m (36,000 ft), which was 147 times compared to the ground level. In addition, the CPS had a difference between the forward and the return route because the flight route was also different. This was good agreement with the route doses simulated by JISCARD (Japanese Internet System for Calculation of Route Doses).

As far as the response of the GM tube was concerned, when the seat-belts wear sign disappears, the CPS in the cabin has reached the same level as the most of evacuation zone in Fukushima, Japan.



**Figure** Relationship between counts per second by GM tube and altitude in a commercial aircraft.