Random radiation clouds found in atmosphere at flight altitudes

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(Phys.org)—A large team of researchers with members from several institutions in the U.S., Korea, and the U.K. has found evidence of random radiation clouds in the Earth's atmosphere at elevations used by aircraft. In their paper published in the journal *Space Weather*, the team describes how they discovered the clouds and offers a theory for their existence.

For several years, NASA has been conducting a project called Automated Radiation Measurements for Aerospace Safety (ARMAS)—devices are placed aboard aircraft that measure radiation levels during flights; readings are recorded in a database for study. In this new effort, the researchers accessed the database and examined data from 265 flights during the period 2013 to 2017. In so doing, they found mostly what was expected—higher than ground levels of radiation. But they also found unusual readings—six instances of high altitude and high latitude flights during which radiation levels rose to twice the normal level for several minutes. The researchers described the events as flying through a radiation cloud.

Increased radiation exposure is, of course, the norm for people aboard an airplane due to their closer proximity to outer space. But the risk from such flights is considered small—equivalent to a chest X-ray for longer flights, or a dental X-ray for shorter flights. Such radiation comes from space courtesy of the solar wind or from other sources in outer space. Our atmosphere and magnetic poles filter enough of it to enable Earth. But we do experience geomagnetic storms sometimes, during which electrons escape from the Van Allen radiation belts (zones of charged particles surrounding the planet that have been captured by the Earth's magnetic field) and rain down to the surface. Data from the ARMAS devices indicated that the radiation clouds might be linked to such storms.

The discovery of such clouds suggests that frequent flying at high altitudes (above 55,000 feet) may be slightly more hazardous than has been thought. The researchers suggest that sensor networks could be used to create a grid for pinpointing such clouds to allow rerouting of airplanes around them.

More information: W. Kent Tobiska et al. Global real-time dose measurements using the Automated Radiation Measurements for Aerospace Safety (ARMAS) system, *Space Weather* (2016). DOI: 10.1002/2016SW001419 , (PDF)

Abstract
The Automated Radiation Measurements for Aerospace Safety (ARMAS) program has successfully deployed a fleet of six instruments measuring the ambient radiation environment at commercial aircraft altitudes. ARMAS transmits real-time data to the ground and provides quality, tissue-relevant ambient dose equivalent rates with 5 min latency for dose rates on 213 flights up to 17.3 km (56,700 ft). We show five cases from different aircraft; the source particles are dominated by galactic cosmic rays but include particle fluxes for minor radiation periods and geomagnetically disturbed conditions. The measurements from 2013 to 2016 do not cover a period of time to quantify galactic cosmic rays' dependence on solar cycle variation and their effect on aviation radiation. However, we report on small radiation "clouds" in specific magnetic latitude regions and note that active geomagnetic, variable space weather conditions may sufficiently modify the magnetospheric magnetic field that can enhance the radiation environment, particularly at high altitudes and middle to high latitudes. When there is no significant space weather, high-latitude flights produce a dose rate analogous to a chest X-ray every 12.5 h, every 25 h for midlatitudes, and every 100 h for equatorial latitudes at typical commercial flight altitudes of 37,000 ft (~11 km). The dose rate doubles every 2 km altitude increase, suggesting a radiation event management strategy for pilots or air traffic control; i.e., where event-driven radiation regions can be identified, they can be treated like volcanic ash clouds to achieve radiation safety goals with slightly lower flight altitudes or more equatorial flight paths.

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