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Estimation of the effective dose from cosmic radiation received during a commercial flight passing through the South Atlantic anomaly

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Exposure to ionizing radiation during commercial flights has repercussions on human health, in particular for flights pass through the South Atlantic Geomagnetic Anomaly (SAA). This radiation is originated from the interaction of cosmic rays (CR) with Earth's atmosphere. Likewise, the flux of CR with energies around GeV is affected by the Geomagnetic field, this establishes a dependence between ionizing radiation and geographical position. Currently, tools such as CARI-7A estimates the effective dose for commercial flights. In general, this kind of code uses semi-empirical models to estimate the radiation at the flight altitude and ignore the contribution of particles like muons on the calculation of the dose; this because of the low probability of interaction with matter and the low dose of muons compare with neutron particles. Nonetheless, a better estimation of the radiation at flight altitude and the contribution of muons for the effective dose can improve this calculation due to the bigger flux of CR into the SAA. Here we show an improvement of the estimation of the effective dose during a commercial flight that crosses the AAS by calculating the secondary radiation produced by CR between 1 GeV and 10ˆ6 GeV, via CORSIKA and GATE codes. In this work, we have included a model (metallic cylinder) of the plane fuselage. In addition, we have evaluated the influence of the geomagnetic field on secondary radiation through a method that uses its local and instantaneous configuration. In this way, this work is a contribution to the understanding of how high-energy RC (<10ˆ6 GeV), the aircraft fuselage, and the geomagnetic field can improve the estimation of the effective dose estimated for commercial flights that cross the SAA.

Keywords: ionizing radiation, effective dose, commercial flights, Geomagnetic field.

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