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Cosmic rays modulation of the cloud effects on the radiative flux in the Southern Hemisphere Magnetic Anomaly region

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Aerosols are thought to cool the planet's surface through increase scattering and cloud cover and re-radiation of solar energy to space. Clouds play an important role in the Earth's radiation budget through trapping outgoing radiation and reflecting incoming radiation. Climate models have some representation of direct aerosol effects in them, but none have yet fully included the indirect effects. A correlation between a global average of low cloud cover and the flux of Galactic Cosmic Rays (GCRs) incident in the atmosphere has been observed recently. The ionizing potential of Earth bound cosmic ray is modulated by the state of the heliosphere, which depends on the solar activity...[5]. Here we show that in the southern Pacific Ocean the cloud effects on the net radiative flux in the atmosphere depends on the intensity of the Earth's magnetic field. In the inner region of the Southern Hemisphere Magnetic Anomaly (SHMA) it is observed a cooling effect of approximately 18 W/m^2 while in the outer region it is observed a heating effect of approximately 20 W/m^2. The variability in the inner region of SHMA of the net radiative flux is correlated to GCRs flux observed in Huancayo, Peru (r = 0.73). It is observed that correlation decrease as the intensity of the Earth's magnetic field intensity increase. The observations are in agreement with the robust mechanism proposed by Brian Tinsley to explain the cloud formation due to GCRs atmospheric ionization. The representation of GCRs induced cloud formation process in Coupled Atmosphere-Ocean General Circulation Models (CGCMs) and the evolution of the SHMA itself will reduce the uncertainties in the energy budget estimation. Future studies are necessary to evaluate if the cooling due to GCRs clouds in the SHMA are strong enough to counter the greenhouse-warming effects.