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Impact of using the data-driven daemonflux model on CORSIKA simulations of atmospheric muons in KM3NeT

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Muons, created in interactions of cosmic rays with the Earth's atmosphere, are the main component of cosmic ray air showers which reach underwater or in-ice neutrino telescopes such as KM3NeT and IceCube. Measurements of such muons provide crucial information about the properties of cosmic rays, and their interactions with the atmosphere. The KM3NeT research infrastructure includes two telescopes in the Mediterranean Sea which are partially installed and operational. The KM3NeT/ORCA detector is deployed at 2450 m depth near Toulon, France. The KM3NeT/ARCA telescope is located at 3500 m depth off-shore Capo Passero, Italy. Previous comparisons of the atmospheric muon flux between the data collected by ORCA (ARCA) and CORSIKA simulations performed using the Sibyll2.3d model for high-energy hadronic interactions and the GSF model for mass composition show a 40% (up to 80%) disagreement, with the simulation underestimating the data. Recently, a data-driven model derived from cosmic ray, accelerator, and surface muon data was proposed to help ameliorate the disagreement. In this study, we estimate the impact of correcting the simulations using the muon flux obtained from the daemonflux model. We show that these corrections significantly increase the atmospheric muon flux in CORSIKA simulations and can potentially alleviate the disagreement seen in previous comparisons between KM3NeT data and CORSIKA simulations.

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