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Estimation of sea level muon energy spectra in the energy range 0.2 GeV TO 10 GeV

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Abstract. The vertical muon energy spectrum has been calculated in the energy range 0.2 GeV to 10 GeV using the latest directly measured primary cosmic ray nucleon spectrum . The primary cosmic ray nucleon spectrum has been calculated from the available measurements JACEE, CRN, SOKOL and the experiments done by Ramaty, Ryan, Seo, Badhwar on P, He, CNO, Ne -Si and Fe. Then using the superposition model the all nucleon spectrum has been constructed which makes the form $N(E)dE = 1.13E^{-2.61}dE$ [cm^2.s.sr.GeV/n]$^{-1}$ The pT integrated Lorentz invariant cross-sections available from the CERN LEBC EHS data for $\pi^{\pm}$ and K$^{\pm}$ production initiated by pp collisions has been fitted and then from the fitting parameters hadronic energy moments have been calculated. The adopted inelastic cross-section for pp interactions is 35 mb and the value of $\sigma_{\mathrm{p-air}}$ cross-section has been adopted as 273 mb.The Z-factors have been corrected for p-air collisions using the methodology of Minorikawa and Mitsui. The Q-G plasma correction of Z-factors has also been made. Adopting the methodology of Arnon Dar and taking the other interaction parameters the modified production co-efficients g_{ATM}^{NM} have been calculated. To calculate the muon flux in this methode one has to estimate C_π and C_K for which we used the parametric values like $B_\pi = 1, B_K = 0.632, pa = 2.3424, \alpha_K = 1.048$.Using those values, C_π and C_K have been found out to be 0.220137 and 0.007149 respectively. The survival probability of muons which are produced at atmospheric depth λ_0 to survive down to atmospheric depth l has been calculated with the help of the average muon production depth $\lambda_0 = 100\,\mathrm{gm\text{-}cm^{-2}}$ and survival depth $\lambda_F = 1033\,\mathrm{gm\text{-}cm^{-2}}$, respectively. The energy loss of muon during its propagation through atmosphere has been calculated. Finally the vertical muon energy spectrum at sea level from conventinal meson decay has been estimated and compared with experimental data of CAPRICE-94 (1999), Allkofer et al.(1976), Allkofer et al. (1971) and Hayman and Wolfendale (1962). It is found that estimated vertical muon energy spectrum in the low energy range is well in agreement with the experimental results. The results of Caprice-94 are lying below our results may be due to the strong solar activity that causes a depression in the muon intensity near 1 GeV region.