We evaluate the prompt atmospheric neutrino flux at high energies using three different frameworks for calculating the heavy quark production cross in QCD: NLO perturbative QCD, kT factorization including low-x resummation, and the dipole model including parton saturation. We use QCD parameters, the value for the charm quark mass and the range for the factorization and renormalization scales that provide the best description of the total charm cross section measured at fixed target experiments, at RHIC and at LHC. Using these parameters we calculate differential cross sections for charm and bottom production and compare with the latest data on forward charm meson production from LHCb at 7 TeV and at 13 TeV, finding good agreement with the data. In addition, we investigate the role of nuclear shadowing by including nuclear parton distribution functions (PDF) for the target air nucleus using two different nuclear PDF schemes. Depending on the scheme used, we find the reduction of the flux due to nuclear effects varies from 10% to 50% at the highest energies. Finally, we compare our results with the IceCube limit on the prompt neutrino flux, which is already providing valuable information about some of the QCD models.

I read the instructions