Cosmic Ray Latitude Intensity

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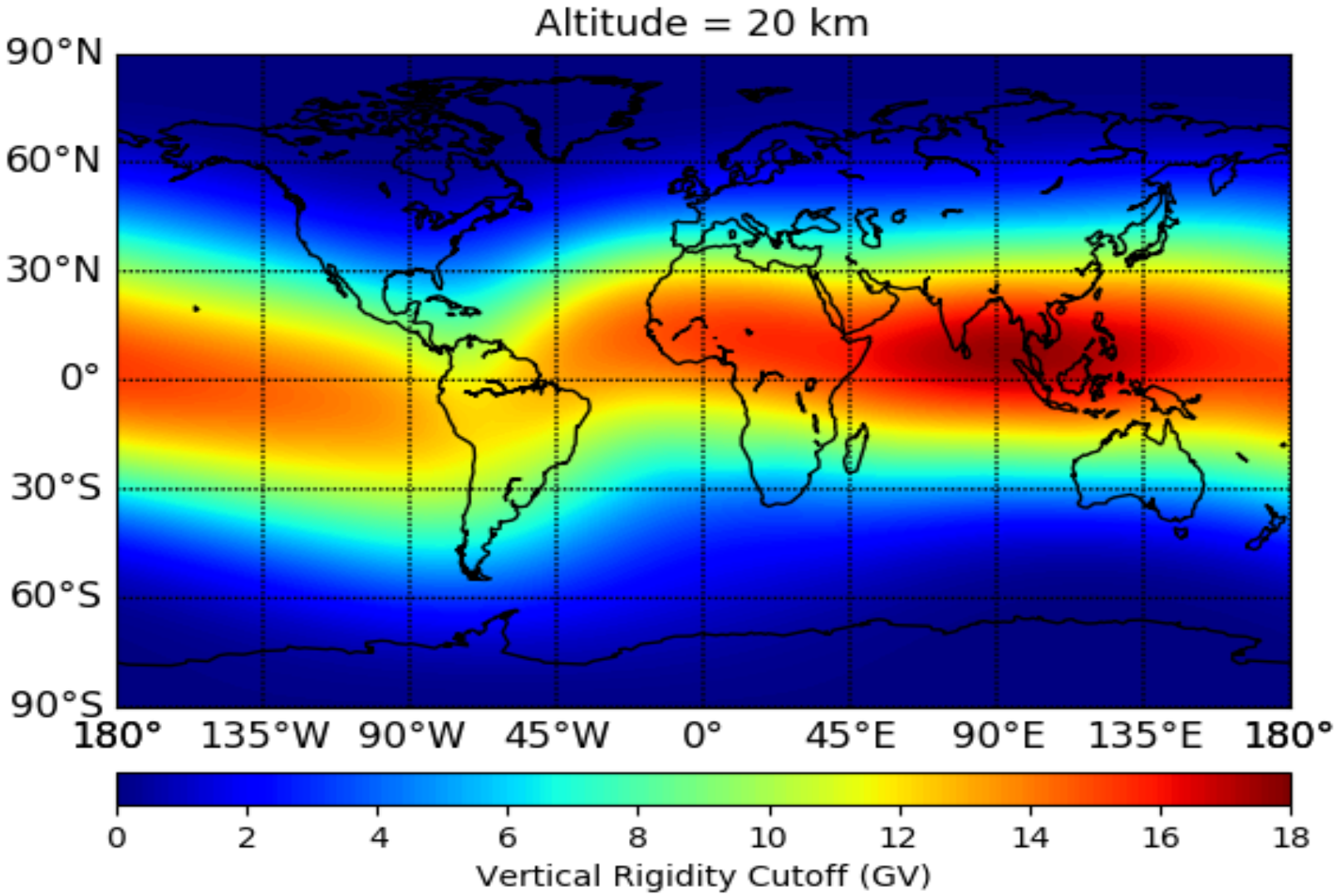
Secondary cosmic ray (CR) intensity at sea level

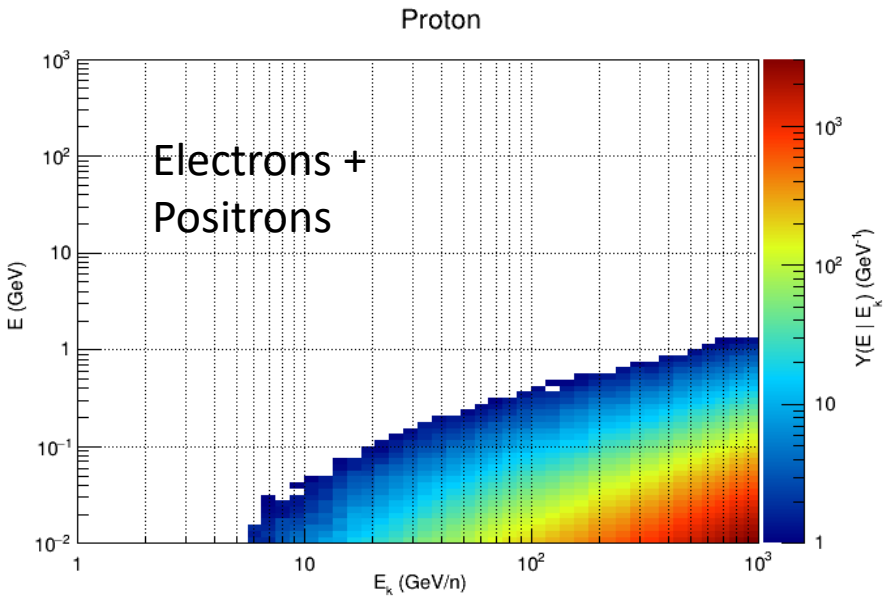
- $I_s(E_s, lon, lat) = \int_{T_{cut}(lon,lat)}^{\infty} dT\, Y_{CR}(\, E_s | \, T\,) I_{CR}(T)$
- s is the secondary particle species, i.e. muons, electrons, positrons, protons, …
- T_{cut} is the cut-off energy as a function of the longitude and latitude at 20 km of altitude (asseumed as the average primary interaction point)
- Y is the muon yield at sea level
- I_{CR} is the cosmic ray (CR) intensity (mainly proton)

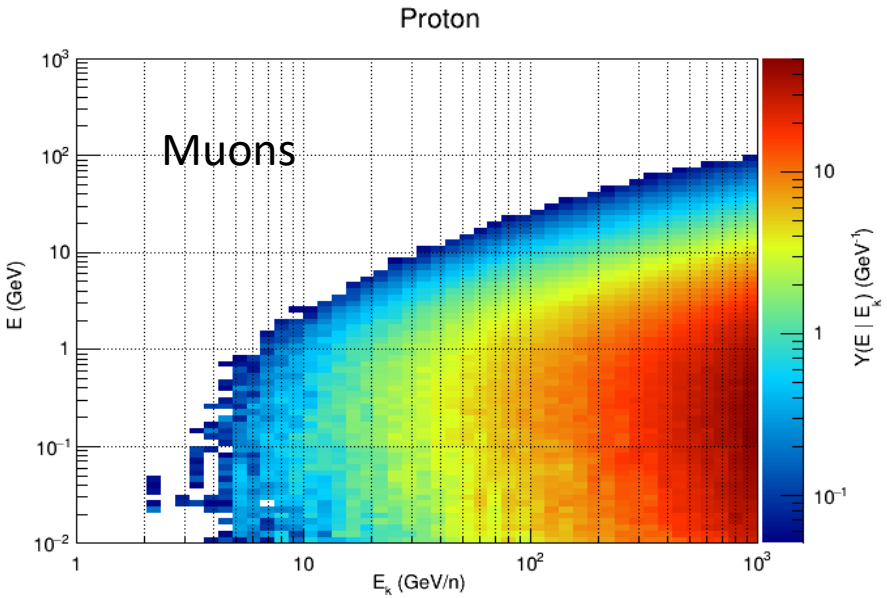
Vertical geomagnetic rigidity cut-off: IGRF model



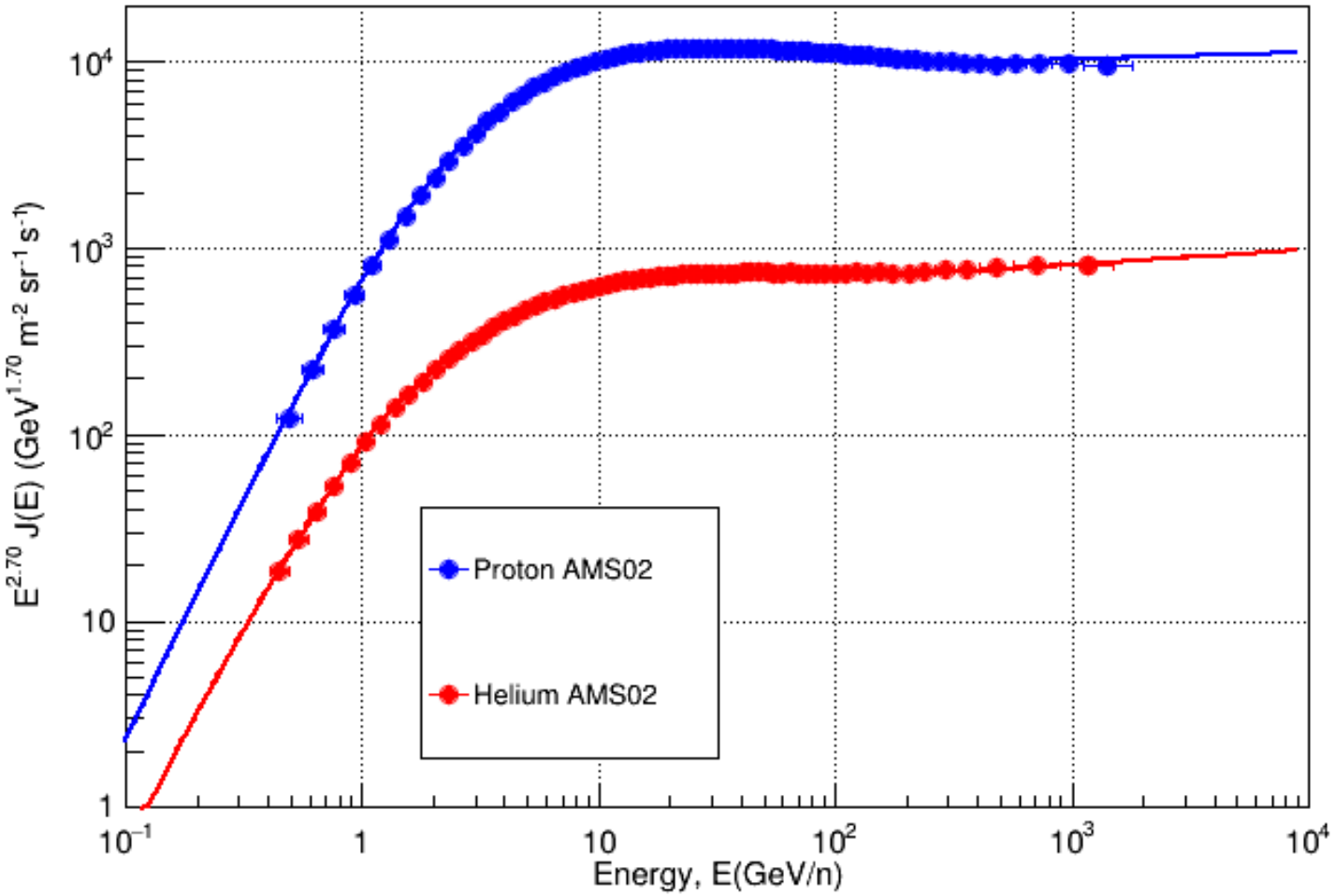
Secondary yields at sea level

- The secondary yields at sea level have been evaluated with Fluka
  - The Earth atmosphere is divided in 100 shells with with the density profile as the U.S. Standard Atmosphere 1976
  - Vertical primary proton starting from 150 km
  - No geomagnetic field
  - Secondary threshold of 1 MeV

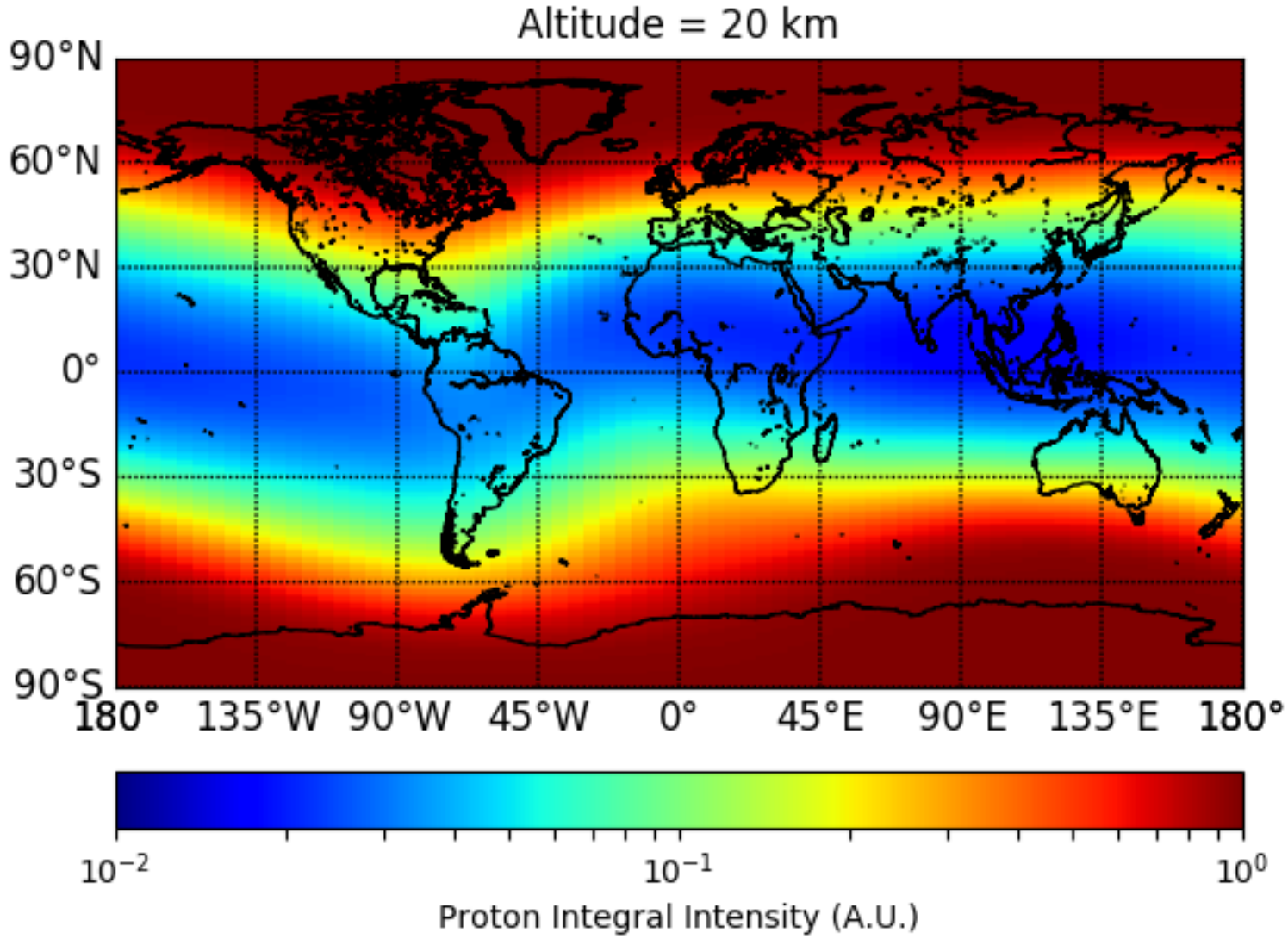




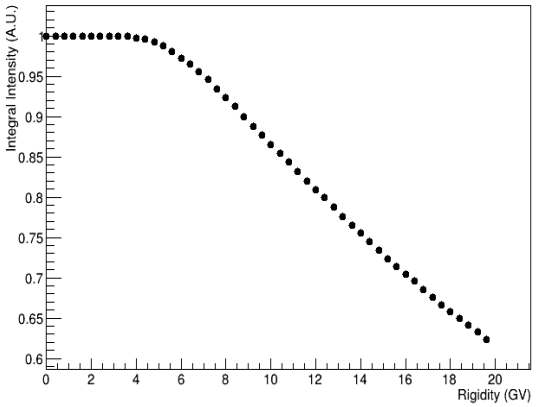
AMS02 data

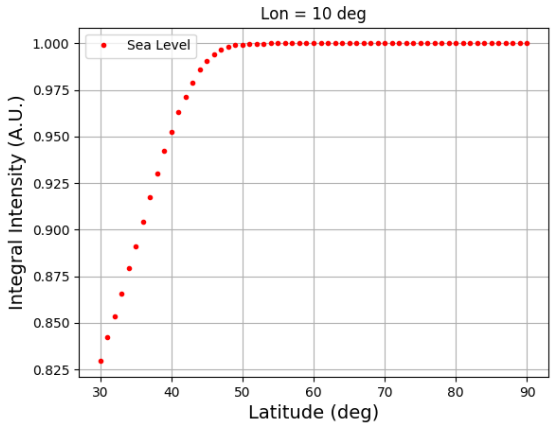

$E^{2.70}$ J(E) (GeV$^{1.70}$ m^{-2} sr^{-1} s^{-1})
Energy, E(GeV/n)
Proton AMS02
Helium AMS02

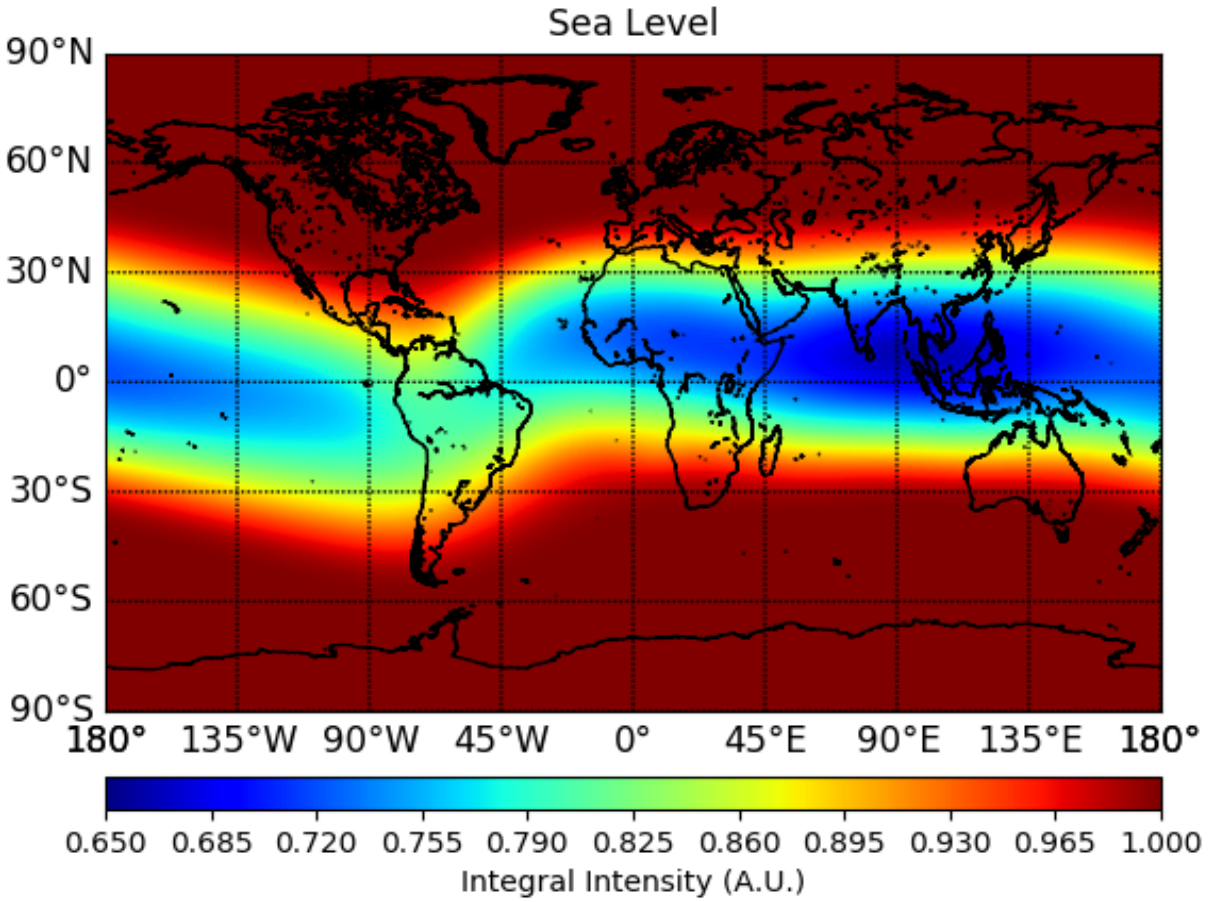
AMS02 proton intensity map with geomagnetic cut-off



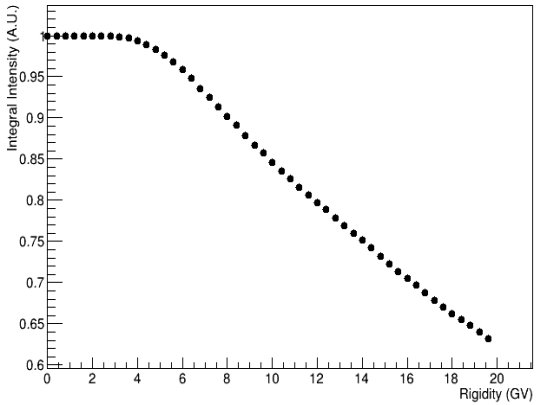
Integral intensity at sea level: $\mu^{\pm}$ (E>10 MeV)

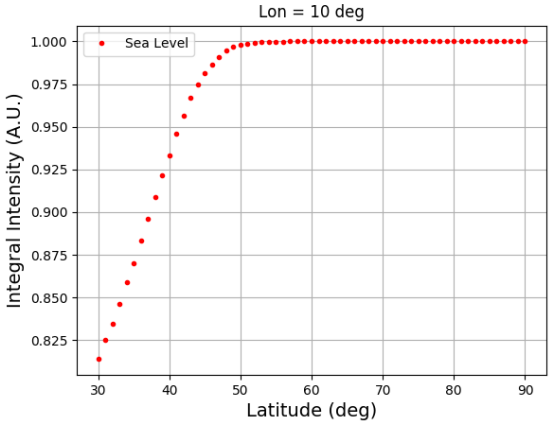


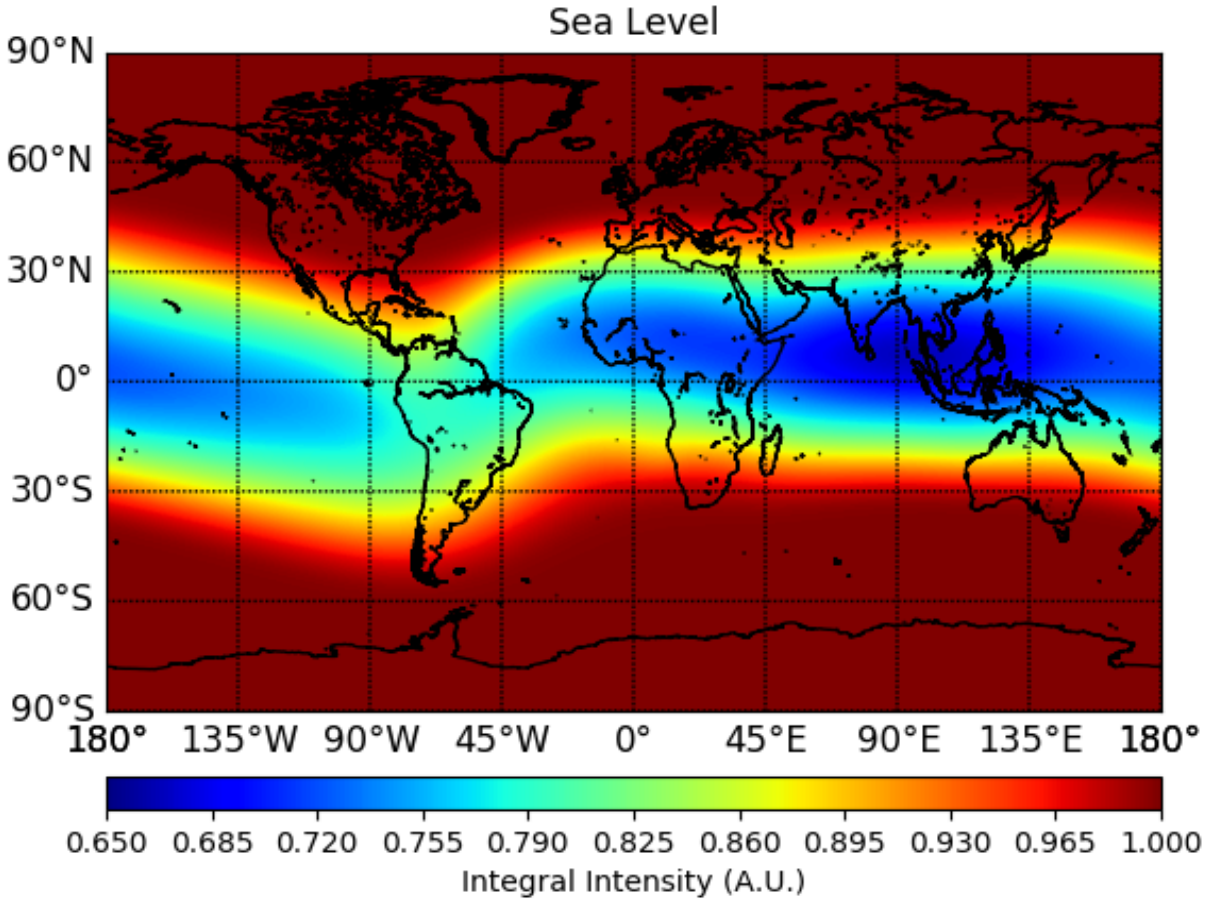




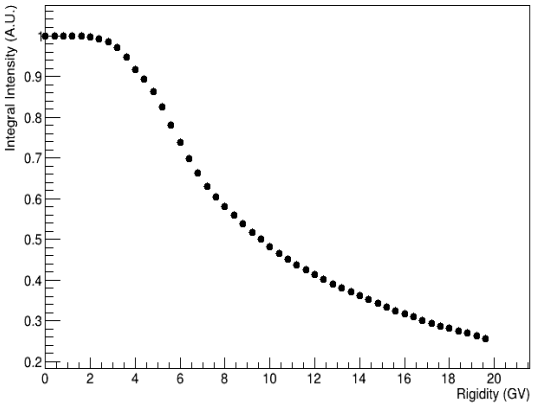
Integral intensity at sea level: $e^{\pm}$ (E>10 MeV)

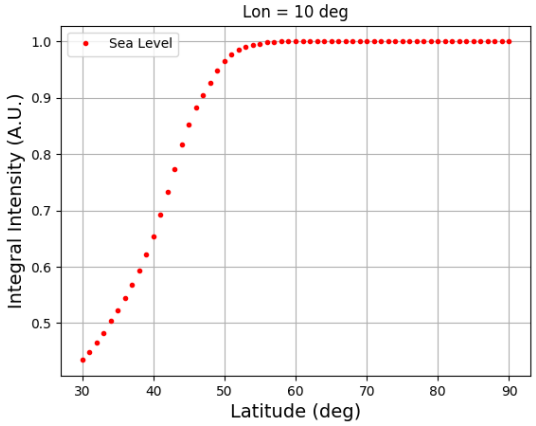


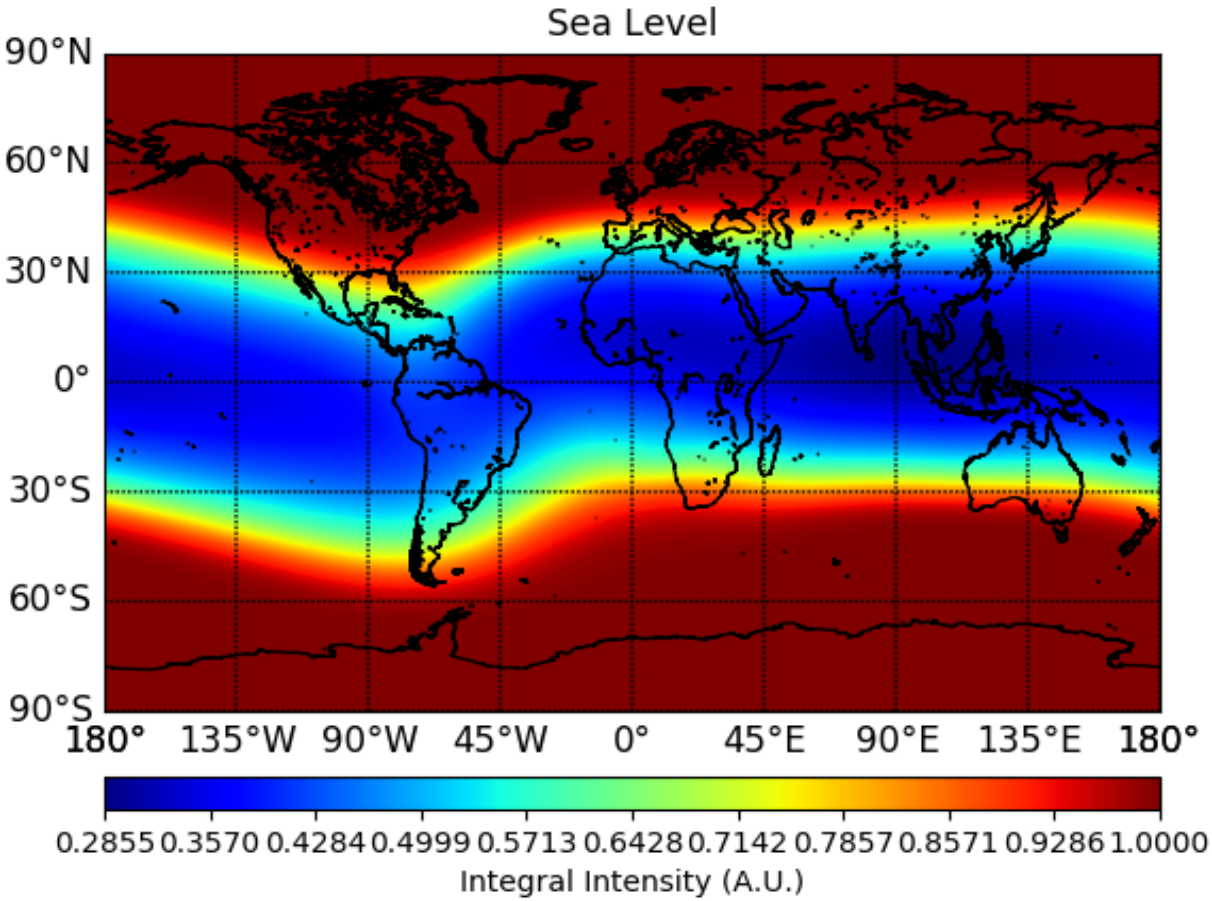




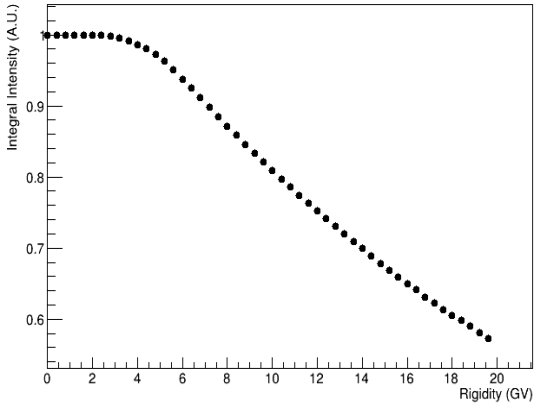
Integral intensity at sea level: protons (E>10 MeV)

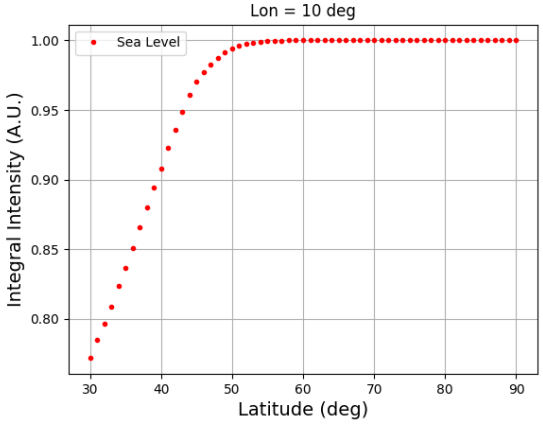


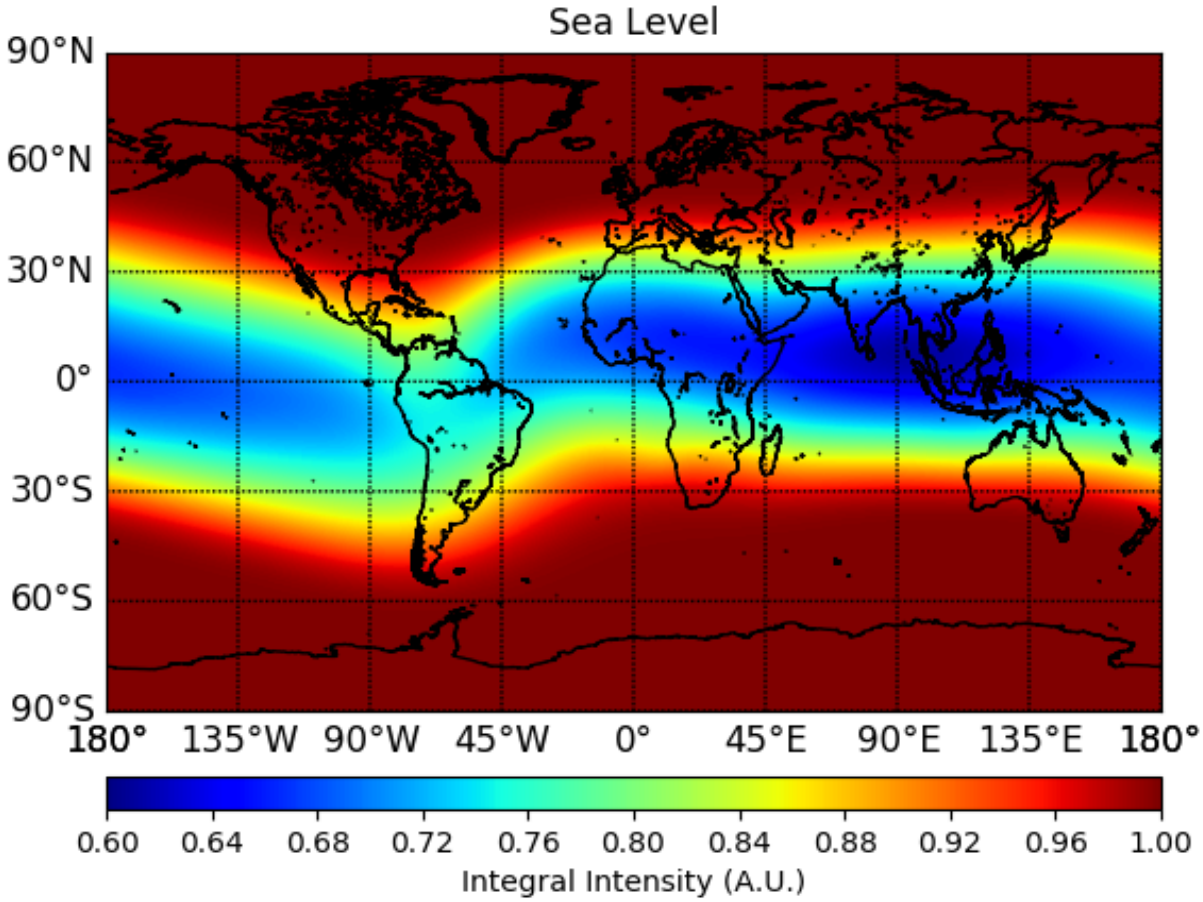




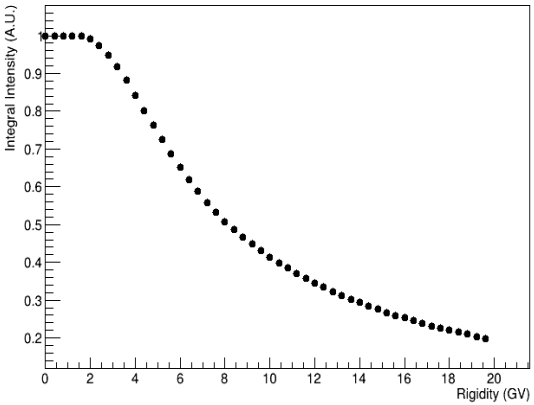
Integral intensity at sea level: $\mu^{\pm}$, $e^{\pm}$, p (E>10 MeV)

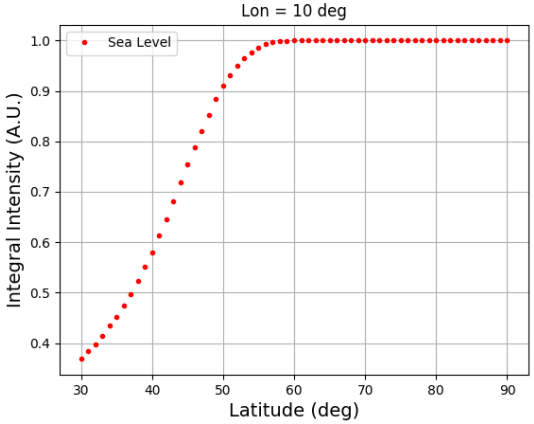


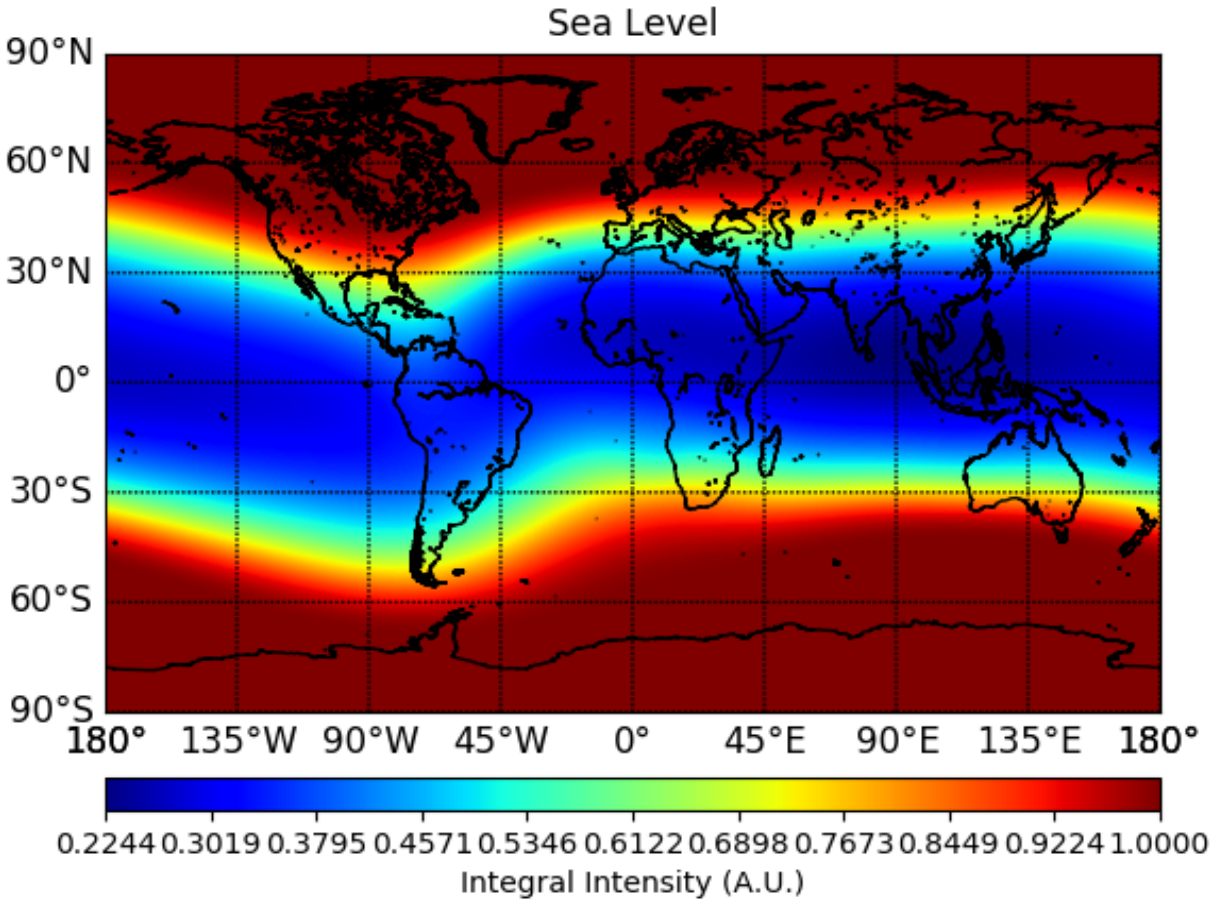




Integral intensity at sea level: neutrons (E>10 MeV)







Earth survey

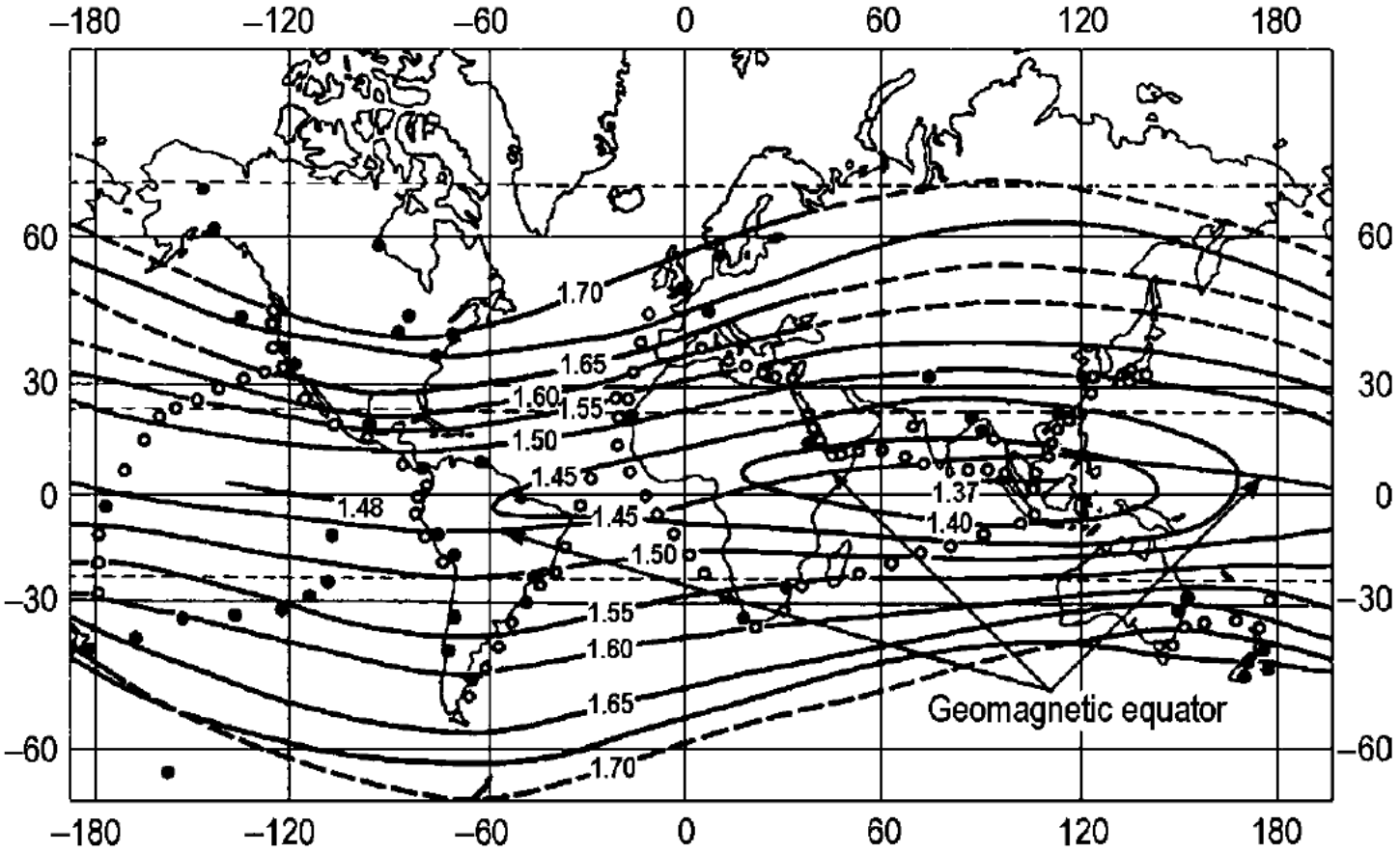


Fig. 1.6 The curves of equal CR intensity (in ion cm^{-3} sec^{-1} – figures on curves) over the whole world (According to Compton, 1936)

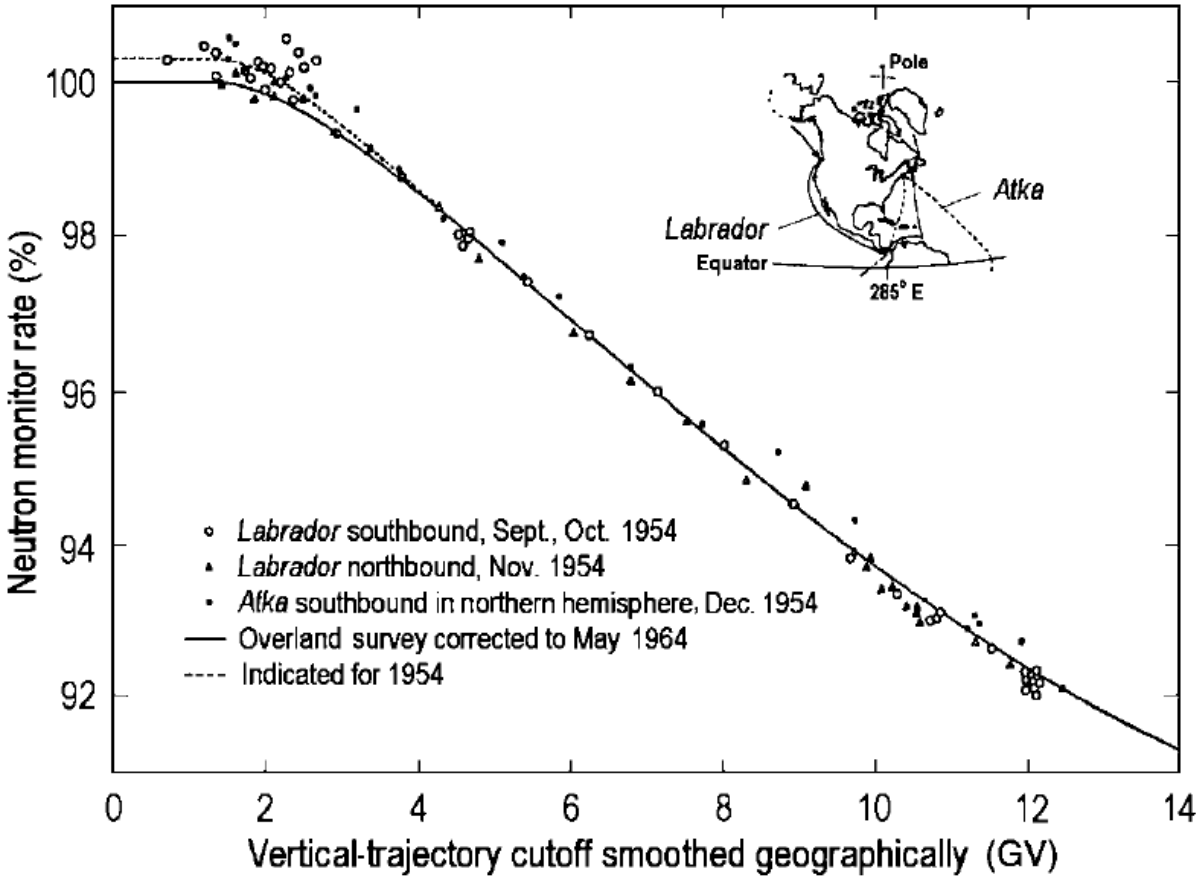
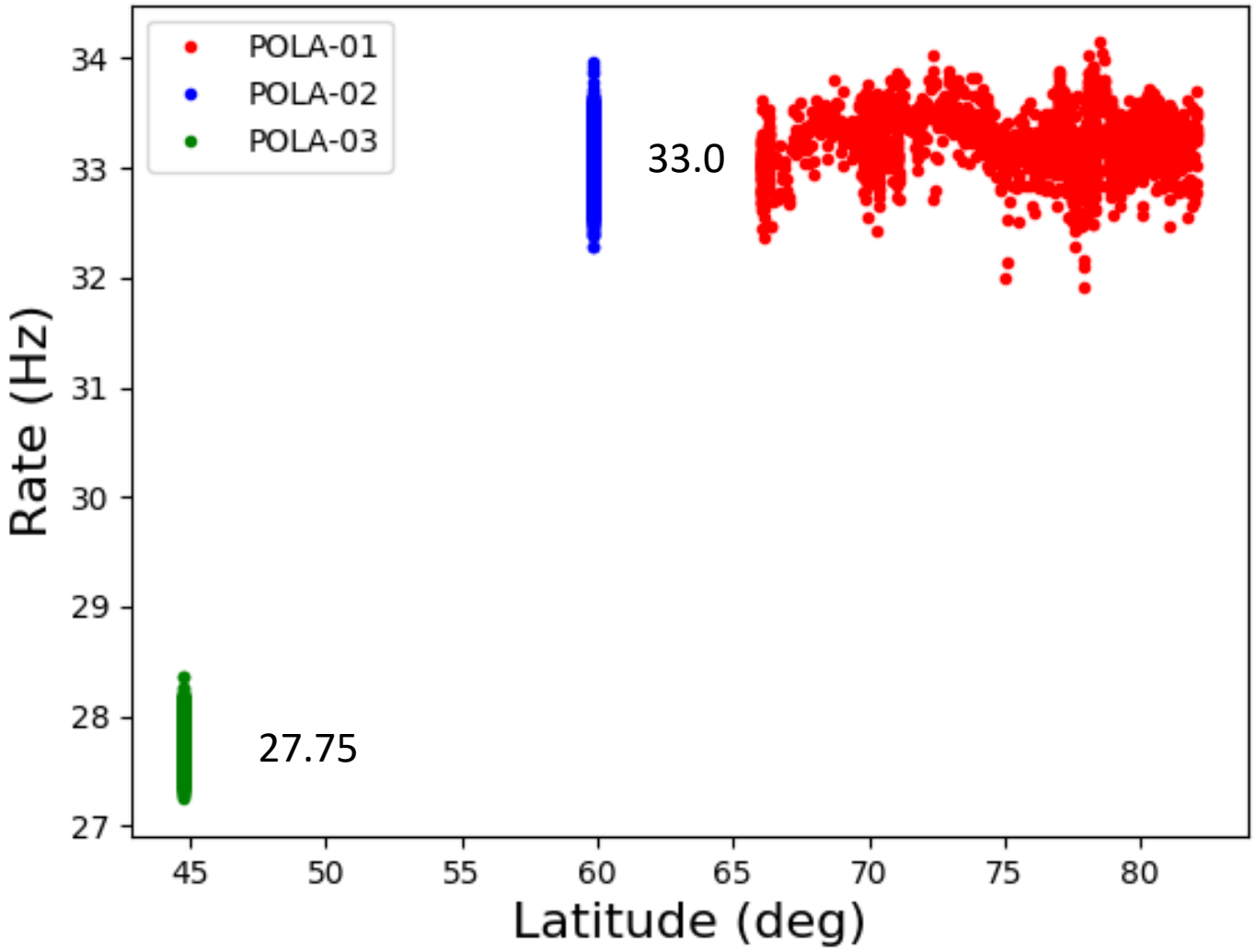


Fig. 4.24 Comparison of neutron monitor latitude surveys during two minimums of solar activity: in three Canadian expeditions in the minimum of 1965/66, and on the ships *Labrador* in September–November 1954, and *Atka* in December 1954–April 1955 (According to Carmichael and Bercovitch, 1969)

Altitude non corrected Polar rate



Expected rate at Polar positions ($\mu^{\pm}$, $e^{\pm}$, p E>10 MeV)