Updates on POLA-R rate time series analysis

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Rate POLA-R a Ny Ålesund

- Alcune delle analisi in corso:
  - Analysis of the may 2024 Forbush decrease at Ny Ålesund, with BSS, CRNS and POLA (and Barentsburg)
    - Submitted to ‘Advances in Space Research’
    - Invited presentation at EGU2025 (next slide)
    - to be submitted to ICRC (who?)
  - correzioni per temperatura
  - analisi di periodicità

EGU2025, Vienna 27 aprile – 2 maggio

- Observation of the Forbush decrease during the May 2024 solar storms with different muon and neutron detectors in the high-latitude site of the Svalbard archipelago
  by Ombretta Pinazza et al.

  accepted for session GI4.4 – Cosmic rays across scales and disciplines: the new frontier in environmental

Nuova proposta di collaborazione a Ny Ålesund

- Sandipan Dawn, from Bhabha institute, Mumbai (India)
- Paper: Characterizing interplanetary magnetic field fluctuations at arctic using cosmic ray secondaries–An approach with machine learning
  - DOI: 10.1016/j.astropartphys.2025.103087
  - *Astropart.Phys.* 167 (2025) 103087
- Plans: deploy a combination of plastic scintillator-based muon detectors along with He-3-based neutron detectors

POLA-R rate : cuts and corrections

- quality cuts: status flag, missing pressure
  diff(rate,ratej) <= 3 Hz
  tempELE max = 40.0 °C
  rate_min = 10.0 Hz
  pseff_min = 0.2
- pseudoefficiency correction

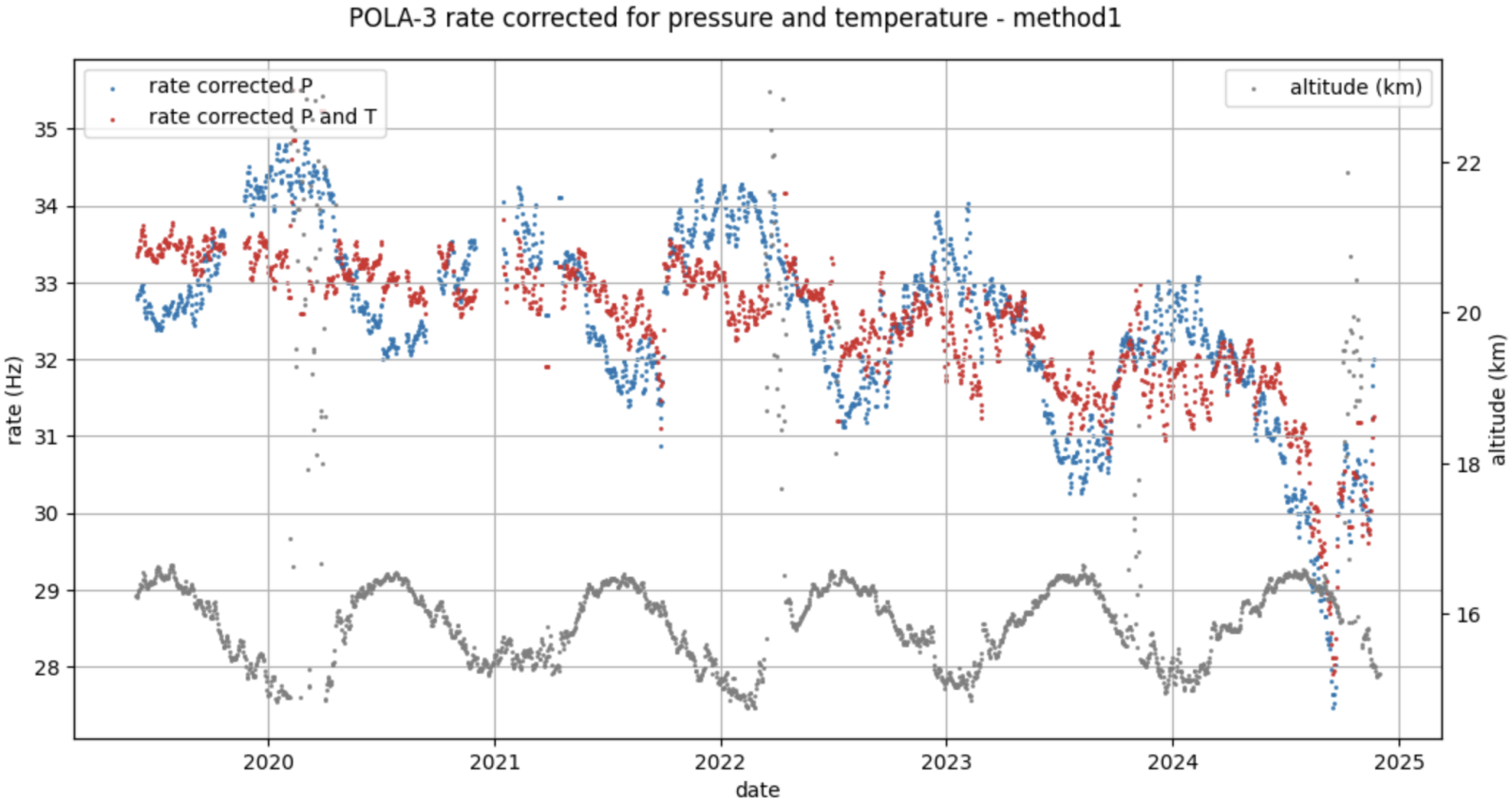
  rate = sum($ratePair_j$/effAv)
  effAv = $e_1*e_2*e_3 + e_1*e_2*e_4 + e_1*e_3*e_4 + e_2*e_3*e_4 - 3*e_1*e_2*e_3*e_4$
- pressure correction

  rateC = rate /math.exp(beta*(pres-presAvg))
  beta <= curve_fit(Linear, P-<P>, 100*ln(R/<R>))
  beta ~= -0.00236 evaluated on the whole period

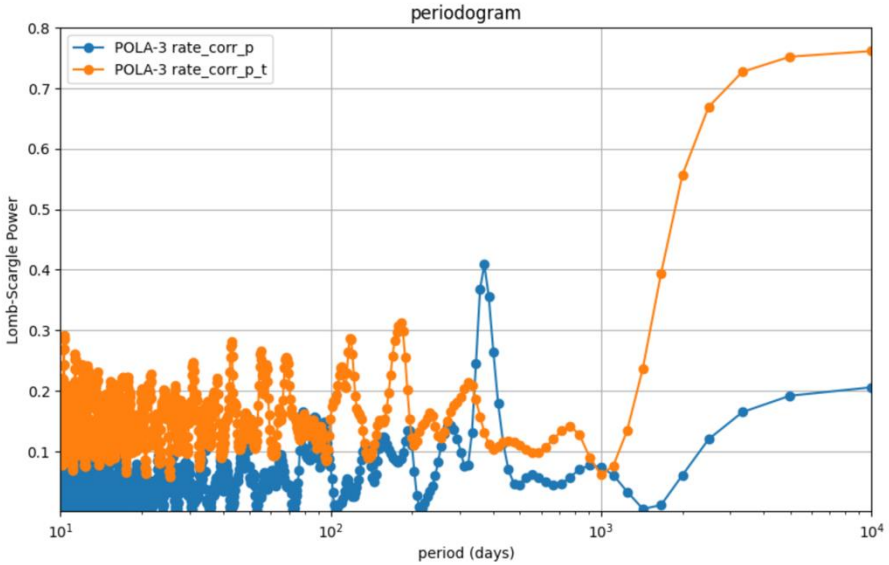
$$ln\left[\frac{I_{[x,y]}(t)}{\langle I_{[x,y]}\rangle}\right]*100\% = \beta_{[x,y]}*[P(t)-\langle P\rangle],$$

POLA-R rate : temperature correction studies

- de Mendonça papers 2016-2019 : 7 methods
- 1. atmospheric expansion method $\Delta I_T = \alpha_{\mathrm{ATE}} * \Delta H\,[p],\ p = 100\ \mathrm{hPa}$



Pearson before = -0.634
Pearson after = -0.084



Appendix
‘Methods for describing and removing the temperature effect’

Rafael R. S. de Mendonça et al.

- 7 methods:
  1. Atmospheric expansion method (altitude profile at p=100 hPa)
  2. Ground method (based on the temperature near the ground)
  3. MMP method (based on temperature variation at the MMP altitude level)
  4. Combination of 1+2+3
  5. THM: Theoretical model (integral of temperature effects at different levels)
  6. **MSS: Mass Weighted method (approx. of THM, as the sum of weighted contributions at different atm levels)**
  7. Effective temperature (single parameter related to pion and nucleaons absorption in the atm., no annual periodicity)

MMP = altitude at which we see maximum production of secondary CR, estimated at 16.5 km, mainly pion decay

BLUE = negative correlation
RED = positive correlation
GREY = no periodicity
BOLD = preferred

Correlation rateCP and rateCPT with envTemp