Observations of the cosmic ray detector at the Argentine Marambio base in the Antarctic Peninsula

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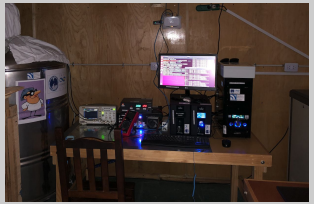
In March 2019 a Space Weather Laboratory was deployed at Marambio base in the Antarctic Peninsula. The main instrument installed was a cosmic ray detector based on water Cherenkov radiation. This detector is the first permanent Antarctic node of LAGO Collaboration (Latin American Giant Observatory). LAGO Project is an extended Astroparticle Observatory and it is mainly oriented to basic research in three branches of Astroparticle physics: the Extreme Universe, Space Weather phenomena, and Atmospheric Radiation at ground level. Observations made during 2019 and 2020 are presented here. We analyze the effect of pressure and temperature in the count rate. The corrected count rate observed with the water Cherenkov detector is compared with observations of Oulu neutron monitor with similar rigidity cut-off than the Marambio site.

(1) Antarctic Space Weather Lab at Marambio Base



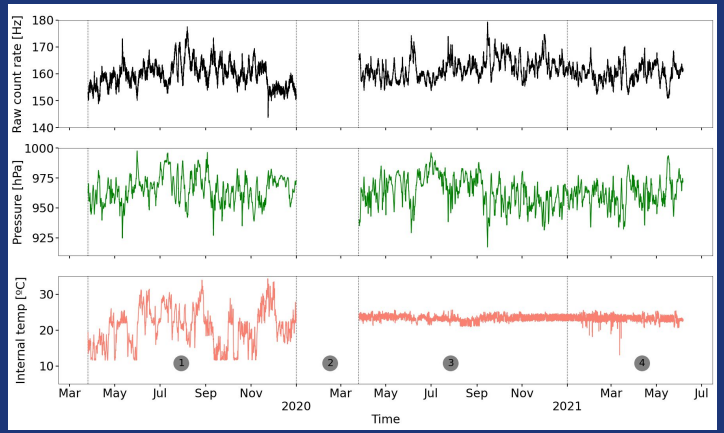
Altitude 200 m a.s.l; **Rigidity cut-off** ≈2 GV

Water Cherenkov detector for Space Weather studies, part of the LAGO collaboration.

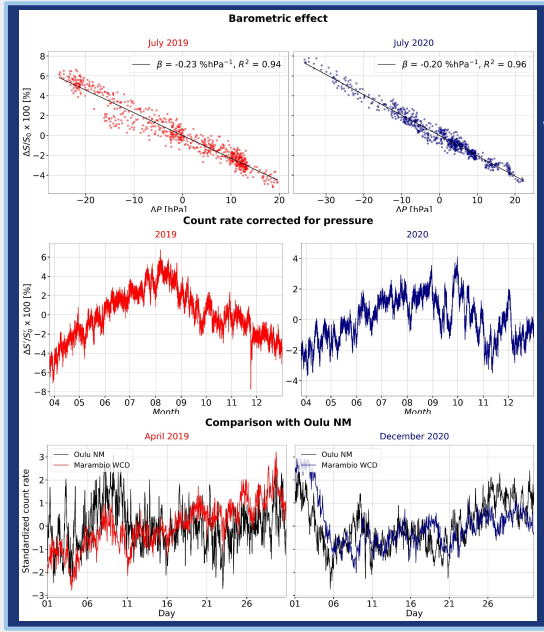
Magnetometer prototype,
GPS system,
Meteorological station,
Real time data - telemetry system.

(2) Observations and DAQ systems

- **First:** From 03/19 to 12/19. DAQ systems: Oscilloscope + Red Pitaya as oscilloscope.
- **Second:** From 01/20 to 02/20. Updates.
- **Third:** From 03/20 to 12/20. DAQ systems: Oscilloscope + system of LAGO Collaboration based on the Red Pitaya.
- **Fourth:** From 01/21 until now. DAQ systems: all mentioned above.



In this presentation we work with the **count rate acquired by oscilloscope** in period **1** and **3** because it is the only DAQ system that have been working since the installation.



(3) Data analysis

BAROMETRIC EFFECT

$\Delta S / S_0 = \beta \Delta P$

We consider time intervals of a month in which Pearson's coefficient is > 0.9 and ΔP > 25 hPa. Then we made linear fits and averaged the slopes. We got

$\beta = (0.20 \pm 0.03)\ \%\ hPa^{-1}$

COUNT RATE CORRECTED FOR PRESSURE

The count rate present a seasonal modulation with a maximum in winter and a minimum in summer.

COMPARISON WITH OULU NM

We select months with the highest Spearman's correlation coefficient. There is an agreement in some periods.

(4) Conclusion

- A New cosmic ray detector for space weather studies based on Water Cherenkov effect was installed in the Antarctic Peninsula in 2019 as part of the LAGO detection network.
- Barometric coefficient: $\beta = -(0.20 \pm 0.03)\ \%\ hPa^{-1}$.
- Seasonal modulation on corrected count rate.

Perspectives

- Remove the temperature effect.
- Count rate for different type of particles using the energy calibration.

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