

Night Time Measurement of the UV Background by EUSO-Balloon

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Motivation

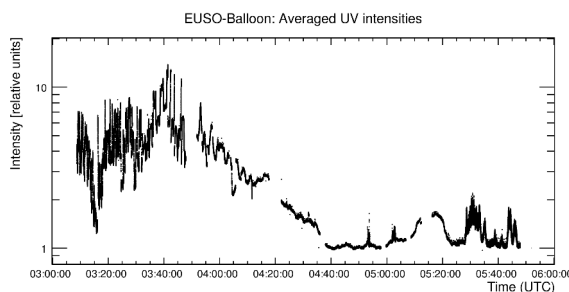
- The Extreme Universe Space Observatory on-board the Japanese Experiment Module (JEM-EUSO), a next-generation space-based UHECR experiment, will achieve increase of exposure in an order of magnitude, compared with present-days experiments
- A precise characterization of the Earth's UV background during night is essential for the observation of UHECR induced EAS from space
- The first flight of EUSO-Balloon was a successful pathfinder mission for observation of the UV background

Main results

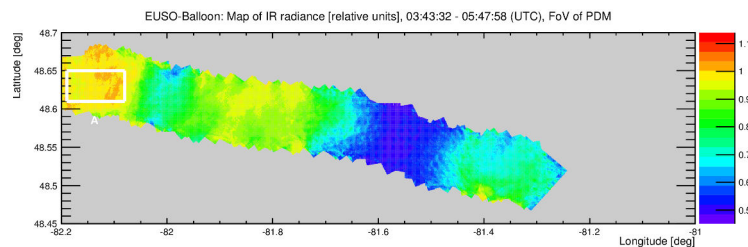
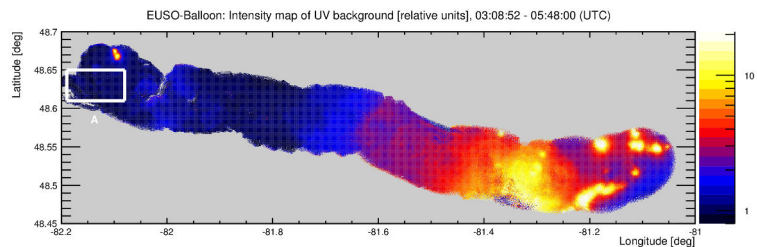
- EUSO-Balloon is the first mission that imaged the UV background in different atmospheric conditions, well monitored by dedicated Infrared Camera
- An anti-correlation between UV and IR up-going radiation was found and an evident dependence of the UV background on atmospheric conditions was revealed
- The tool for masking the regions affected by clouds and man-made light in the FoV is prepared to fulfill the requirements for a high quality detection of UHECR

UV Background in Different Atmospheric Conditions

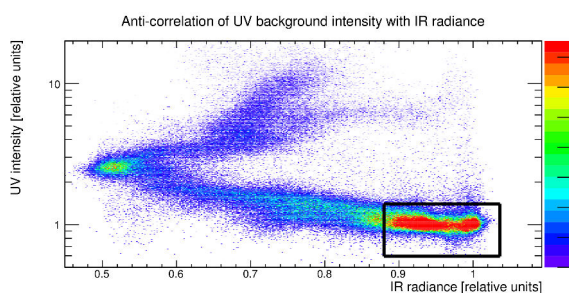
- A single photo-electron detection from an area of $\sim 50 \text{ km}^2$ during night 03:08 – 05:48 (UTC) on 25 August, 2014 was performed by PDM with 6×6 -array multi-anode photomultiplier tubes (MAPMTs) with 8×8 pixels each
- UV telescope range: 290 – 430 nm
- IR camera range: 10.37 – 11.22 μm and 11.57 – 12.42 μm



- The evolution of the measured UV background intensity (I_{BG}) is plotted
- The numerous sharp peaks are intensive man-made UV lights in the FoV
- The displayed values are relative to the mean value of I_{BG} over reference area "A" (white box)
- The imaging capabilities of the EUSO-Balloon telescope and IR camera were used for creation of UV and IR maps



- Pixels with the lowest I_{BG} and the highest IR radiance correspond to clear atmosphere
- The clouds have higher albedo than ground and increased I_{BG} values
- In general, there is an anti-correlation between the UV and the IR radiation
- The pixels affected by man-made lights (the city Timmins with neighborhoods, mines, and airport) do not follow the general IR-UV anti-correlation



- The combination of the IR and UV data provides a powerful tool for characterization of the atmospheric properties
- It opens the possibility to assign individual pixels with clear atmosphere conditions (black box) and mask the cloudy pixels and pixels affected by man-made light
- It allows to characterize the cloud coverage in the cloudy pixels and it improves the possibility to use the EAS data taken in the cloudy atmosphere conditions

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