

# Satellite Data for Atmospheric Monitoring at the Pierre Auger Observatory

## Executive Summary

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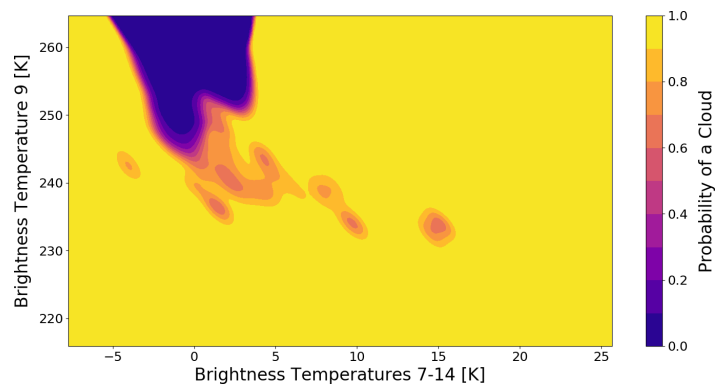
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The Pierre Auger Observatory is used to study extensive air showers that occur when a cosmic ray interacts with Earth's atmosphere. Atmospheric monitoring is necessary to correctly reconstruct extensive air showers. Measurements made by ground based monitoring systems can be supplemented by satellites.

## 1 GOES-16 Cloud Monitoring

The fluorescence detectors (FD) of the Pierre Auger Observatory require clear-skies, and moonless-nights to operate. GOES-16 is a satellite used to observe weather of the Americas year round.

Responses to clouds of an infrared camera located at the Los Leones FD site were compared to the pixel in GOES-16's aperture where the ground infrared camera is located. A cloud probability algorithm was created using this ground-truthing technique.



## 2 Aeolus Parametric Aerosol Measurement

Aeolus is used to measure the wind profiles in Earth's atmosphere. A UV lidar that measures the Doppler shift of light as it returns to the satellite provides wind speed measurements. The lidar pulses can be seen with the FDs of the Pierre Auger Observatory. The laser pulses can be reconstructed to find the beam energy.

A parametric fit of laser energy and vertical aerosol optical depth (VAOD) is possible. Aeolus fires multiple lasers across the array in one pass allowing for a maximum-likelihood fit to be used. The results of the likelihood are used as a cross-check with the CLF's VAOD measurement.

