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# Performance of the Cherenkov Telescope Array in the presence of clouds

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The Cherenkov Telescope Array (CTA) is the future ground-based observatory for gamma-ray astronomy at very-high energies. The atmosphere is an integral part of every Cherenkov telescope. Different atmospheric conditions, such as clouds, can reduce the fraction of Cherenkov photons produced in air showers that reach ground-based telescopes, which may affect the performance. Decreased sensitivity of the telescopes may lead to misconstructed energies and spectra. This study presents the impact of various atmospheric conditions on the CTA performance. The atmospheric transmission in a cloudy atmosphere in the wavelength range from 200 nm to 1000 nm was simulated for different cloud bases and different optical depths using the MODerate resolution atmospheric TRANsmission (MODTRAN) code. MODTRAN output files were used as inputs for generic Monte Carlo simulations. Analysis was performed using the MAGIC Analysis and Reconstruction Software (MARS) adapted for CTA. As expected, the effects of clouds are most evident at low energies, near the energy threshold. Even in the presence of dense clouds, high energy gamma rays may still trigger the telescopes if the first interaction occurs lower in the atmosphere, below the cloud base. A method to analyze very-high energy data obtained in the presence of clouds is presented. The systematic uncertainties of the method are evaluated. These studies help to gain more precise knowledge about the CTA response to cloudy conditions and gives insights on how to proceed with data obtained in such conditions. This may prove crucial for alert based observations and time-critical studies of transient phenomena.

## Keywords

Cherenkov telescopes; clouds; CTA; MODTRAN; Monte Carlo simulations

## Collaboration

CTA

## other Collaboration

## Subcategory

Experimental Results

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