Cosmic rays of energies above $10^{14}$ eV are detected mostly indirectly, by observing the extensive air showers they create in the atmosphere. Multiple experiments suggest that the current models of high-energy interactions do not describe the cosmic ray data perfectly, in particular when it comes to the prediction for the number of muons at ground. We present two models aiming to improve the description of the muon component, one based on the addition of particles with small momenta in the local center-of-mass frame of the high-energy hadronic interactions in the shower, the other on the addition of the so-called dark photons to the electromagnetic part of the shower. While we find the latter having no observable consequences, the former improves the agreement between observed and predicted amounts of muons both for the DELPHI cosmic ray data and for the measurements by the Pierre Auger Observatory. We also describe the FRAM telescope, a device used to monitor the atmosphere at the Pierre Auger Observatory, and its applications to the search for anomalous shower profiles and to the measurement of the aerosol content of the atmosphere, which is crucial for the analysis of data obtained by fluorescence detectors.