



From the ultra-violet to the near-infrared for one decade: A comprehensive data set of astronomical spectra for atmospheric research

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Astronomical spectra taken with ground-based telescopes offer the unique possibility to study various effects arising in our Earth's atmosphere with instruments usually not available for atmospheric sciences, since the light of the observed astronomical targets has to pass through it creating a specific fingerprint for the time of the observation. The European Southern Observatory operates the spectrograph X-Shooter at the Very Large Telescope in the Chilean Atacama desert (24.6°S, 70.4°W), which provides medium resolution spectra simultaneously comprising the entire 0.3...2.5 μ m wavelength regime in three spectral subranges, the ultra-violet spectral arm (UVB, 0.3...0.56 μ m), the visual arm (VIS, 0.56 μ m...1.02 μ m), and the near-infrared arm (NIR, 1.02...2.5 μ m).

X-Shooter is in operation since 2009 and highly demanded by astronomers. Thus, the entire data set covers nearly one decade of frequent observations and comprises ~232,000 individual spectra (~71,000 UVB arm, ~71,000 VIS, and ~90,000 NIR). Though taken for astronomical purposes, this data set can be used for research of the Earth's atmosphere after applying specific calibration steps. Its application includes airglow studies of the mesopause to ionospheric regions due to the simultaneous observation of all major emission contributors (e.g. OI@557nm, OI@630nm, NaD@589nm, nearly all OH bands, FeO/NiO continuum, ...), chemical composition investigations of the lower atmosphere (absorption features of e.g. H₂O, CH₄, O₂, O₃,...), and climate studies (e.g. long-term CO₂ monitoring).

In this presentation, we describe the data set in detail, the specific calibrations, and an overview of recent results.