Geophysical Research Abstracts
Vol. 21, EGU2019-8876, 2019
EGU General Assembly 2019

Remote sensing and modelling of terrestrial potassium nightglow

Stefan Noll (1,2), John M. C. Plane (3), Wuhu Feng (3,4), Bastian Proxauf (5), Stefan Kimeswenger (6,7), and Wolfgang Kausch (6)

(1) Institut für Physik, Universität Augsburg, Augsburg, Germany, (2) Deutsches Fernerkundungsdatenzentrum, Deutsches Zentrum für Luft- und Raumfahrt, Weßling-Oberpfaffenhofen, Germany, (3) School of Chemistry, University of Leeds, Leeds, United Kingdom, (4) National Centre for Atmospheric Science, University of Leeds, Leeds, United Kingdom, (5) Max-Planck-Institut für Sonnensystemforschung, Göttingen, Germany, (6) Institut für Astro- und Teilchenphysik, Universität Innsbruck, Innsbruck, Austria, (7) Instituto de Astronomía, Universidad Católica del Norte, Antofagasta, Chile

The evaporation of cosmic dust particles entering the Earth's atmosphere at high speeds leads to the formation of metal layers in the mesopause region at around 90 km. The alkali metal potassium (K) can be observed via the K(D_1) line at 769.9 nm, which can be stimulated by sunlight, lasers, and chemical reactions. The latter mechanism is particularly useful for studying the underlying chemistry. However, as the related weak nighttime emission is difficult to observe, only a mean intensity of about 1 Rayleigh has been measured, so far. With about 2,300 high-resolution spectra from the astronomical echelle spectrograph UVES of the Very Large Telescope at Cerro Paranal in Chile taken between 2000 and 2015, we have been able to study K nightglow in much more detail. Nighttime, seasonal, and long-term variations have been investigated for the first time. The K(D_1) intensities are relatively high close to sunrise, in June (related to a dominating annual oscillation), and at low solar activity. Moreover, we have simulated the K emission with the Whole Atmosphere Climate Community Model (WACCM) in order to estimate the efficiency of the chemiluminescent emission process. Focussing on the WACCM data for the most reliable month January and estimating an intensity ratio of the obscured D_2 and measured D_1 line of 1.67, we obtain a quantum yield of 50 to 60%. Overall, the variability and quantum yield are surprisingly different from the corresponding results for the better studied nightglow emission of the alkali metal sodium.