

**Plenarvortrag** PV XIII Do 9:00 Plenarsaal  
**Climate change and gravity waves in the middle atmosphere** — ●FRANZ-JOSEF LÜBKEN — Leibniz-Institute of Atmospheric Physics, Schloss-Str. 6, Kühlungsborn, Germany

The middle atmosphere (MA, here roughly 20-120 km) exhibits some unexpected features. For example, the summer mesopause region (at roughly 80-90 km) at middle and polar latitudes is much colder in summer compared to winter. It cools down to approximately 130 Kelvin which is the coldest place in the Earth's atmosphere and promotes the formation of ice particles known as noctilucent clouds (NLC). The peculiar thermal structure is mainly caused by gravity waves and tides which propagate from lower altitudes to the middle atmosphere where they break and lead to a circulation with upward/downward winds

in the summer/winter hemisphere accompanied by cooling/heating, respectively. In this presentation some new results regarding observations of gravity waves by ground based lidar will be discussed.

The increase of greenhouse gases leads to a cooling of the MA by up to -2 K/decade which is significantly stronger in magnitude compared to the warming in the troposphere. NLC are proposed to be sensitive indicators for trends in the middle atmosphere. We have recently shown that an increase of carbon dioxide alone surprisingly does not(!) lead to an increase of NLC brightness and occurrence frequency. Instead, an enhancement of methane (which is chemically converted to water vapor in the middle atmosphere) causes significant changes of NLC parameters on centennial timescales. The physical background of these results are explained in the presentation.