Diurnal variation of stratospheric ozone above Bern

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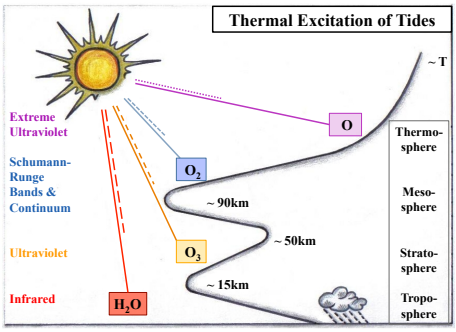
1. Motivation

- To understand the relation between diurnal ozone variation and tides
- To monitor tides by ground-based microwave radiometry
- To verify our measurements of the diurnal ozone variation
- To correct the effect of the diurnal ozone cycle in long-term series of satellites

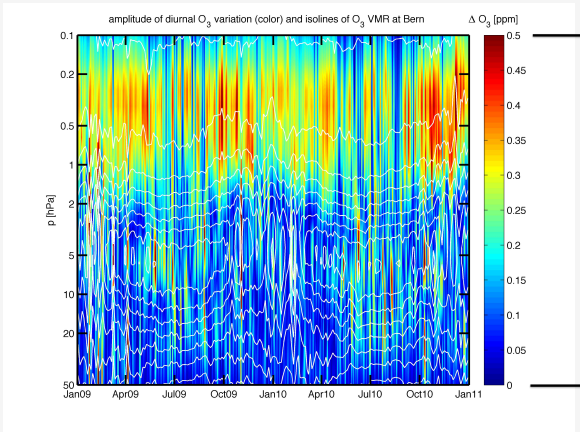


S. Studer after idea by M. Hagan

2. Basics

- Insolation of stratospheric ozone = main reason for atmospheric tides
- Mixing and advection of ozone by tides
- Tides transfer momentum and energy
- Tides have periods of (24h)/n and are surprisingly variable

3. Diurnal variation of stratospheric ozone

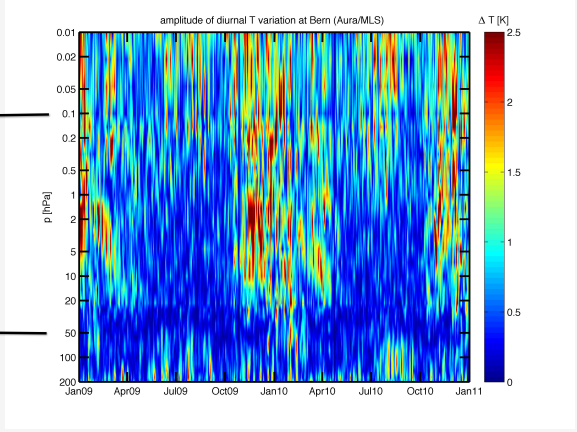


- Observations are from GROMOS ozone microwave radiometer at Bern (all daytime, all weather, Δt=30 min)
- Beyond 1 hPa (stratopause) the amplitude correlates with O_3 VMR (white lines)
- Stratosphere: O_3 amplitude is maximal during **summer**
- Tidal amplitude is modulated by intra-seasonal oscillations

extension of vertical axis

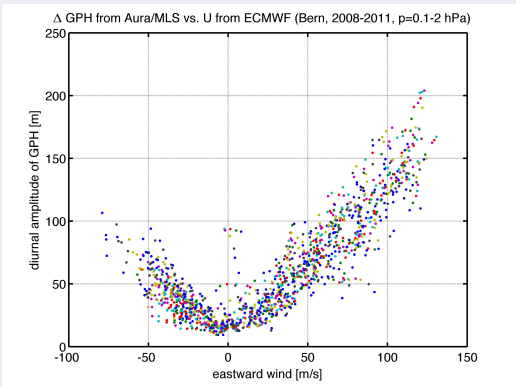
Why?

4. Diurnal variation of temperature



- Observations are from the sun-synchronous satellite Aura/MLS surpassing Bern around noon and midnight
- Beyond 0.1 hPa (z ≈ 65 km) the amplitude has a semi-annual variation
- Stratosphere: T amplitude is maximal during **winter**
- Tidal amplitude is modulated by intra-seasonal oscillations

5. Are tides forcing the zonal mean flow?



- Strong correlation is found between zonal wind (ECMWF operational reanalysis) and amplitude of diurnal tide (variation of geopotential height from Aura/MLS)
- Migrating tides take westward momentum from their source region
- Zonal mean flow must compensate for the westward wave momentum
- Correlation is also found at the tropopause and for intra-seasonal timescale

6. Conclusion

We just started and found that atmospheric tides are an exciting theme. The new observations may reveal the impact of tides on atmospheric circulation and composition.