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Orographic gravity waves (GW) in OH-airglow imaging systems

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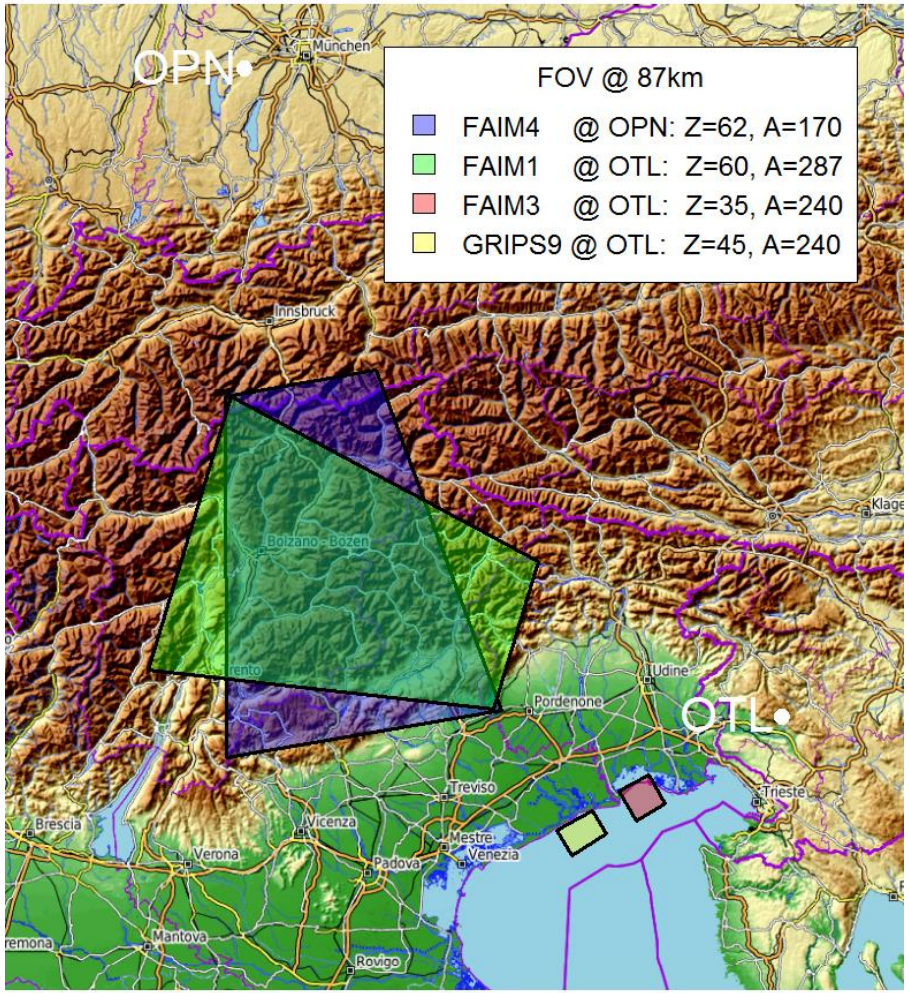
Data basis: OH imaging systems and a little bit of modelling data



- Infrared camera: FAIM 3
  - 2D measurements of OH airglow intensity since 26th October 2017 at Otlica, Slovenia (Hannawald et al. (2016) & Sedlak et al. (2016))
  - Temporal resolution: 2.8s per image
  - Mean spatial resolution: 24 m / px
  - FoV: ca. 14 x 14 km
  - Analysis: see publications above, additionally: calculation of mean of mid pixels, star removal, wavelet analysis
- Additionally infrared spectrometer: GRIPS 9
  - Derivation of 1D temperature time series since 15th July 2017 at Otlica, Slovenia (Schmidt et al. (2013) & Schmidt et al. (2018))
  - FoV: ca. 250 km²
  - Analysis: Derivation of daily gravity wave potential energy according to Wüst et al. (2016) & Wüst et al (2017)

Upper mesosphere / lower thermosphere (UMLT)

- Additionally: ERA 5
  - Temperature and wind data
  - Calculation of Scorer Parameter (Scorer, 1949)

Below

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Case studies: investigation of GW activity before, during and after strong Bora (tropospheric wind events)

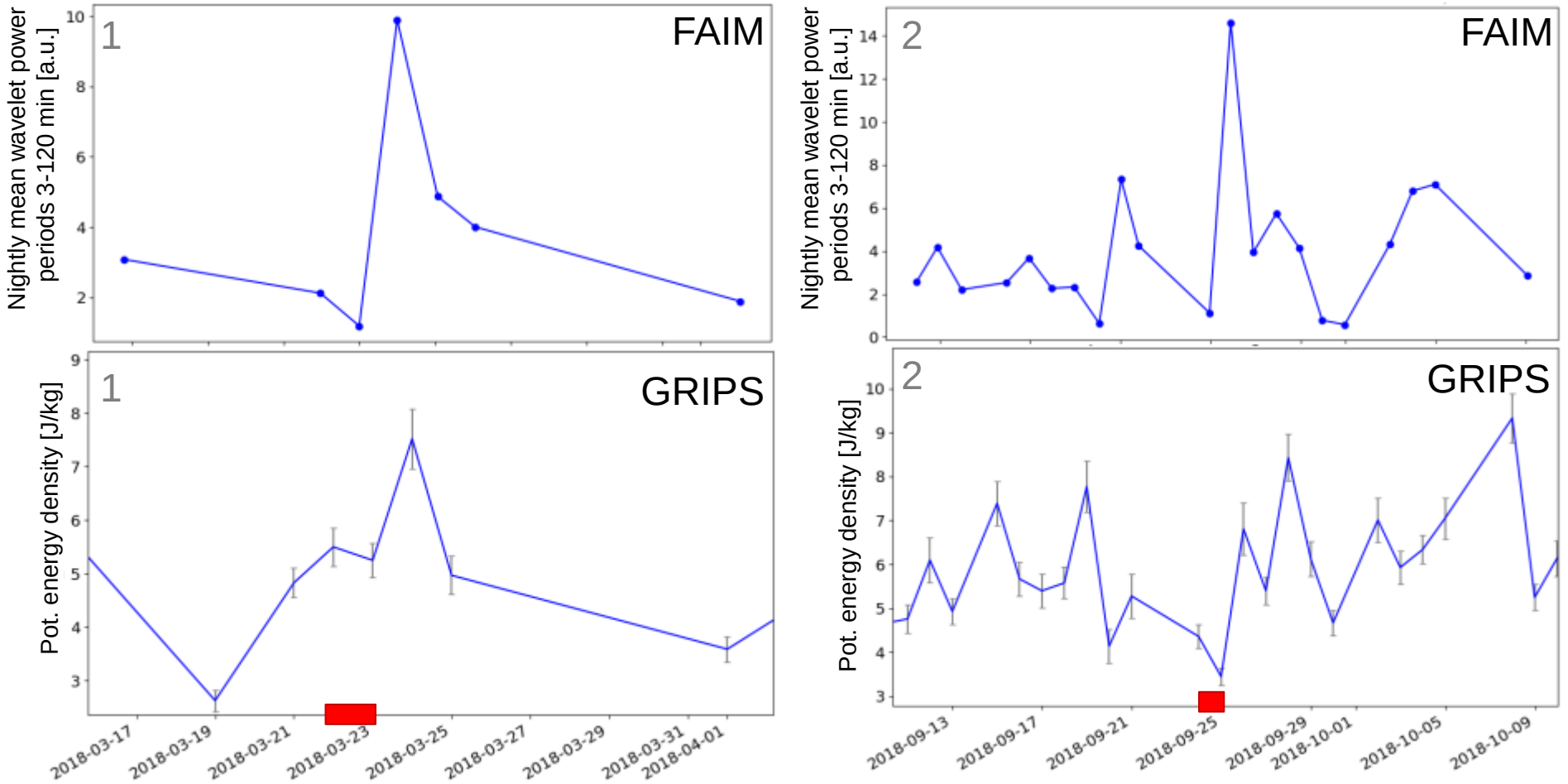
Needed: GRIPS & FAIM sensitive to clouds → cloudless or not too cloudy period of ca. 2–4 weeks around a strong Bora event:

First event:
22. & 23. March 2018

Second event:
24. & 25. September 2018

Results:

- GRIPS and FAIM agree qualitatively
- Maximum in GW activity observable 1–2 nights after Bora



Source of figures: Jonas Till, 2020, Orographische Schwerewellen im Alpenraum: Fallstudien zur Ausbreitung in der mittleren Atmosphäre, master thesis, University of Augsburg

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Gravity wave (GW) propagation possible from the ground to the UMLT?

- GW propagation depends on temperature and wind field below UMLT
  - → Scorer-parameter delivers first estimate of minimal horizontal wavelength of a wave which is able to propagate from ground into UMLT (see lowermost plot, based on ERA 5 data)
- Instrument sensitivity:
  - FAIM: due to FoV size mainly sensitive to waves with horizontal wavelengths smaller than ca. 14 km (yellow dashed line in lowermost plot)
  - GRIPS: due to averaging over FoV mainly sensitive to waves with horizontal wavelengths longer than ca. 15 km (rose dashed line in lowermost plot)

→ Possible that we see an effect of strong tropospheric winds on wave activity in UMLT

→ Study of further events