CO2Image aims at reliable emission quantification for localized sources down to 1 MtCO₂/y (~90% of all coal-fired power plant emissions), enabled by fine ground resolution (50 m):

- Zoom-in companion for CO2M and other survey missions.
- SWIR-2 spectrometer with 1-1.5 nm spectral resolution to disentangle surface spectral features.
- Payload fits on DLR-CompactSat.

Launch 2025.

Strandgren et al., https://doi.org/10.5194/amt-13-2887-2020, AMT, 2020
Global survey missions (OCO-2, CO2M) with ground resolutions on the km-scale can resolve point-source emissions \(>10\) MtCO\(_2\)/y i.e. up to 25% of emissions from global coal power-plants.

Missions with extremely fine ground-resolution (\(<50\)m) are able to detect and quantify point-source emissions \(>1\) MtCO\(_2\)/y i.e. up to 90% of emissions from global coal power plants.

Strandgren et al., https://doi.org/10.5194/amt-13-2887-2020, AMT, 2020
Extremely fine ground-resolution (<50m) facilitates:

- Enhanced concentration contrast.
- Plume sampling by multiple ground pixels.
- Plume shape analysis for constraining turbulent dispersion.

... but, it hinders:

- dense coverage on larger scales and thus, it is not suitable for regional-to-continental scale assessments.

Thus, CO2Image will be a „zoom-in“ companion for CO2M and other survey missions.
CO2Image: SWIR-2 with 1 - 1.5 nm resolution

Extremely fine ground-resolution (<50m) requires collecting photons and CO₂ absorption signal in the spectral domain - **coarser but not too coarse spectral resolution**:

- Prefer SWIR-2 (2 micron) over SWIR-1 (1.6 micron) since SWIR-1 too noisy due to smaller CO₂ absorption optical depth (even if accounting for typically higher albedo).

- „Optimal“ resolving power ~1500 (1-1.5 nm at 2 micron). Smaller resolving power implies (unresolvable) **correlations with surface spectral reflectance**.

See poster by J. Wilzewski, same session.

Wilzewski et al., [https://doi.org/10.5194/amt-13-731-2020](https://doi.org/10.5194/amt-13-731-2020), AMT, 2020;
CO2Image: Preliminary instrument fits on compact satellite

Extremely fine ground-resolution (<50m) requires relative large telescope, fast optics, forward motion compensation: preliminary instrument concept fits an DLR Compact-Sat.

Strandgren et al., https://doi.org/10.5194/amt-13-2887-2020, AMT, 2020
**CO2Image: Plume detection, emission quantification**

**Ongoing:** Plume detection via image processing. Emission quantification via mass balance, continuity considerations and emerging techniques.

**LES simulation for Indianapolis CO₂ sources with 50m ground resolution**

(emission from HESTIA @ K. Gurney, surface reflectance from Sentinel-2)

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