

Estimation of Air Pollution with Remote Sensing Data: Revealing Greenhouse Gas Emissions from Space

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Nitrogen Dioxide

- Anthropogenic air pollutant
- Adverse effects on human health and environment

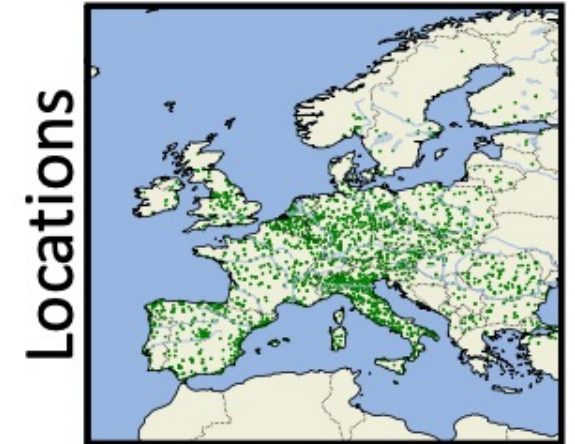
Problem

- Surface-level air pollution data is scarce
- Remote measurements are low resolution

Goal

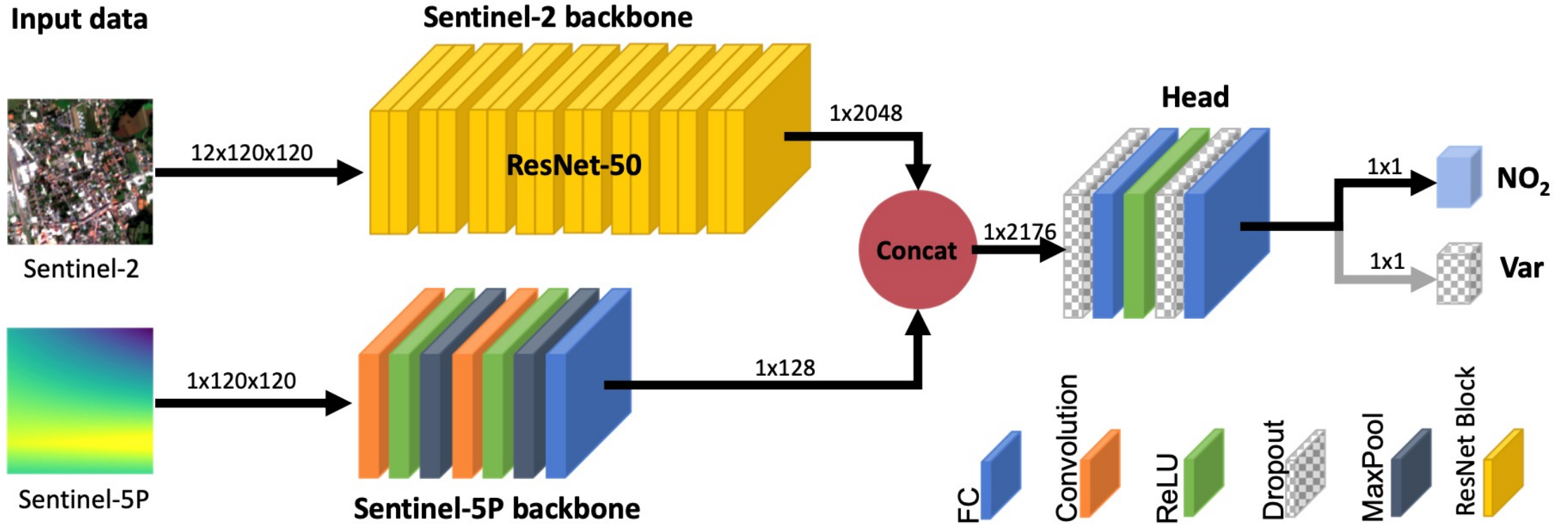
- Estimate surface air pollution from remote sensing data

Ground truth NO_2



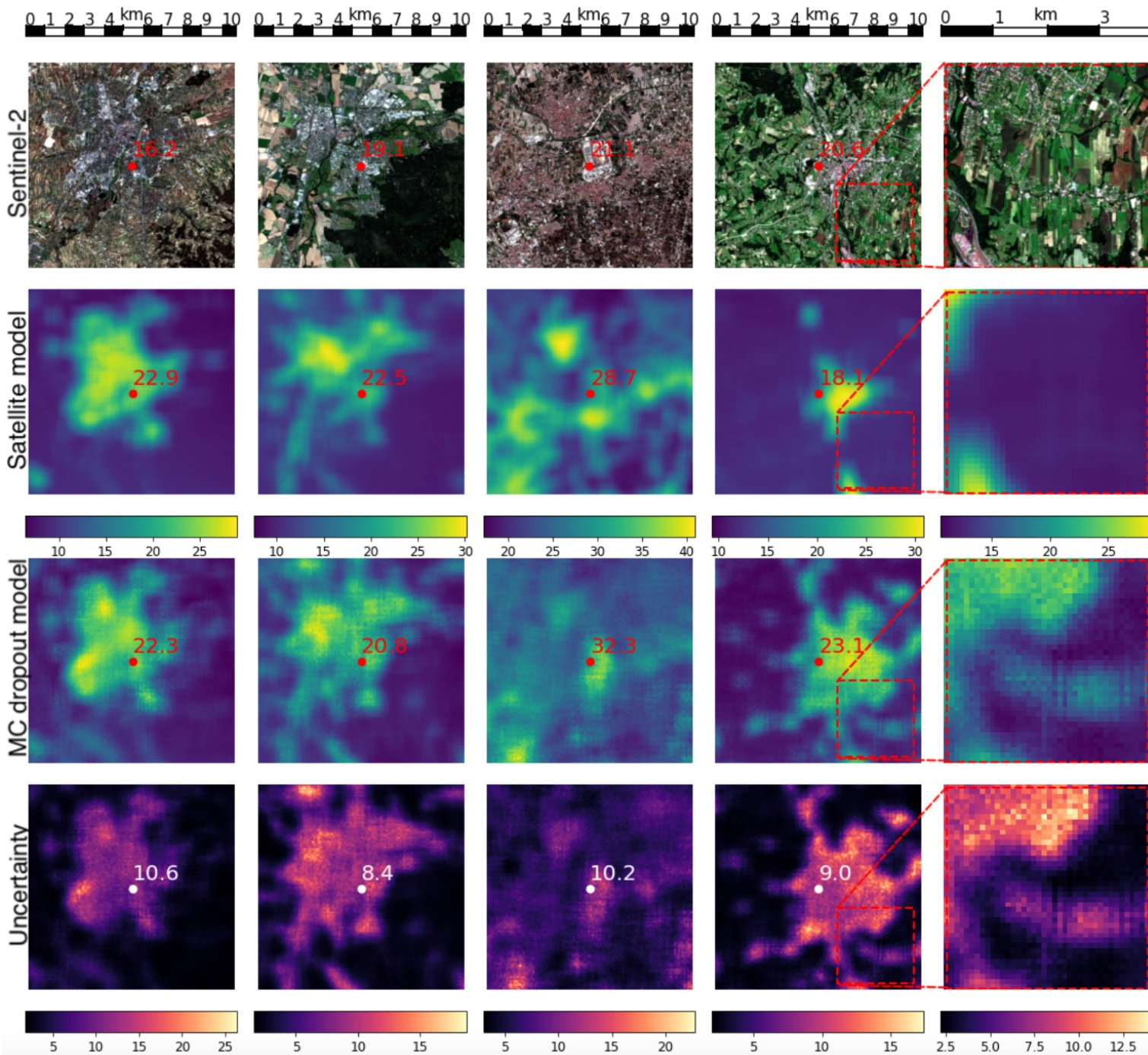
Satellite inputs





- Deep neural network model
- Sentinel-2/5P input data
- Ground-level NO₂ measurements as target

Addition [2]:
Uncertainty quantification
with Monte Carlo Dropout



Results

- High resolution NO₂ estimates
- From 3.5x5km (Sentinel-5P) to 10x10m resolution
- From ~3k locations in Europe to any location on Earth!
- ~5.5 $\mu\text{g}/\text{m}^3$ mean absolute error

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- [1] Scheibenreif, L., Mommert, M., & Borth, D. (2021). Estimation of Air Pollution with Remote Sensing Data: Revealing Greenhouse Gas Emissions from Space. *Tackling Climate Change with ML Workshop at ICML 2021*.
- [2] Scheibenreif, L., Mommert, M., & Borth, D. (2022). Towards Global Estimation of Ground-Level NO₂ Pollution with Deep Learning and Remote Sensing. *EEE Transactions on Geoscience and Remote Sensing*