SCALER

Assessment of the added value of the CAMS air quality forecasting products for Luxembourg

Forest use case

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INTRODUCTION

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Co-creation

↓↑

Identify stakeholder needs

↓↑

Potential impact on stakeholder workflows

↓↑

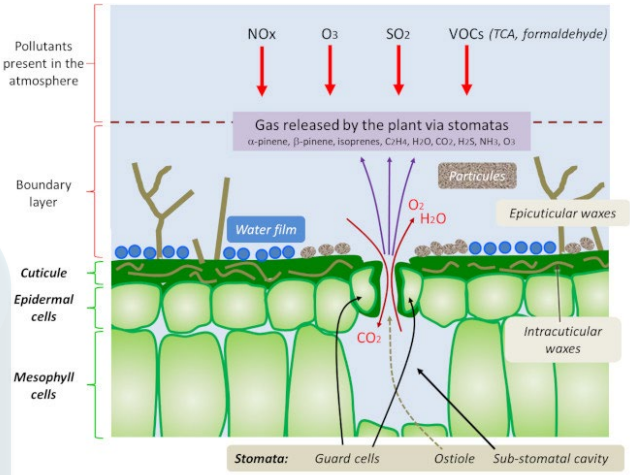
Functionalities

↓↑

Interactive dashboard

- → Filtering of air pollutants vs. deposition of air pollutants exceeding critical values damage forest ecosystems (use of indices, e.g. AOT40)
- → Providing information on changes in air quality during periods of severe drought

stakeholders / public administrations / forest managers



- → A user-friendly data platform ensures that real-time air quality information is accessible to forest managers (protection and sustainability goals)
- → Tracking long-term pollution trends affecting forests based on CAMS data and in-situ air quality records help identify long-term impacts of pollution on forests

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SYNERGIES

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LE GOUVERNEMENT DU GRAND-DUCHÉ DE LUXEMBOURG

Administration de la nature et des forêts

VILLE DE LUXEMBOURG

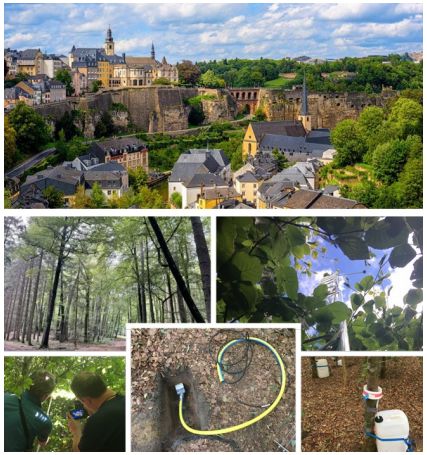
Luxembourg National Research Fund

PRIDE

FORLUX project: Health, adaptation and sustainability of forests in the context of climate change: impact of drought intensification and sustainability of forest ecosystems in the City of Luxembourg.

→ Implementation of a long-term observatory including air quality (NO_2, O_3, NH_3)

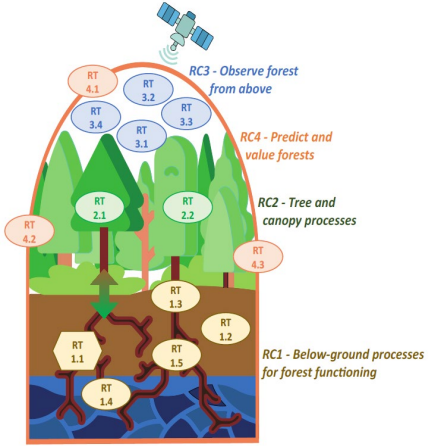
→ https://www.list.lu/en/environment/project/forlux/



FORFUS project: Doctoral training unit (Forest function under stress)

→ Evaluation of O_3 and NH_3 dry deposition to forest under drought conditions

→ https://www.list.lu/en/environment/project/forfus/



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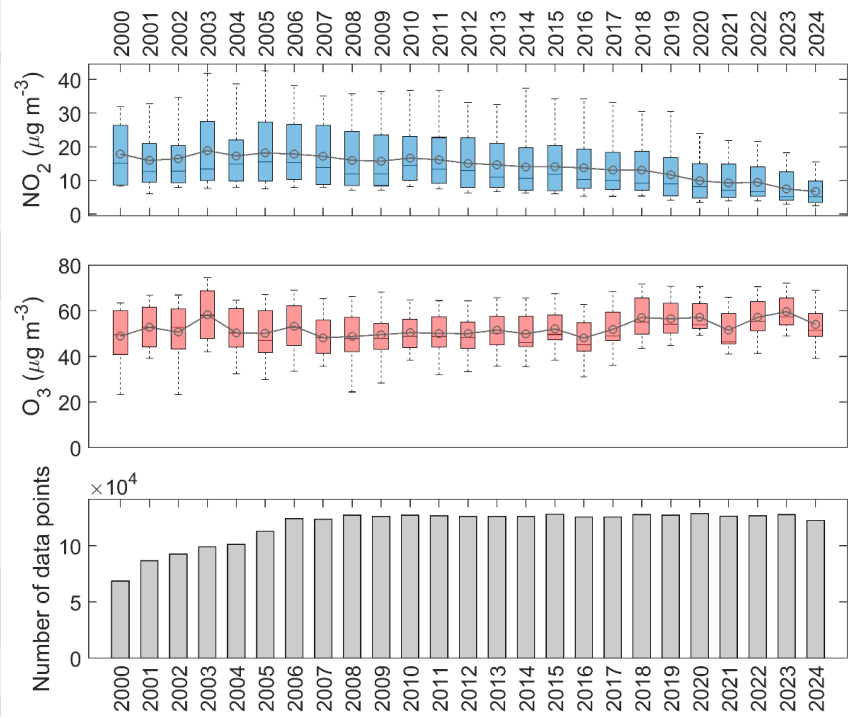
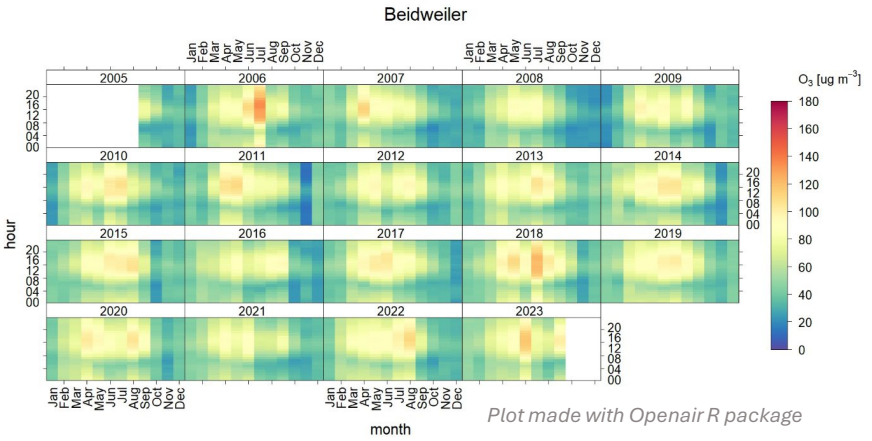
CONTEXT FOCUS ON O_3



Statistical distribution of NO_2 and O_3 across 15 stations in the Greater region from 2000 to 2024.



Plot made with Openair R package

- → O_3 levels constant despite declining NO_2
- → persistent air quality, ecosystem and health problem in the region

IDEA

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Processing:

1. Compute AOT40 value for each forest area in Luxembourg
2. Compare the calculated AOT40 values with the critical threshold values for forests (EU guidelines)
3. Identify risk areas where forests are exposed to harmful O_3 levels
4. Overlay AOT40 data with forest type maps (e.g., coniferous vs. deciduous forests) → use available land cover data from geoportail LU
5. Correlate ozone exposure with stress symptoms or growth reductions in specific forest areas
6. Optional: Include information on drought

Results:

- Map of AOT40 values across Luxembourg
- Risk classification of ozone exposure (low / medium / high) depending on forest type
- Time series of AOT40 development at selected location

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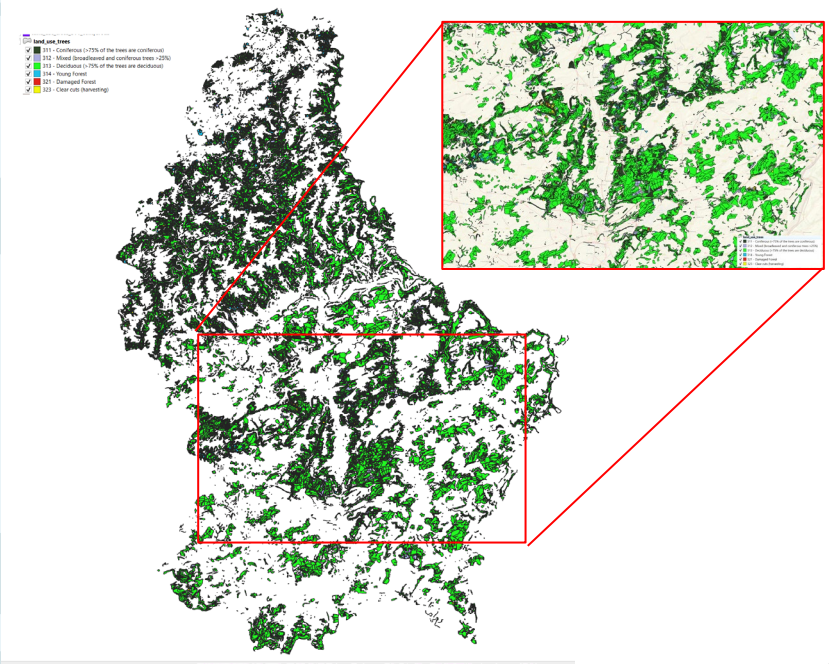
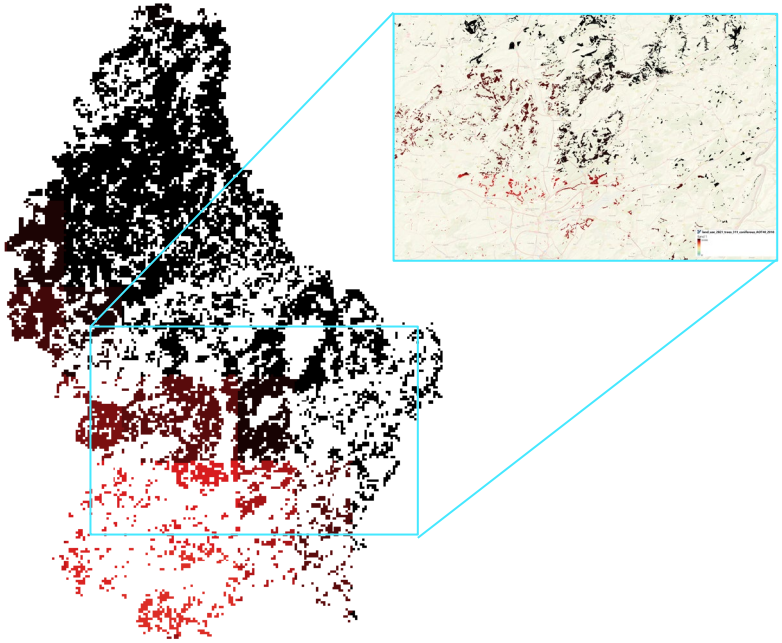
IDEA – LAND USE & AOT40 MAPPING IN DSS

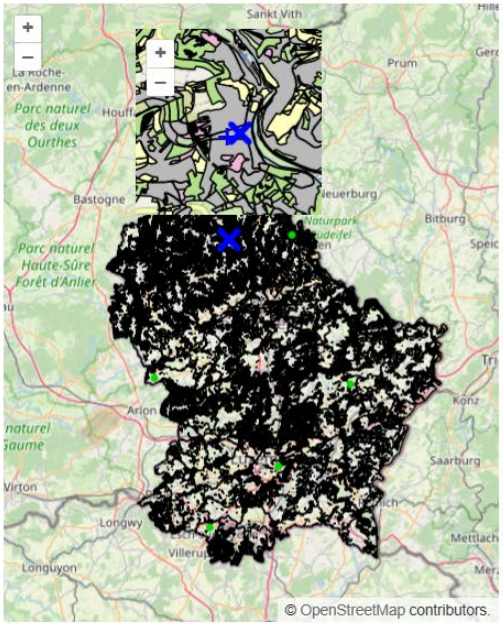


land use "trees"

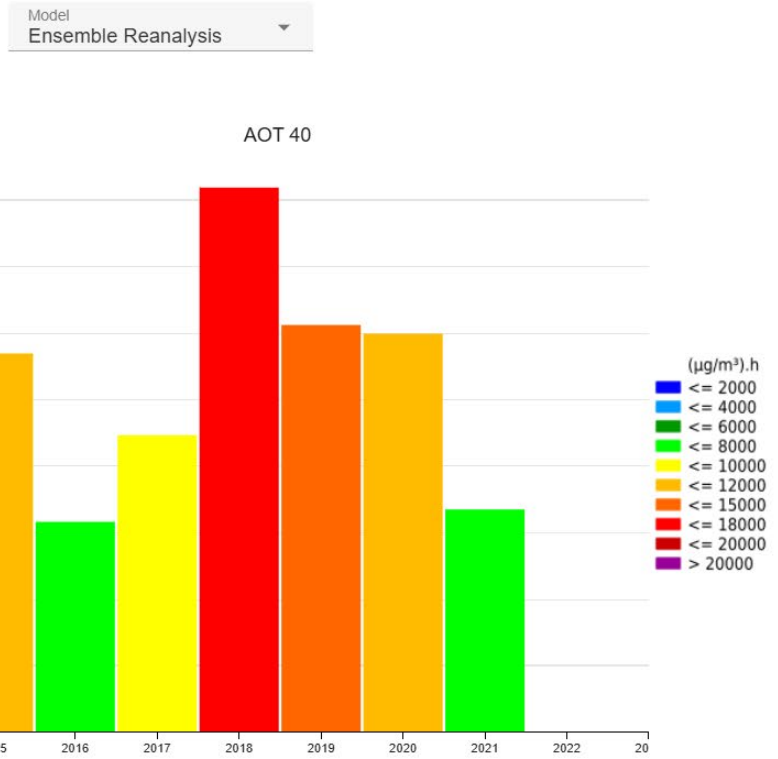


AOT40 for coniferous forest areas computed from reanalysis data

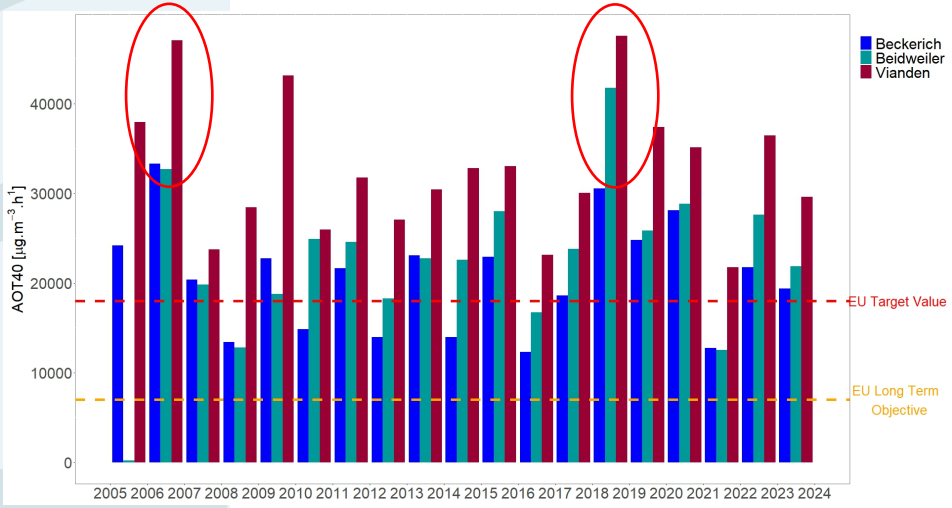
IDEA – ZOOM APPLICATION IN THE DSS



311 - Coniferous (>75% of the trees are coniferous)
312 - Mixed (broadleaved and coniferous trees >25%)
313 - Deciduous (>75% of the trees are deciduous)
314 - Young Forest
321 - Damaged Forest

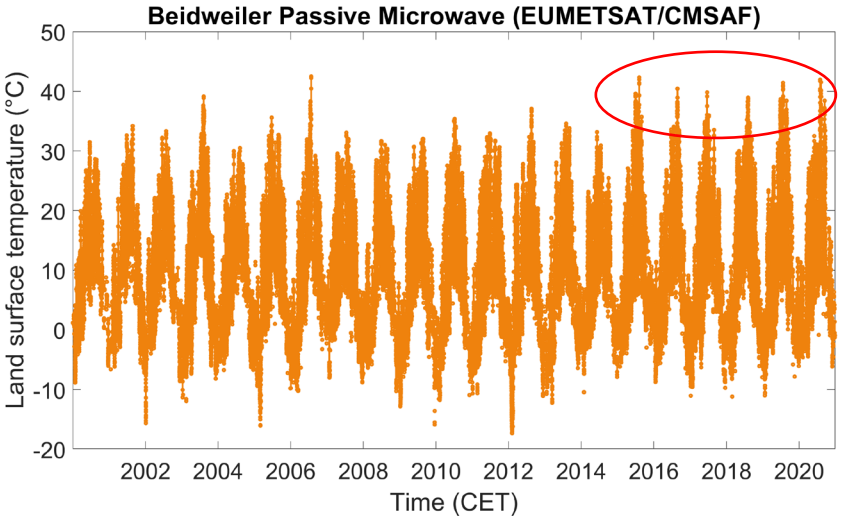


LINK TO HEAT WAVES AND DROUGHT EVENTS



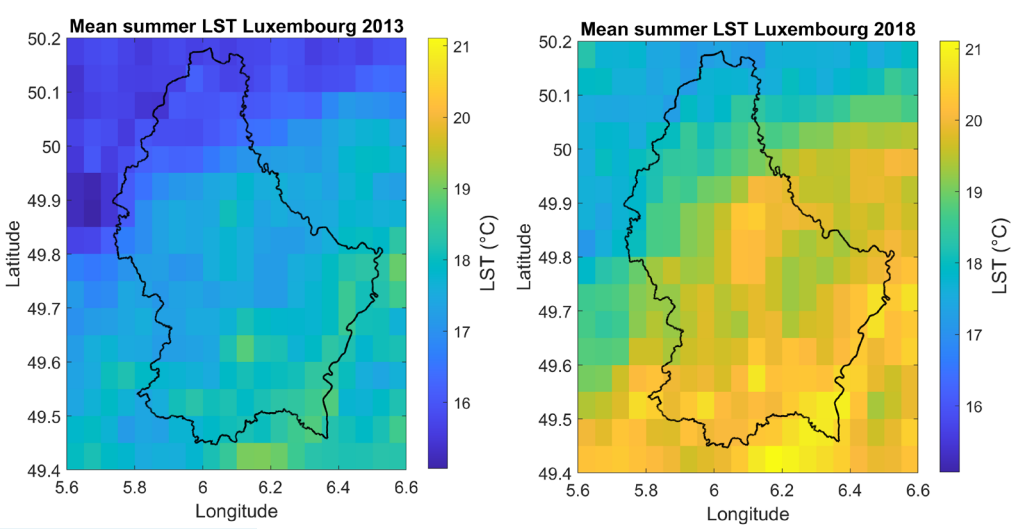
Plot made with ggplot R package

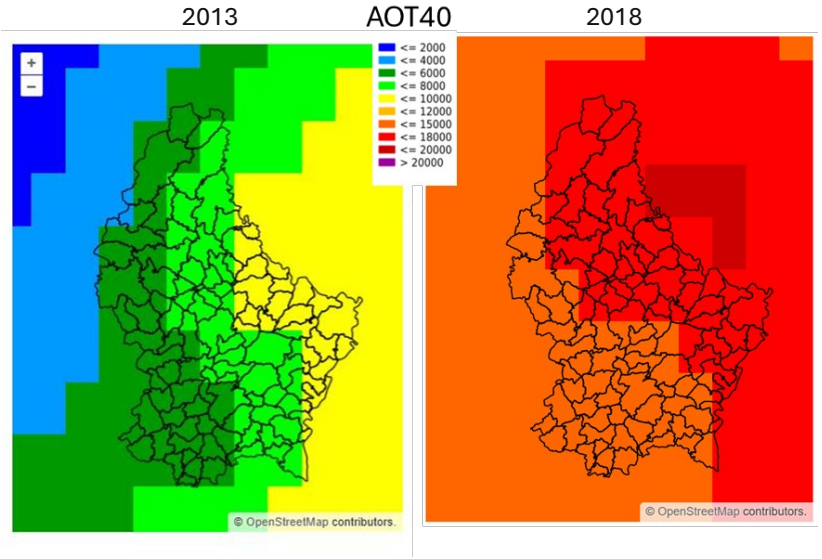
AOT40 from observations at rural locations from official network (AEV)



Spatial resolution: 0.05° x 0.05° -> Grid cell over Beidweiler extracted
Data source: MVIRI/SEVIRI on METEOSAT
EUMETSAT/Satellite Application Facility on Climate Monitoring (CM SAF)

COMBINED THREAT FOR FORESTS





Positive LST anomalies indicate soil moisture deficits and vegetation stress. When combined with air quality data, it can provide a powerful, spatially continuous tool for monitoring and assessing forest damage risk.

POTENTIAL STAKEHOLDER NEEDS AND REQUIREMENTS

- → Summer drought link with elevated O_3 concentrations (AOT40)
- → Air quality intersected with forest health status, with sampling for each forest (locations and data needed)
- → Influence of geology on forest condition (especially clay soils), input of old beeches in the last 3–4 years
- → Use of nationwide forest condition using LiDAR (what is the temporal resolution?)
- → Filter function, areas of lower pollutant concentration over forests, intersected with land-use maps (ecosystem services of urban forests)
- → Difference between managed and unmanaged forests

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thank you