Climate change services at the urban scale: Targeting the air quality over Amsterdam/Rotterdam

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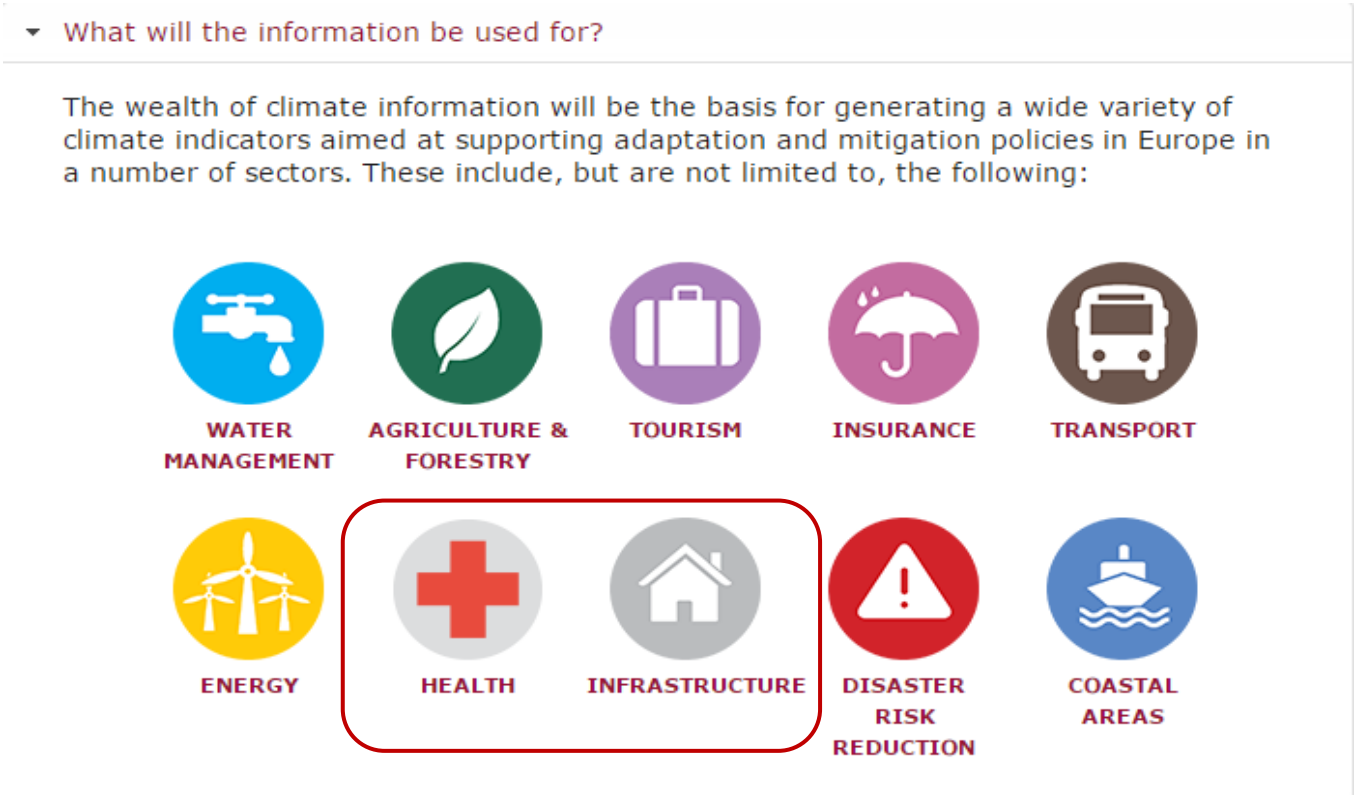
Copernicus Climate Change Services (C3S)



Urban SIS

Aim:

Provide a proof-of-concept of a service offering Essential Climate Variables (ECV) and impact indicators based on temperature and other climatic variables together with air pollutant concentrations.

Air Quality ECVs ($\mu g \cdot m^{-3}$)

- NO_2
- O_3
- PM10
- PM2.5

Air Quality Impact Indicators:

- EU limit values: concentrations
- EU limit values: exposure
- Mortality long-term exposure
- Mortality short-term exposure

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Urban-SIS results & further dowstream applications

Advanced end-users needs (ex: consultants, urban planners, modellers):

- improved input data to run local impact models
- consistent, dynamically downscaled Essential Climate Variables (ECVs)
- both historical periods and future climate projections
- generation of city-specific impact indicators
- possibility for an extended commercial market of local assessments

Urban-SIS results & further dowstream applications

Urban planners in general:

- the spatial perspective (maps) allow identification of “hot-spots”
- possibility to compare and prioritize different climate-related hazards to a specific city and sector
- possibility to compare impact indicators between cities
- possibility to discuss problems and solutions across different sectors

Urban SIS data portal

Purpose

- Presentation and possibility of download data

Main focus during design/implementation

- Good overview of the available data
- Nice presentation of indicators
- Documentation
- Meta-data according to conventions
- Simple viewing of both time-series & gridded data
- Export of time-series, single grids & time-series of grids

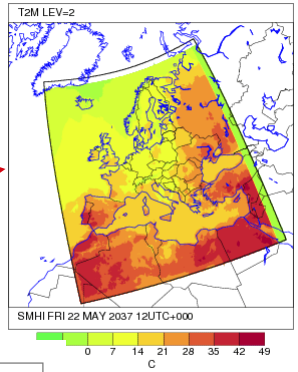
Technology

HTML, Javascript (bootstrap, Leaflet), NETCDF, THREDDS

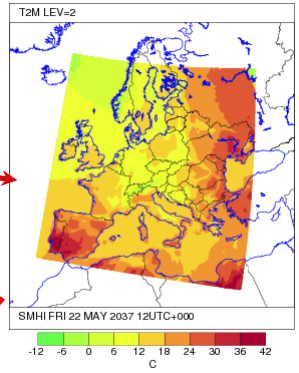
Climate scenarios simulations: domains, IC & BC

GLOBAQUA
EC-Earth model
RCP8.5

HCLIM model
0.2° x 0.2°

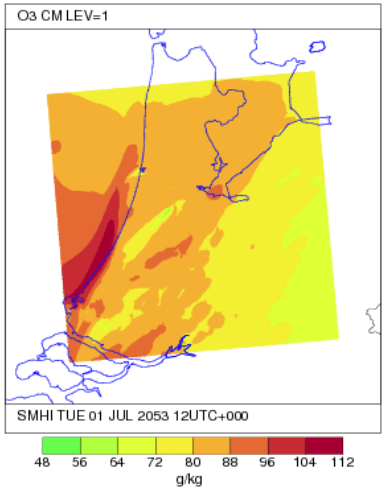


ECLIPSE emissions
Present climate: 2010
Future climate: 2030



MATCH model
0.2° x 0.2°

Chemical BC



Rotterdam/Amsterdam

Urban emissions:
Present climate: 2010
Future climate: 2030

DCMR, Netherlands

Climate simulations: periods

Climate scenarios windows with 5 years of data, a limitation due to computational costs

Considerations on choosing the 5 years periods for urban climate simulations:

- focus on the warm season: May through September (MJJAS)
- based on temperature and precipitation

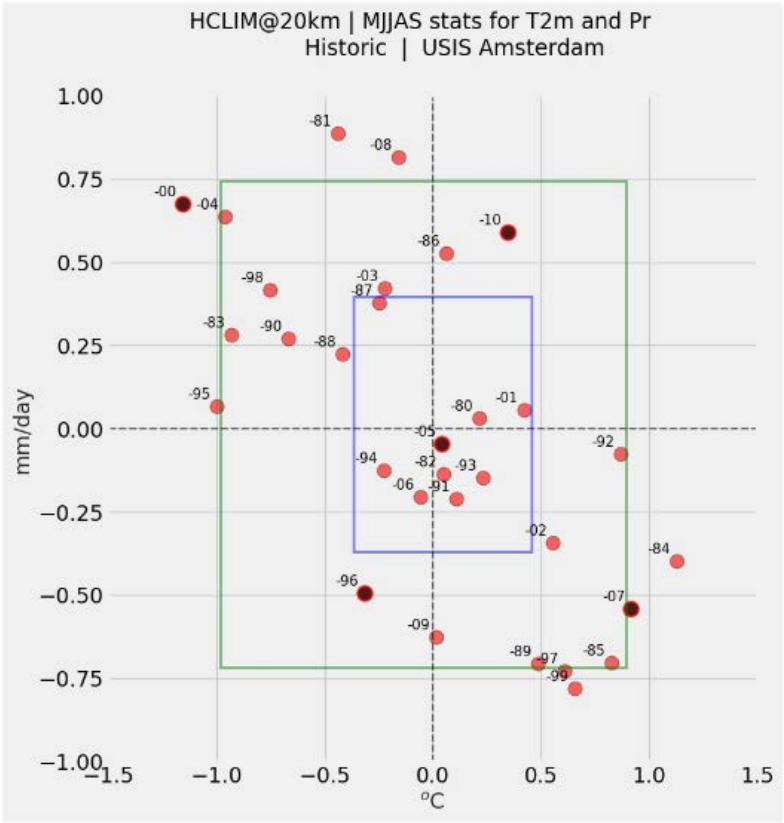
  combinations of cold/wet, cold/dry, warm/wet, warm/dry and 'normal'* season

- existence of extreme events;
  - T2m - days with extreme heat or multi-day heat waves,
  - Precipitation - long (multi-day) or short duration (daily to sub-daily) events, flash floods and droughts.

*close to average conditions in the considered time period

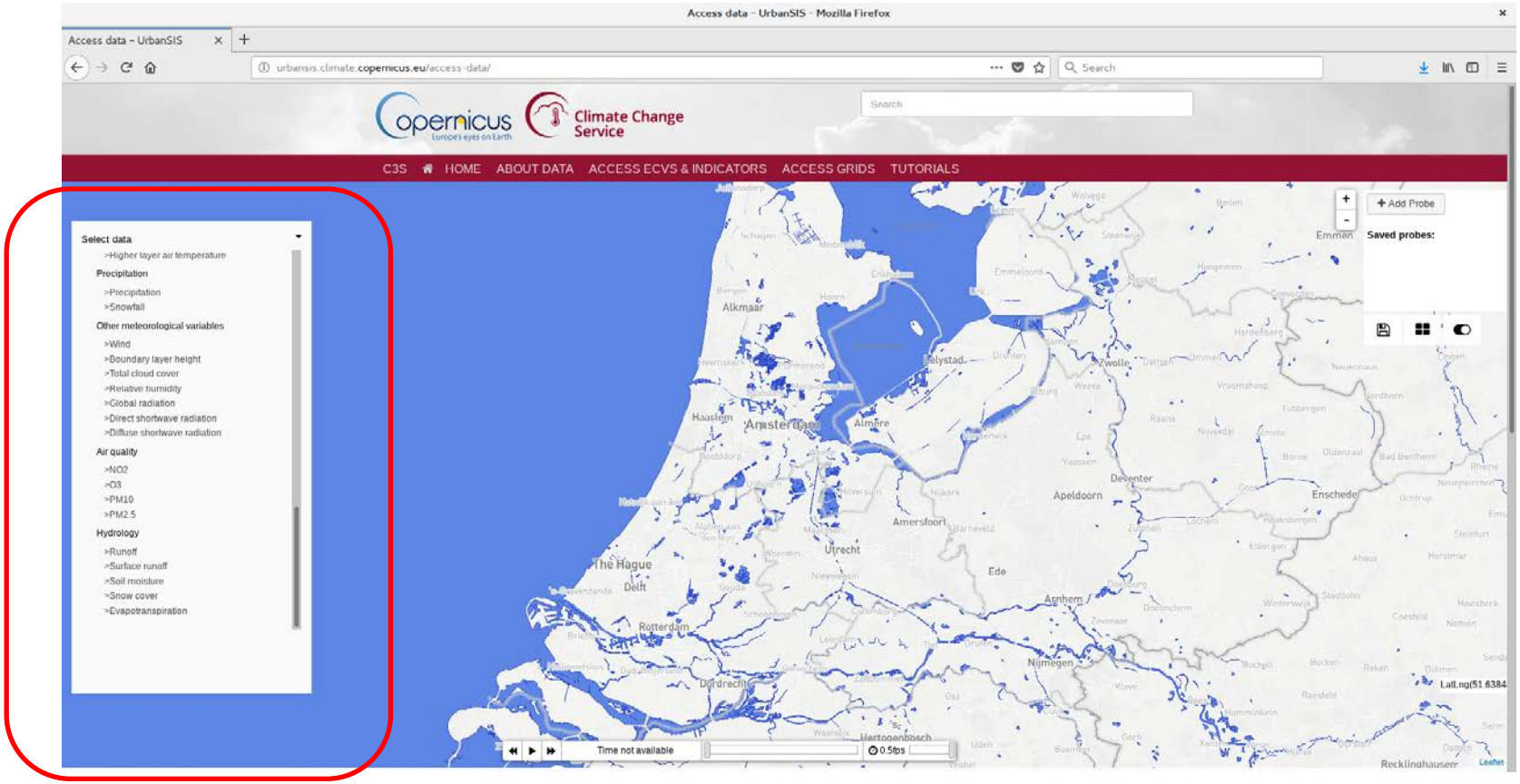
Climate simulations: periods

5 ”years” chosen among 30 year climatic runs both for the present [1980-2010] and the future [2030-2060]

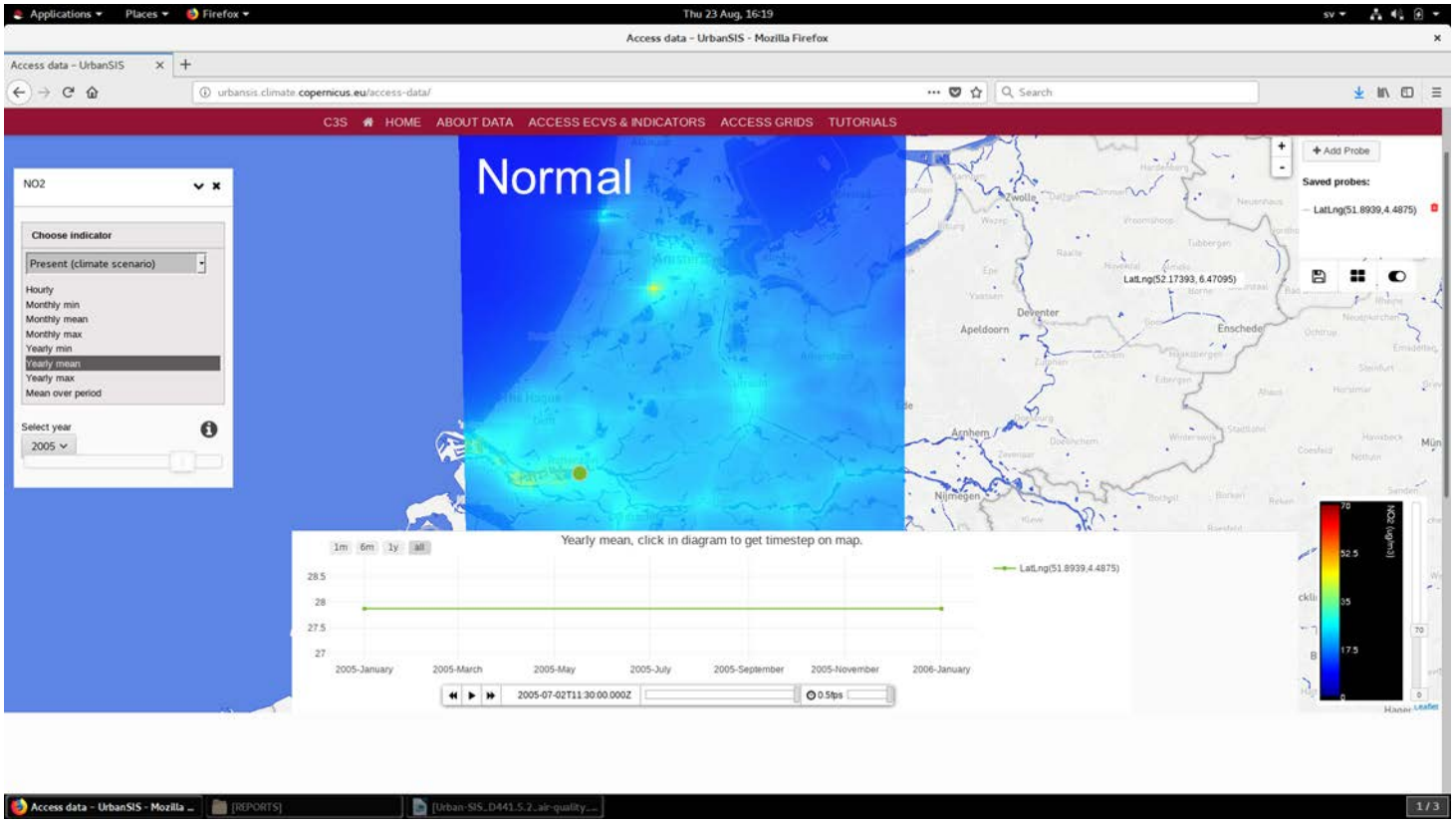


Climate type	Present Climate	Future Climate
Normal	2005	2053
Cold/Wet	2000	2038
Cold/Dry	1996	2034
Warm/Wet	2010	2035
Warm/Dry	2007	2049

URBAN SIS Results – Rotterdam/Amsterdam

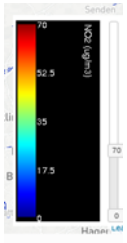


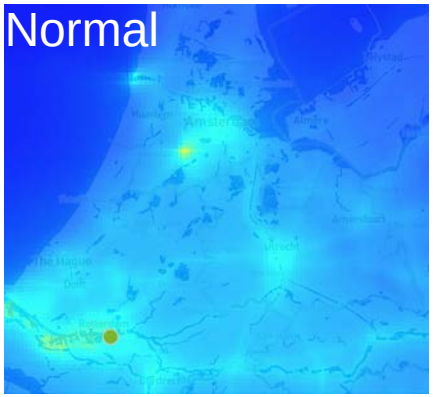
URBANSIS Air Quality Rotterdam/Amsterdam

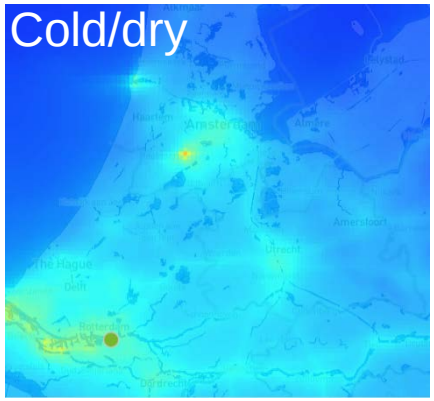


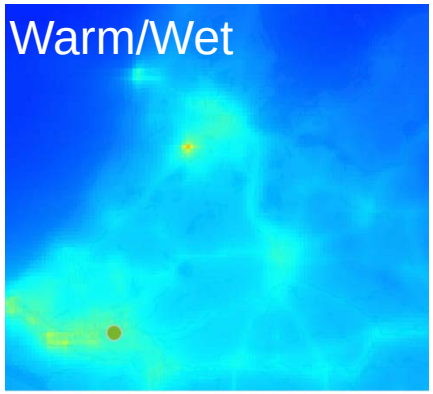
URBANSIS Air Quality
Rotterdam/Amsterdam

Yearly mean NO_2 concentration fields obtained in three climate types









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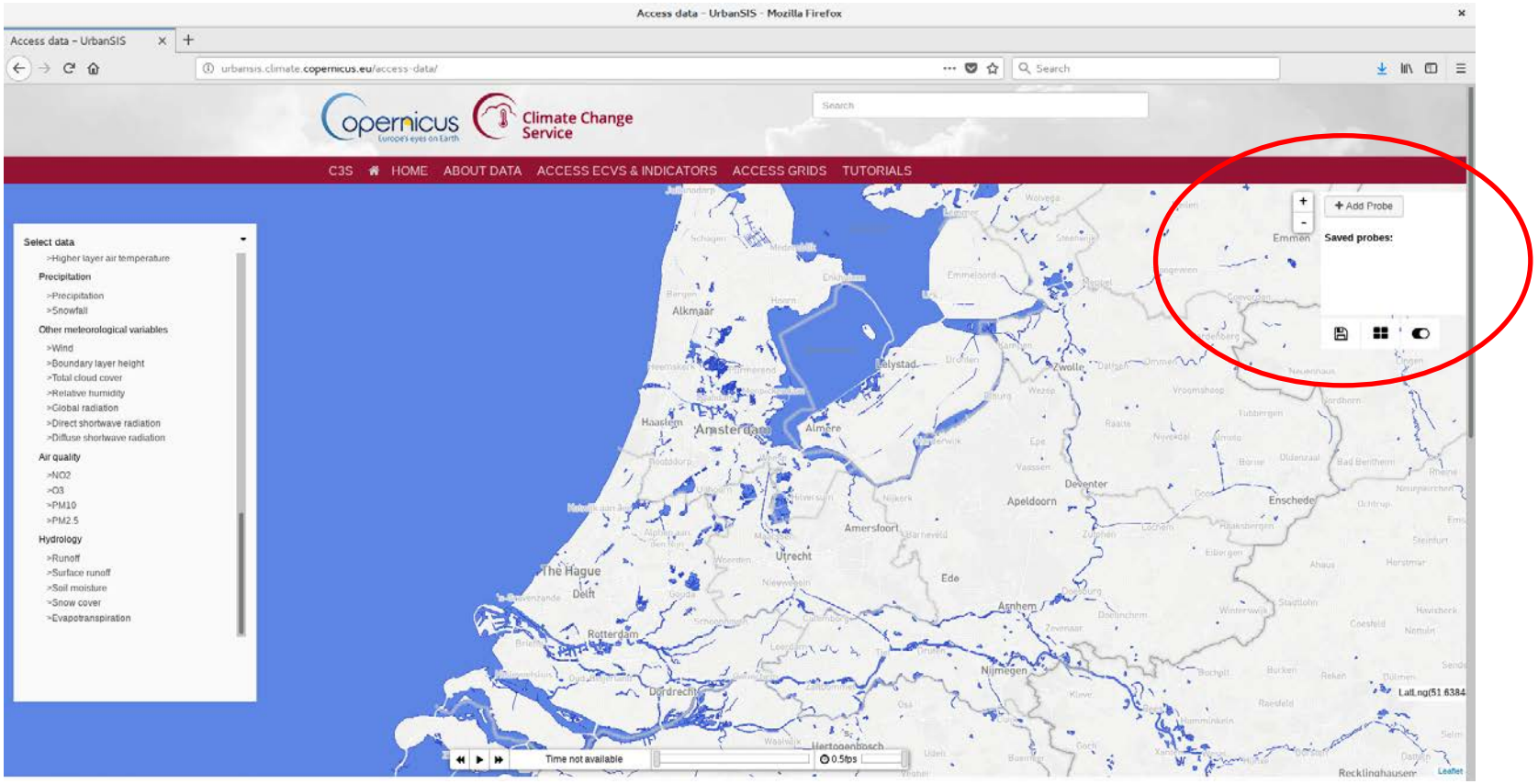

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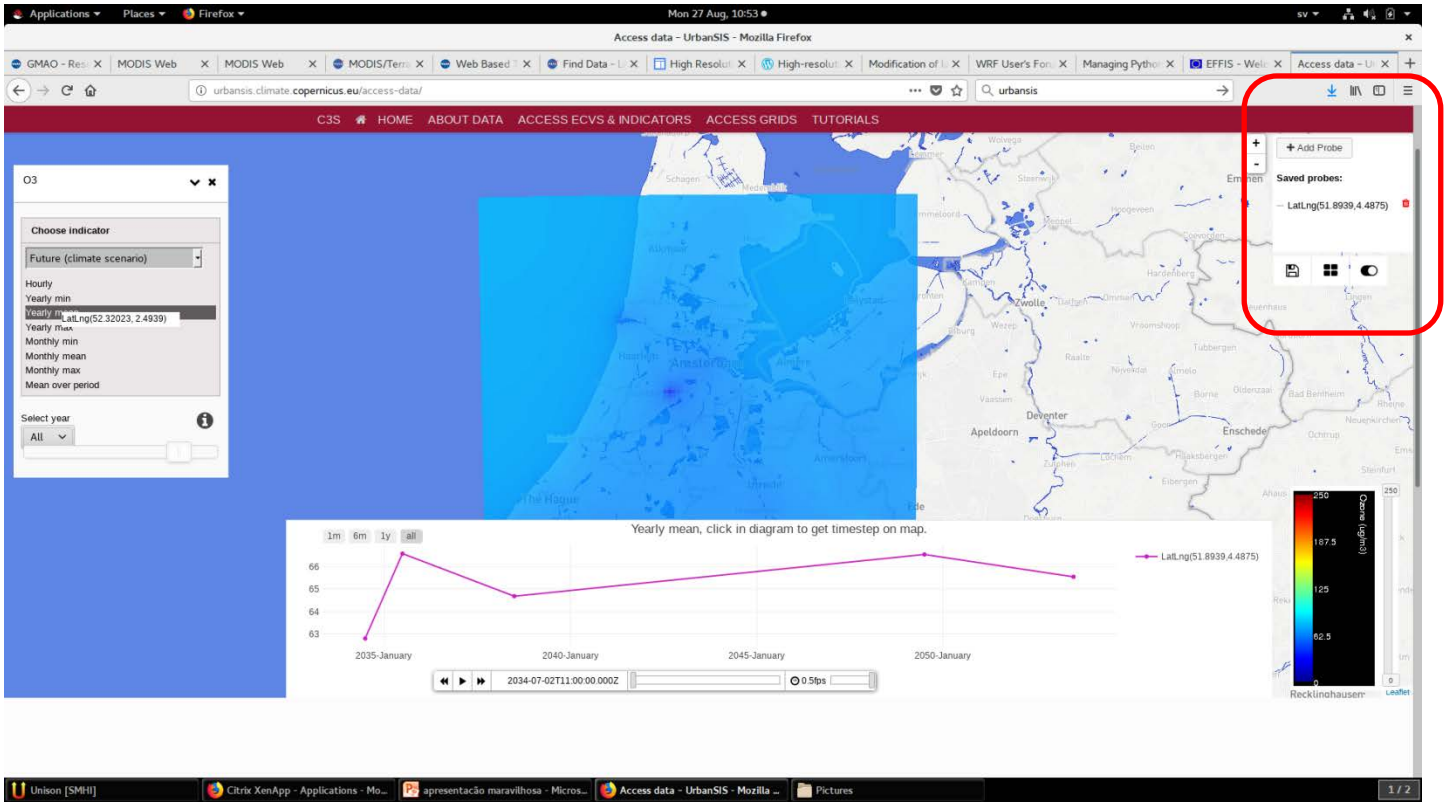

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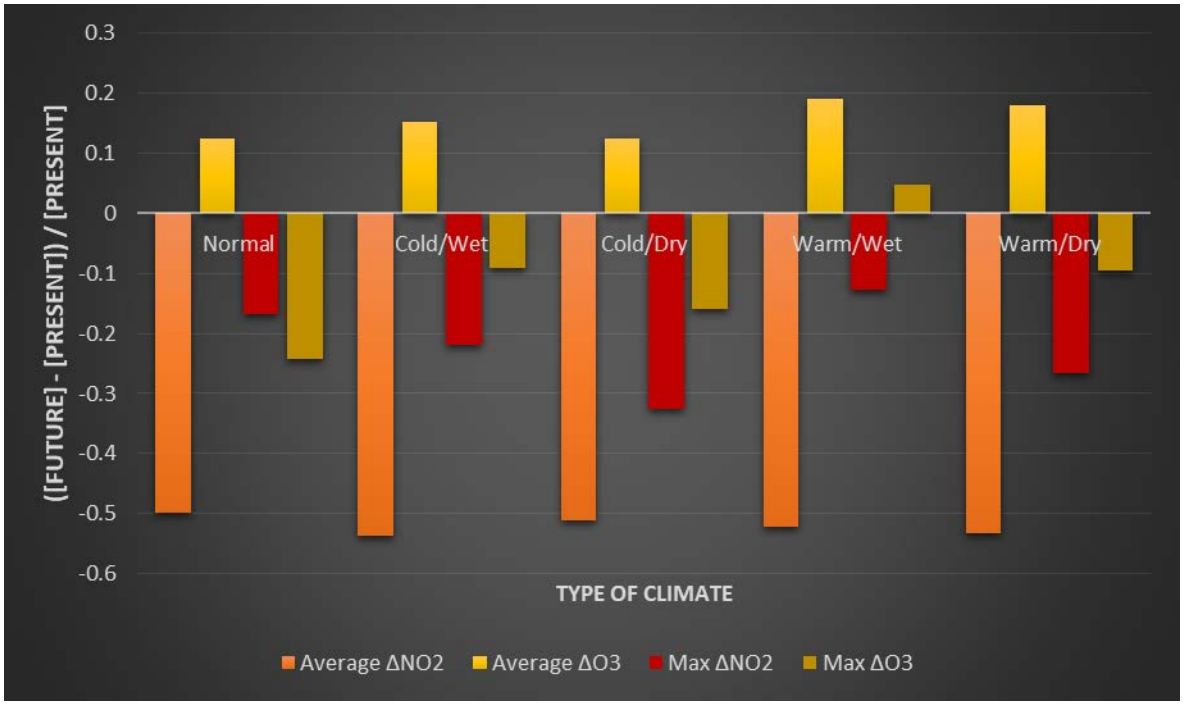

Final Remarks

The choices made in the downscalling chain …

- Global model simulations according to the RCP8.5 scenario
- 5 climate years chosen according to summer temperature and precipitation conditions in the city of interest
- ECLIPSE emissions projections for 2010 and 2030 at the regional level
- Urban area emissions according to local authorities for present and future conditions

… are reflected in the results:

- Climate change is an important factor for the obtained general increase in O3 mean concentrations, especially in warm years.
- Over urban centres the reductions in NO_x emissions will also contribute to a local increase in ozone mean levels
- The high ozone peaks were found to decrease

Copernicus financed and frames the development done in UrbanSIS