Institute for Advanced Sustainability Studies
IASS in Potsdam

HEAT WAVES, URBAN VEGETATION, AND AIR POLLUTION

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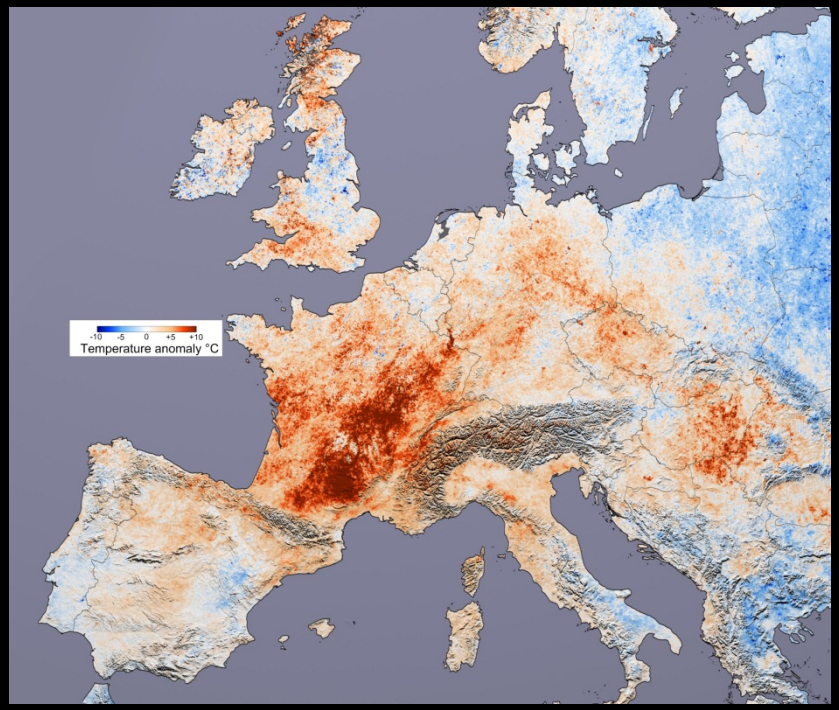
Objective

- To investigate how heat waves affect emissions of volatile organic compounds (VOC) from urban/sub-urban vegetation and corresponding ground-level ozone levels.
- Case study – Berlin, Germany

Heat Waves

2003



2010

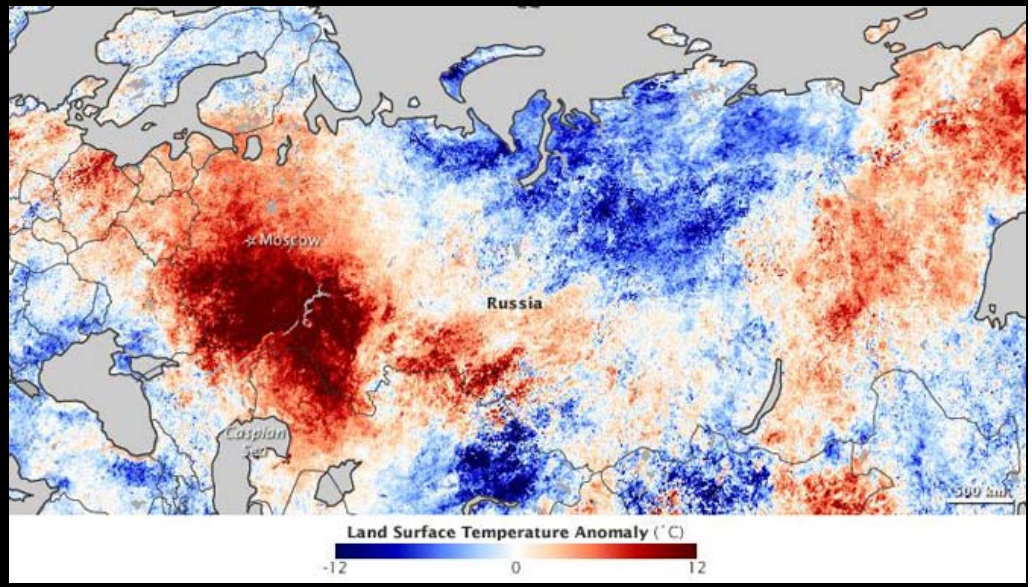
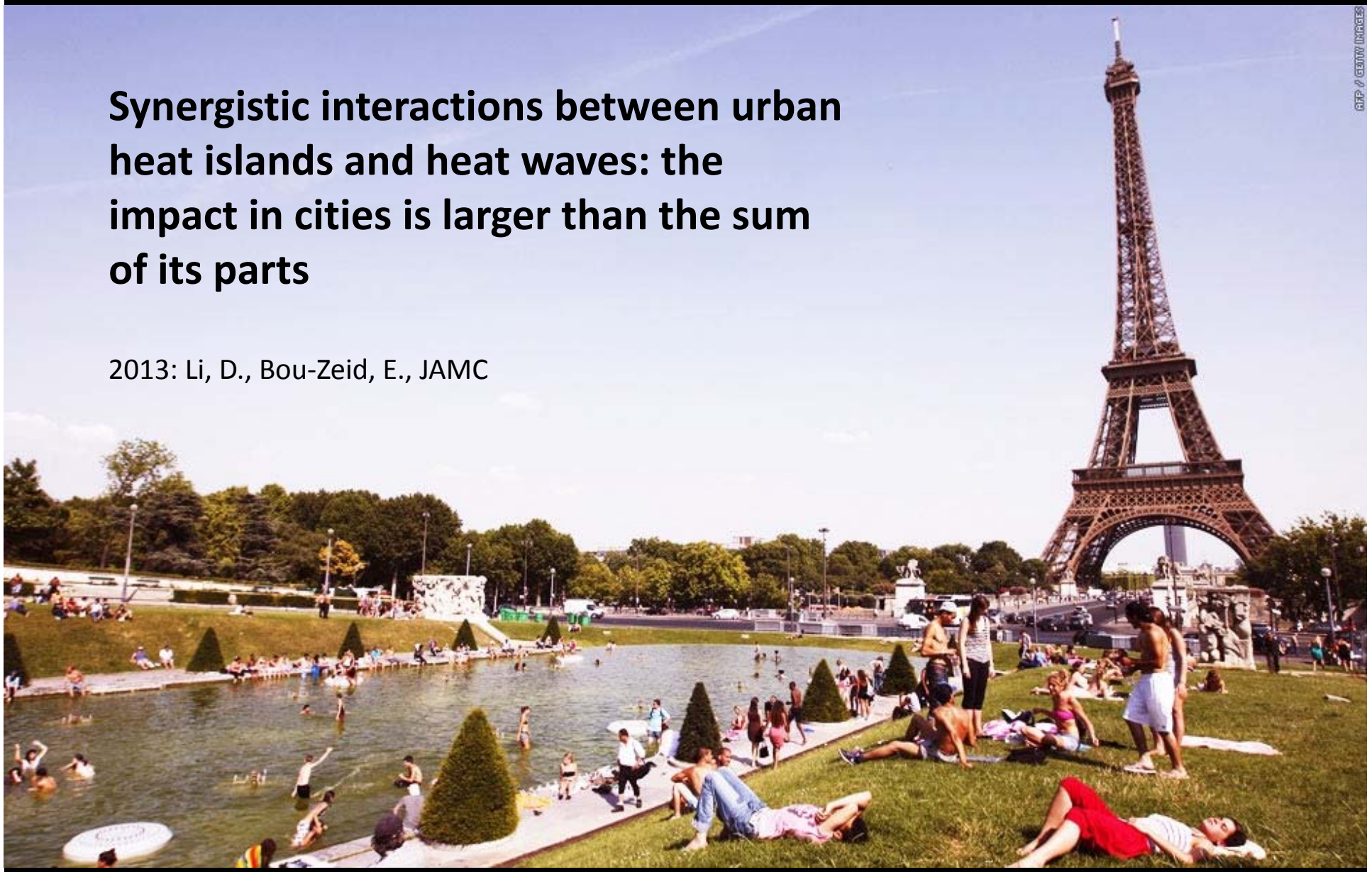


Image courtesy NASA

Synergistic interactions between urban heat islands and heat waves: the impact in cities is larger than the sum of its parts

2013: Li, D., Bou-Zeid, E., JAMC



Urban Heat Island Effect

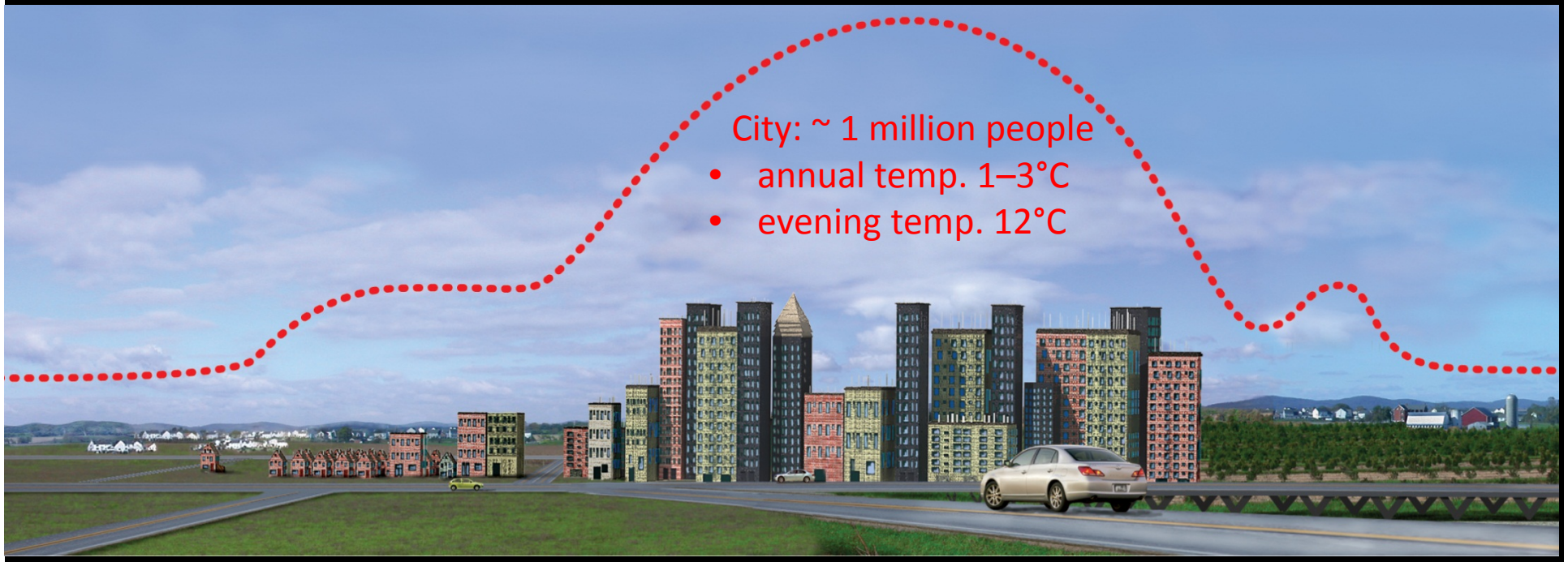


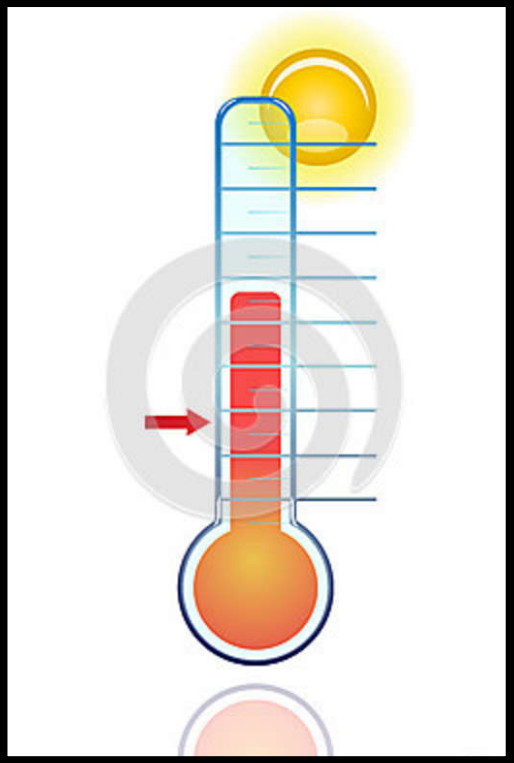
Image courtesy NASA


Urban greening: adding more trees, green spaces, and roof/wall vegetation to the cities

Biogenic volatile organic compounds (BVOC)

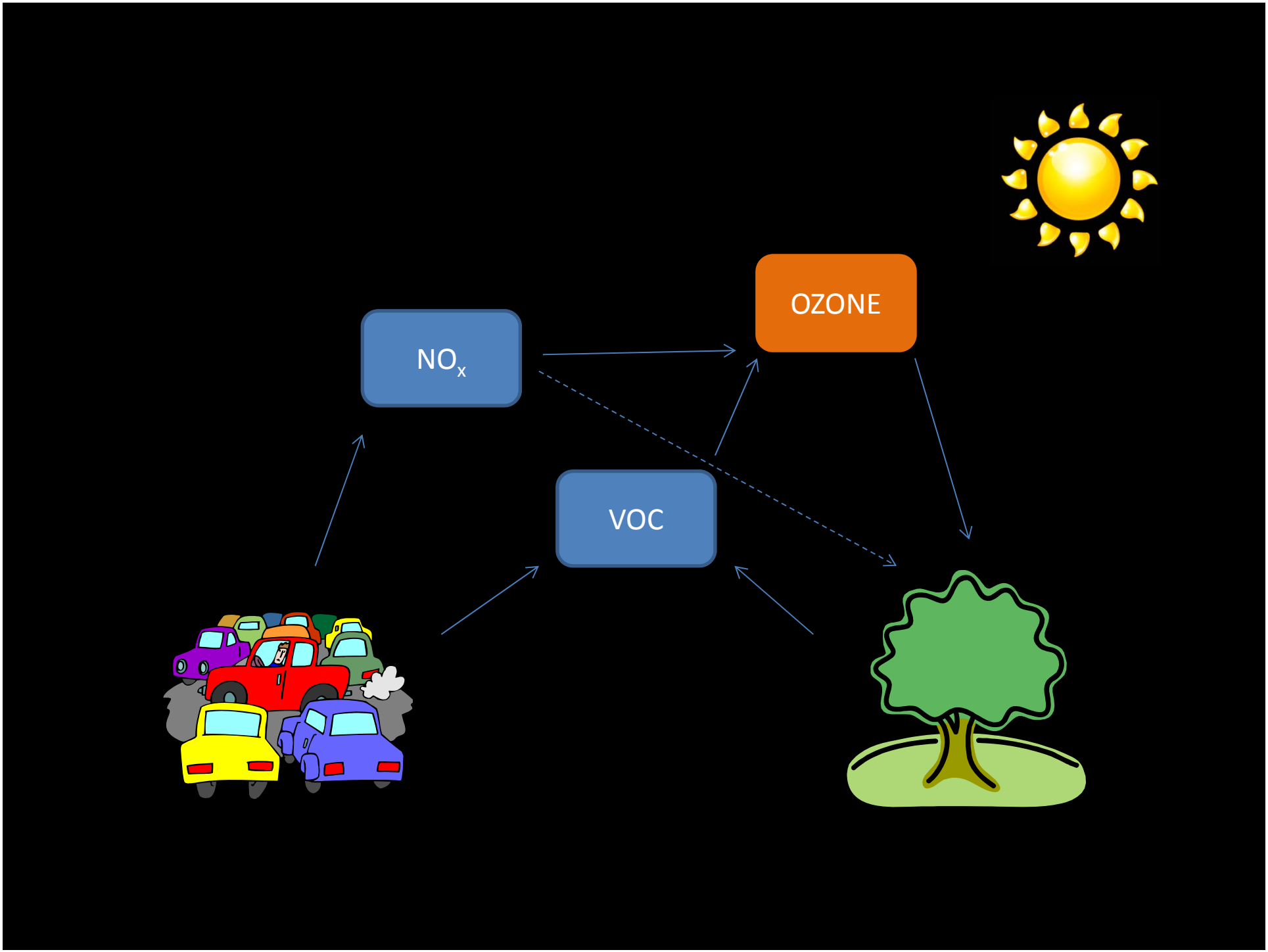
Smell by Jan Brueghel the Elder & Peter Paul Rubens

Temperature and light



Insect outbreaks

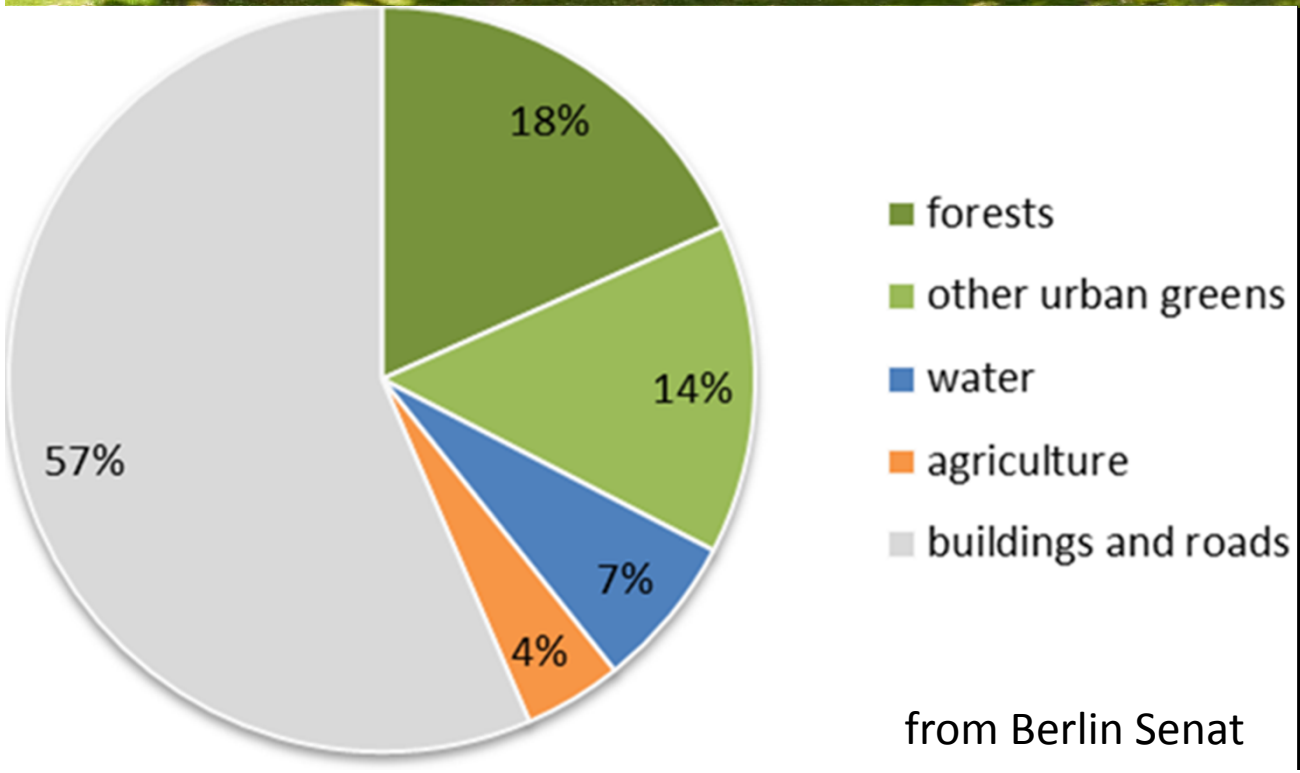
Lawn mowing


OZONE
NO_x
VOC

Ground level ozone: Health hazard

Ground-level ozone: Reduction of plant growth

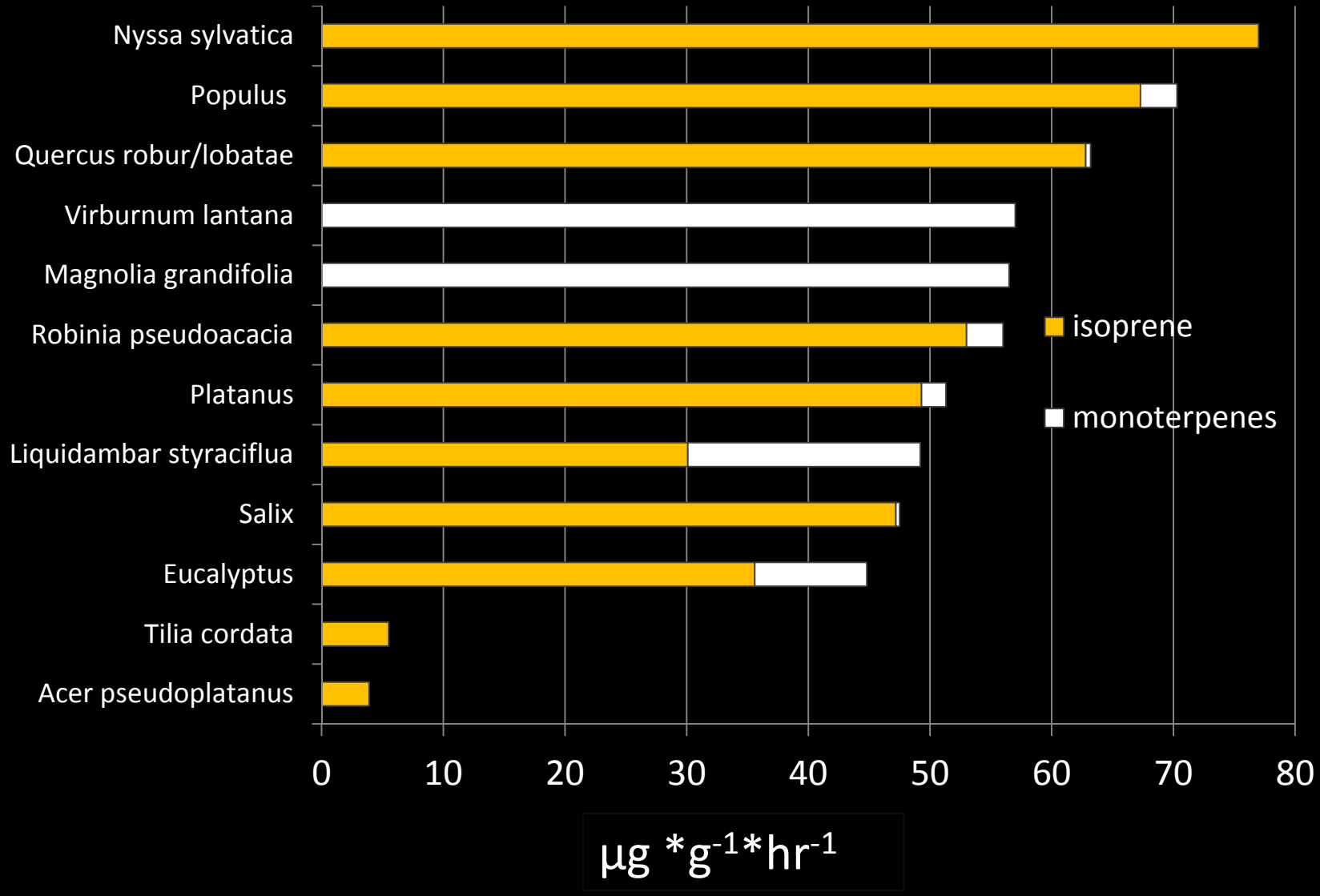
Berlin is a green city



from Berlin Senat

Tilia 36 %
Acer 20 %
Quercus 9%
Platanus 6%
Robinia 3%
Other 19%

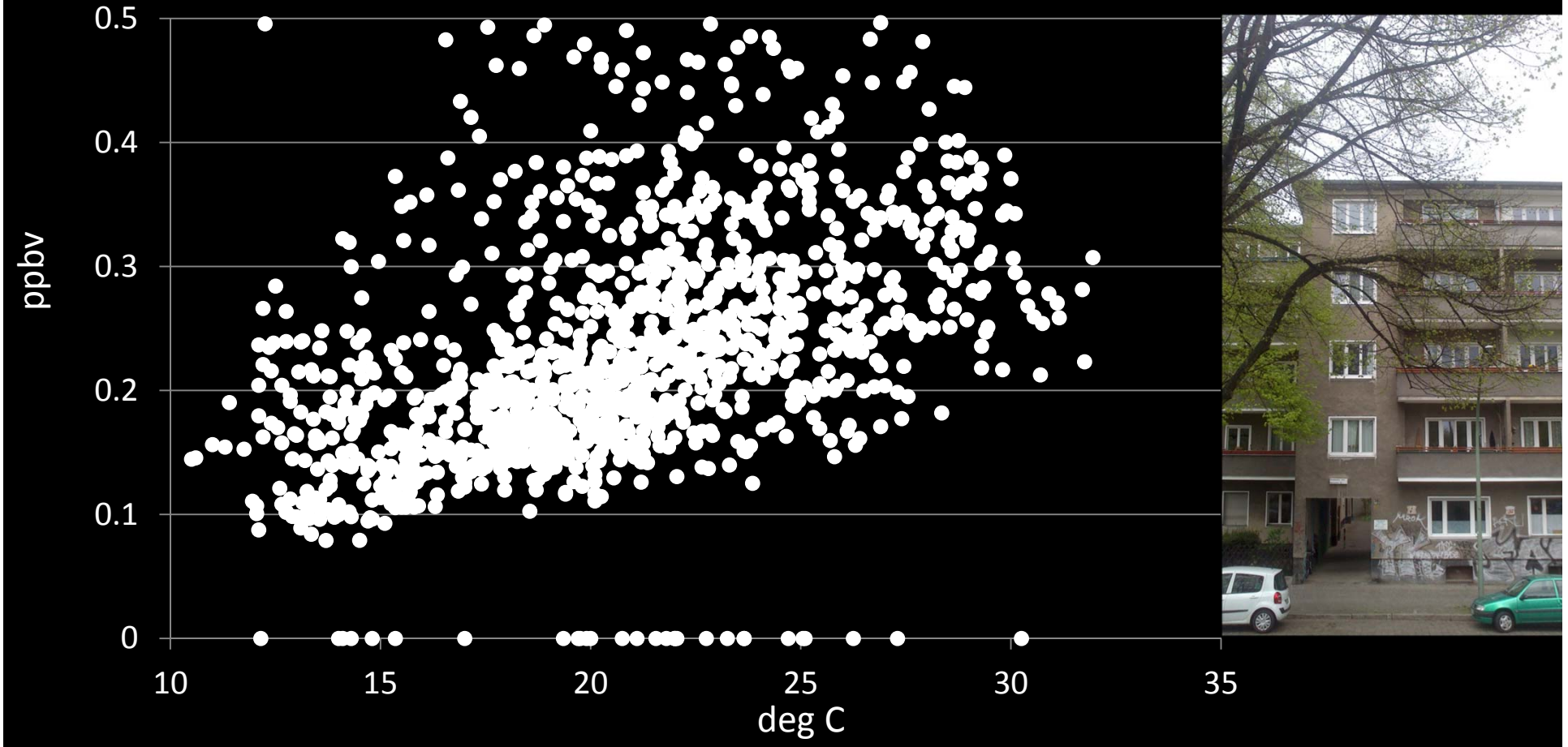
Selected popular urban trees and their average VOC emissions rates



Methods

- Observations of temperature, humidity, ozone
- Weather Research and Forecasting Model with coupled atmospheric chemistry (WRF-CHEM)

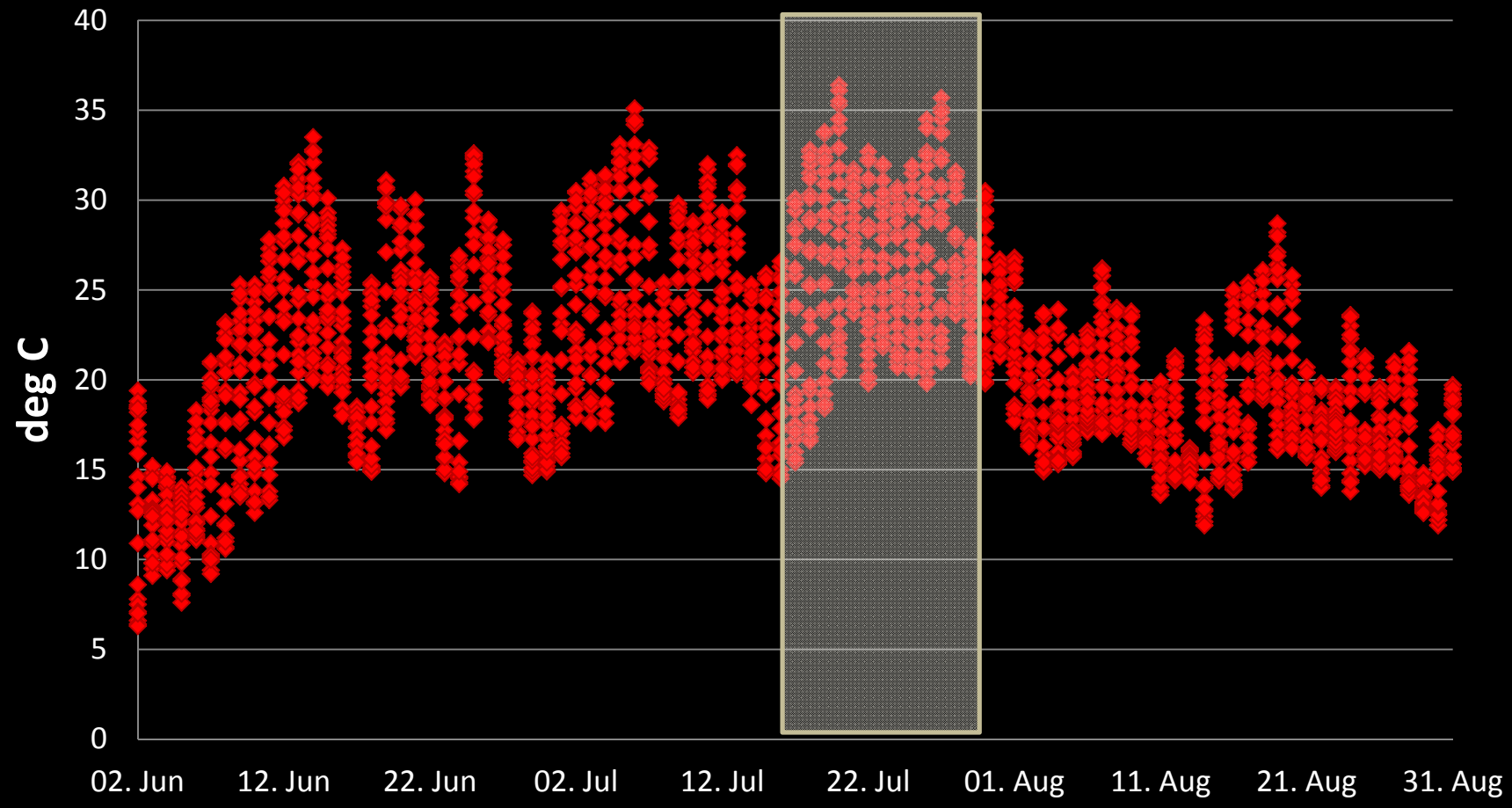
Temperature is an important driver of isoprene emissions



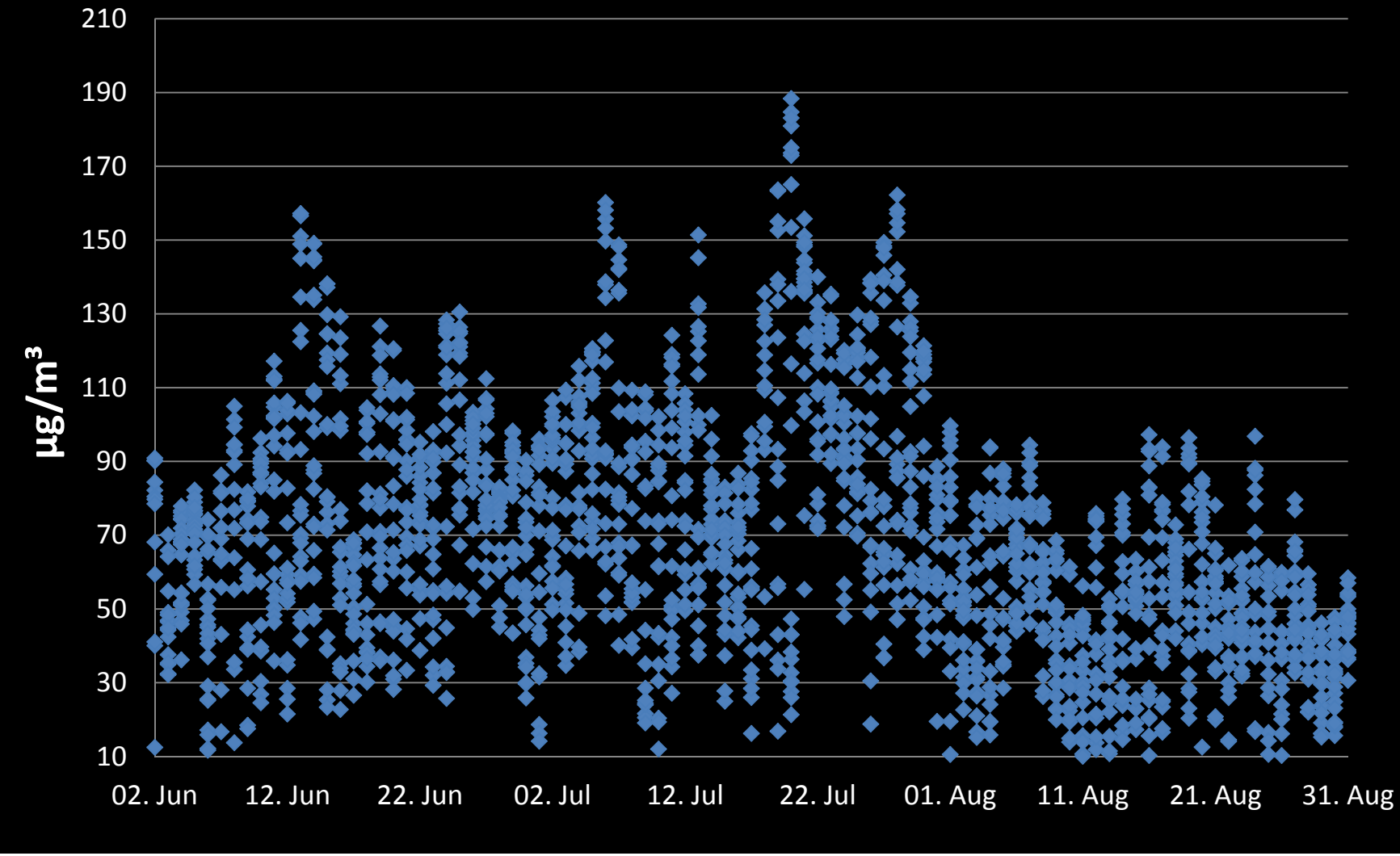
12 June-11 August 2014, Berlin, Germany

Temperature from BLUME network (Berlin Senat), isoprene from PTR-MS measurements (IASS)

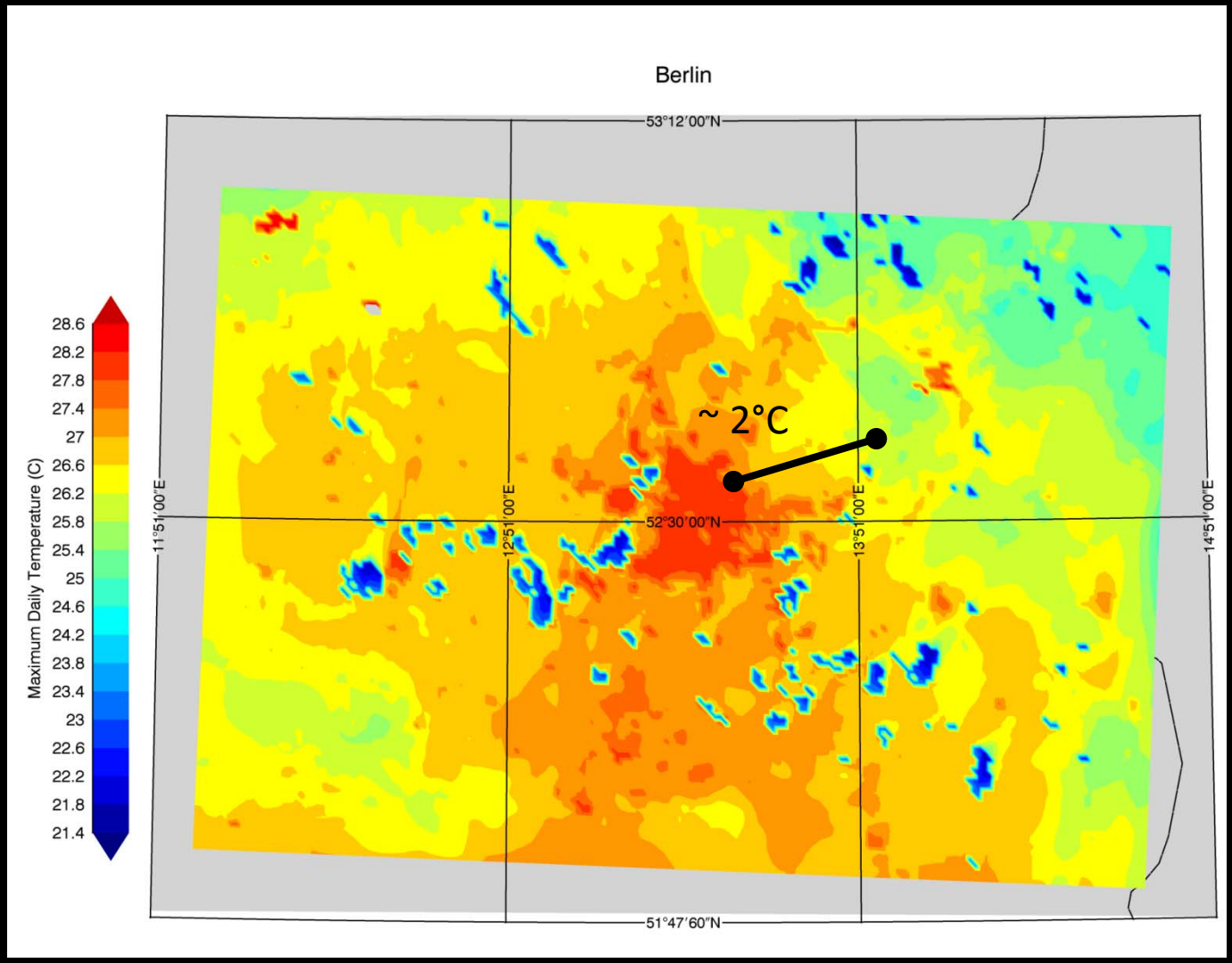
Results: Heatwave 2006



Results: Heatwave 2006

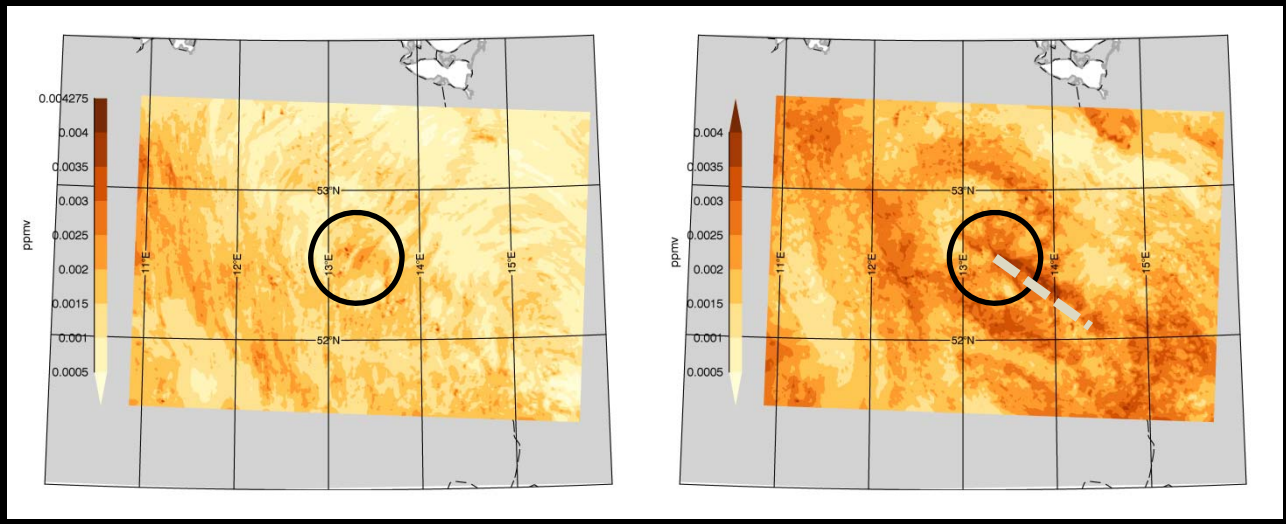


Heat island effect in Berlin



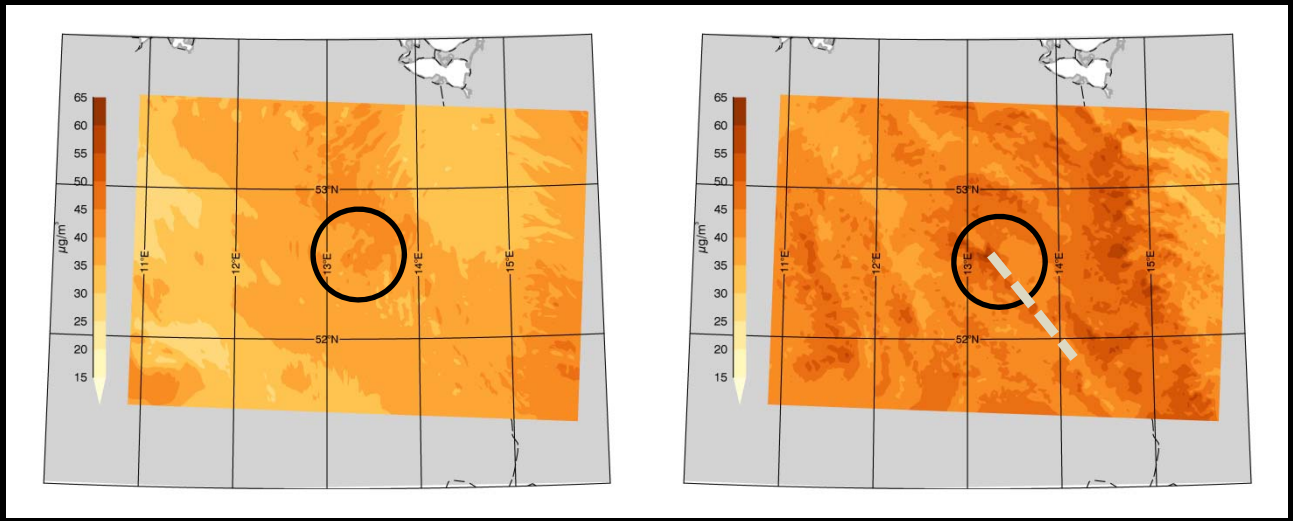
Simulation with WRF-Chem model for July 2007

Isoprene



08:00 16:00

Ozone



19 July 2006