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NOVA

Nederlandse
Onderzoekschool
Voor
Astronomie

SRON

Nederlands
Instituut
voor
Ruimteonderzoek

RIVM

Rijks-
Instituut voor
Volksgezondheid en
Milieu

KNMI

Koninklijk
Nederlands
Meteorologisch
Instituut



**Measure aerosols with
your smartphone!**

1 health



1

health

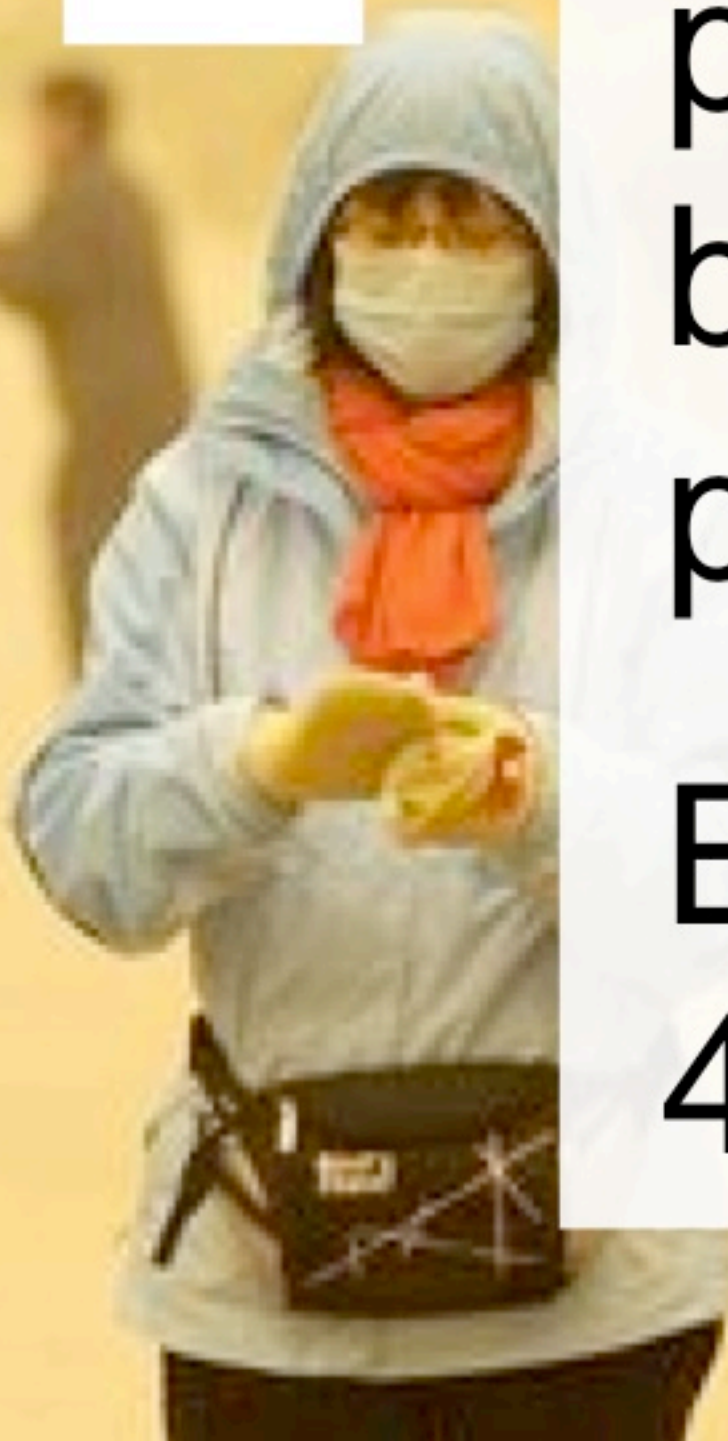


health

Thousands of people in the Netherlands die prematurely each year because of exposure to particulate matter.

Economic impact:
4-40 G€.

source: RIVM, astmafonds



2


economy



2

economy





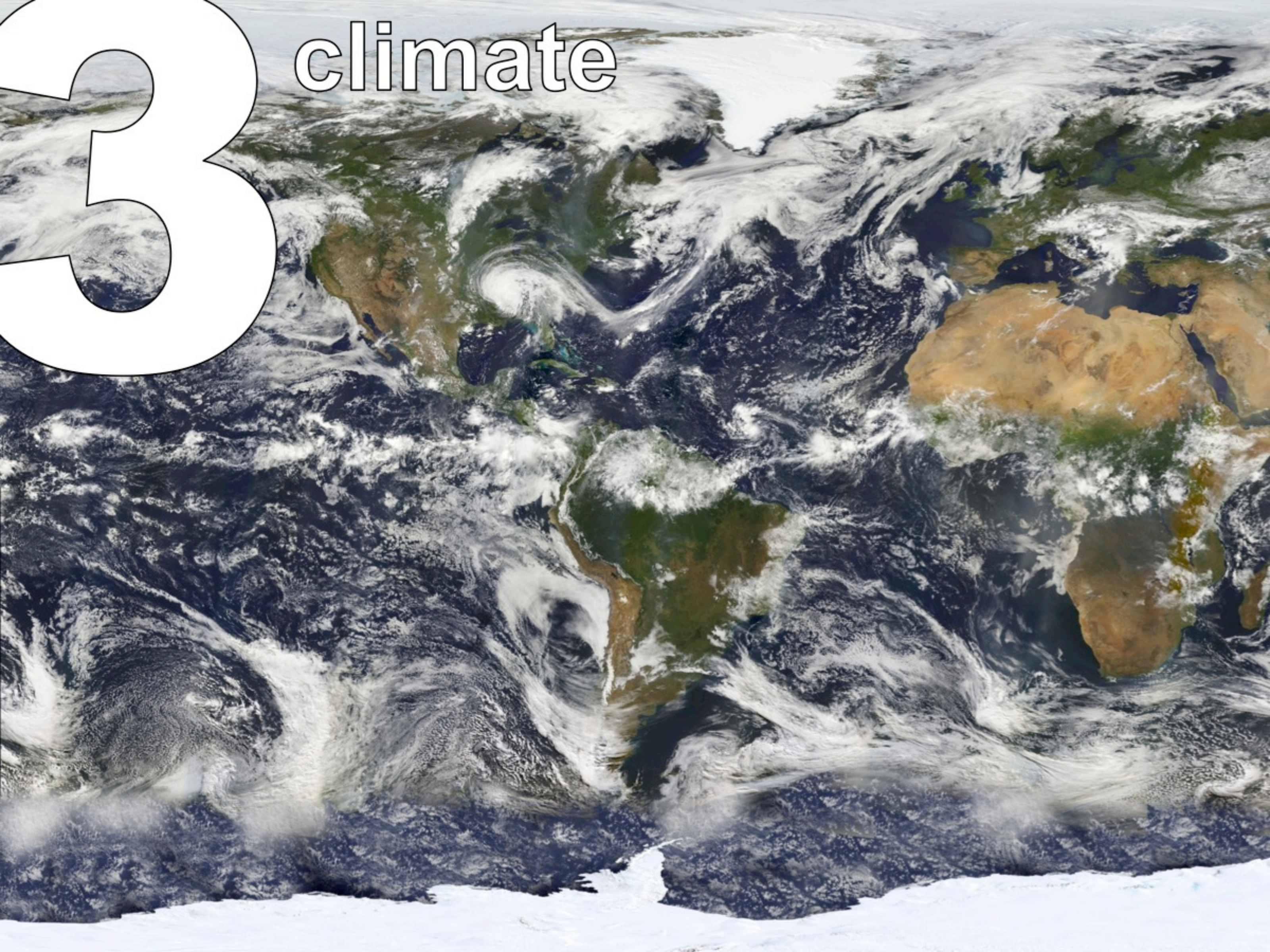
economy



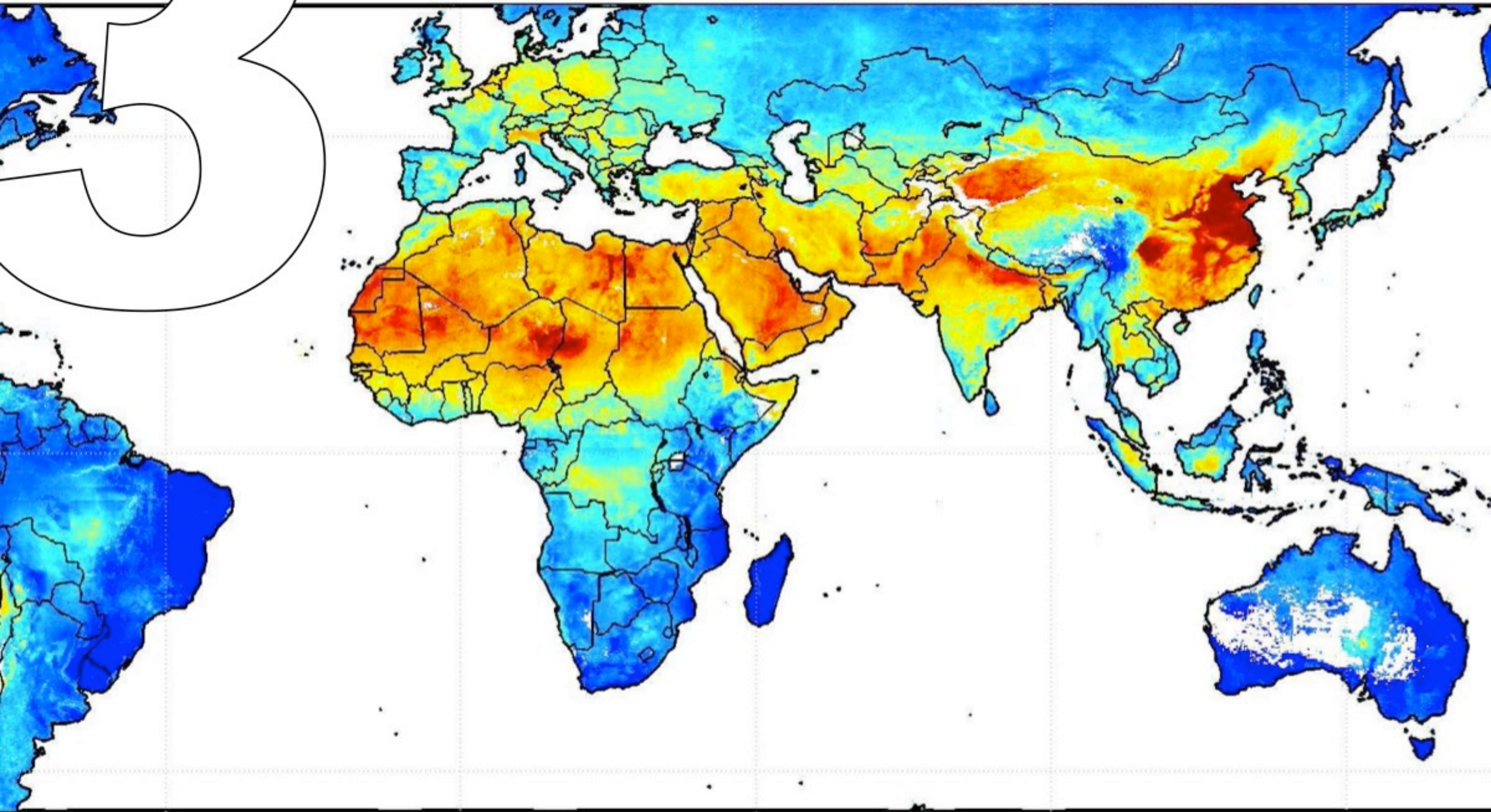
Cancellation of flights due to the volcanic ash clouds in 2010 has cost airlines more than a billion euros.

source: IATA

climate



climate



5

10

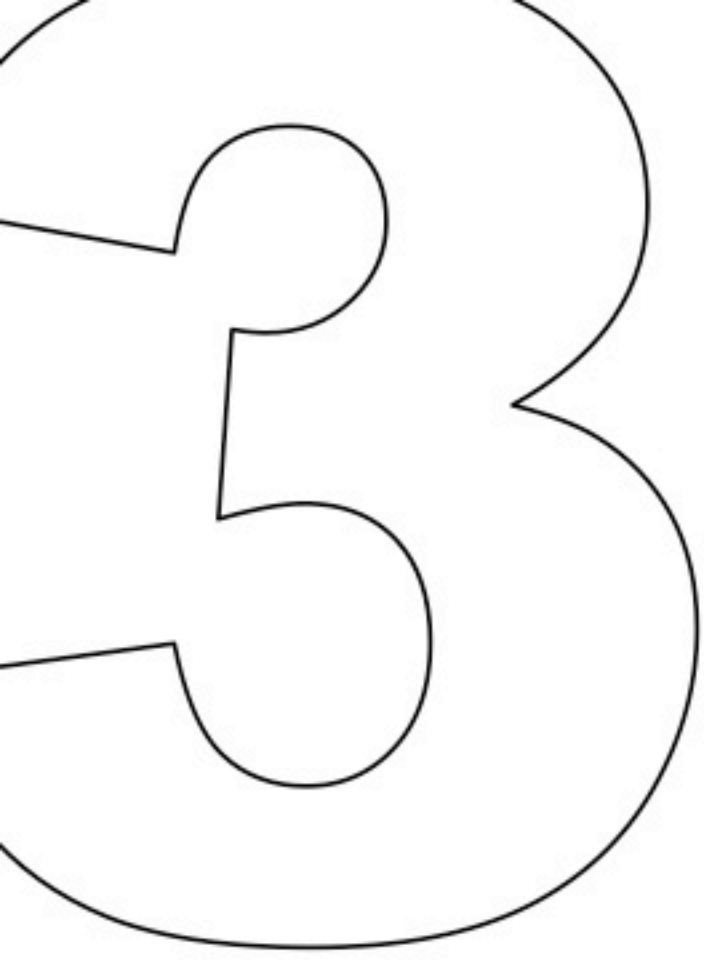
15

20

50

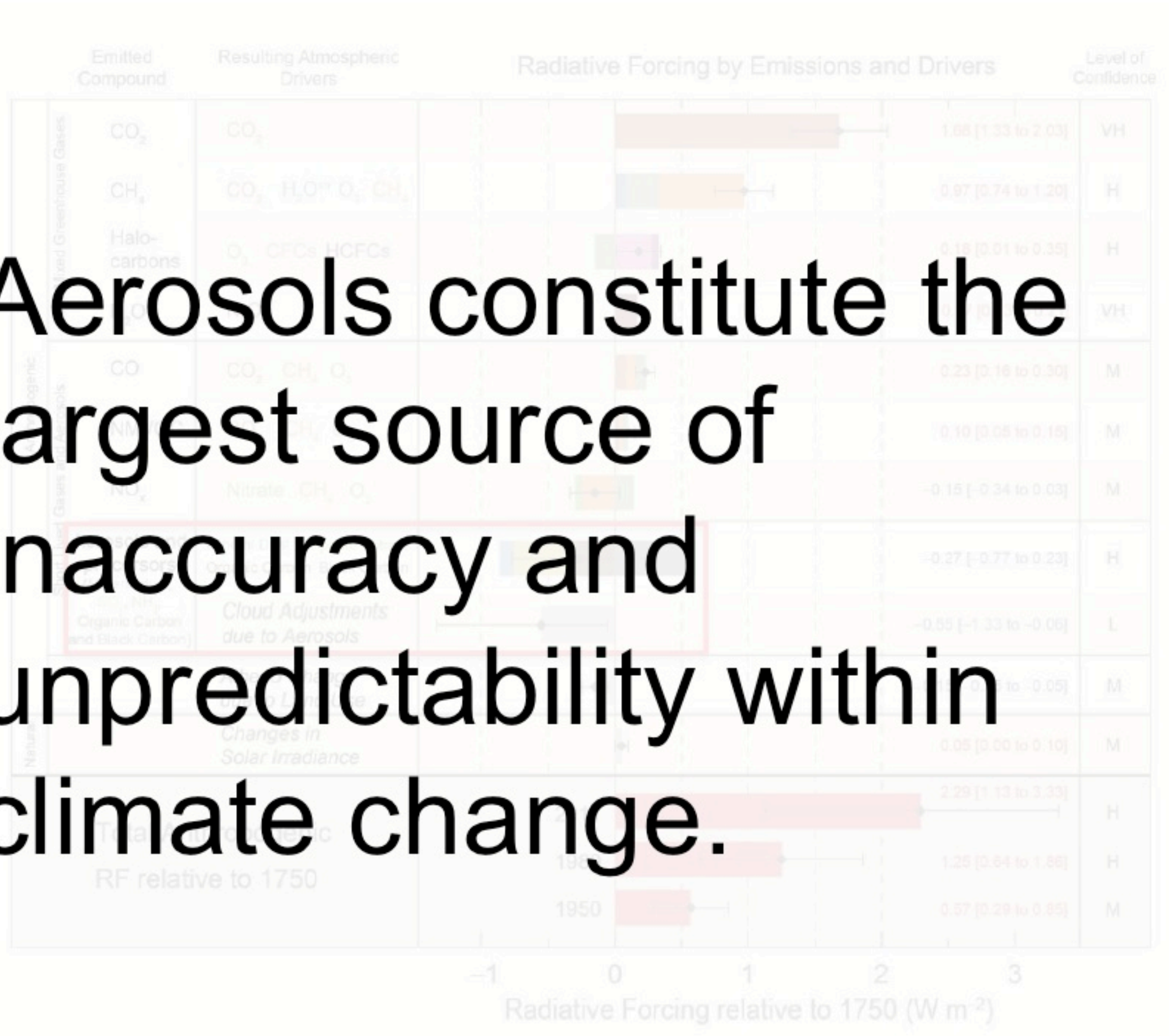
80

3

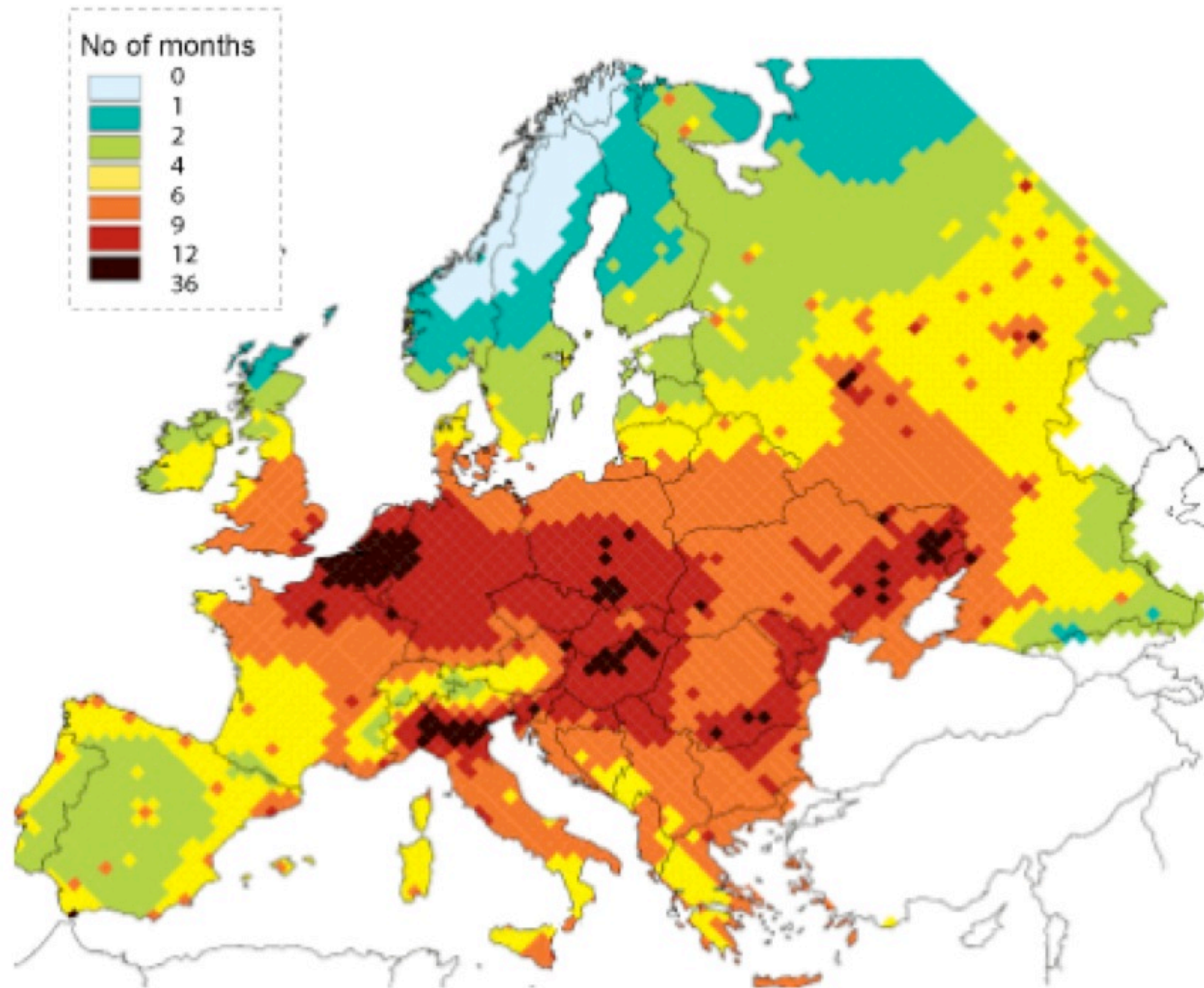


climate

Aerosols constitute the largest source of inaccuracy and unpredictability within climate change.



→ Reduction in life expectancy due to exposure to PM 2,5
Year 2000

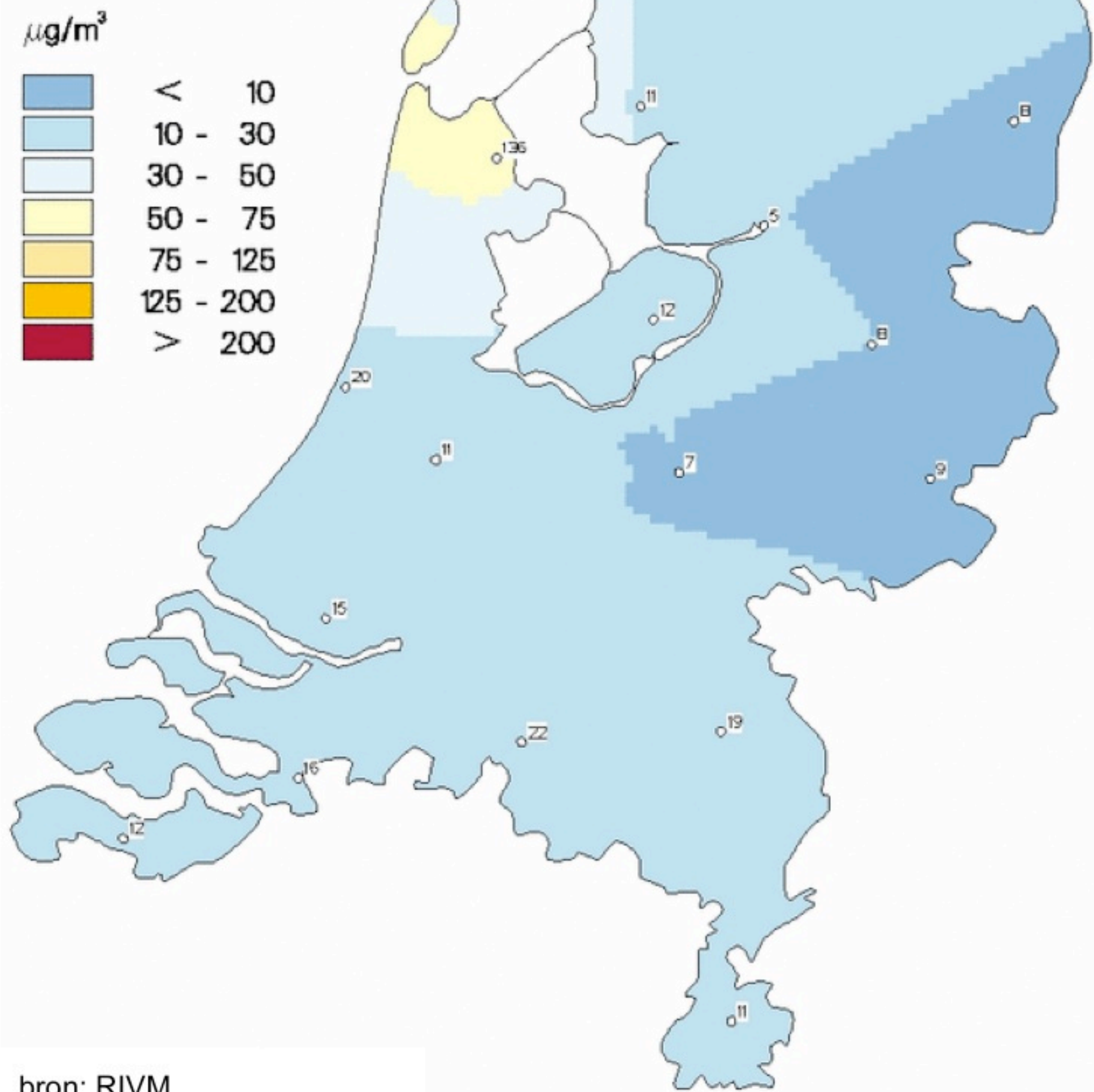


SOURCE: Clean Air for Europe Programme / www.environment.no

PM10: glijdend 24-h gemiddelden

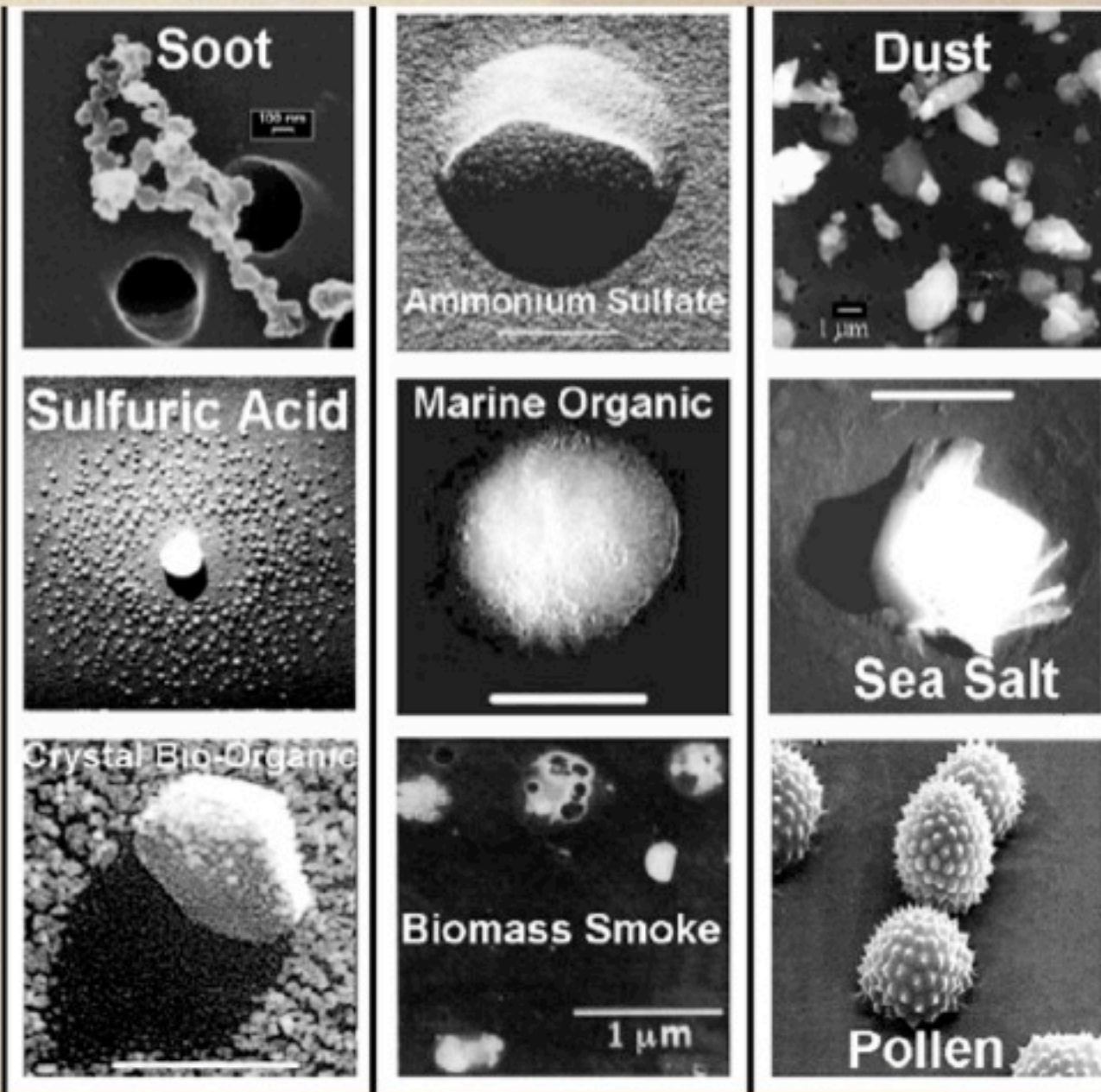
7 oktober 2011

18.00 h.



very local

little info on
types of
particles



SPEX



unpolarized light



polarized light



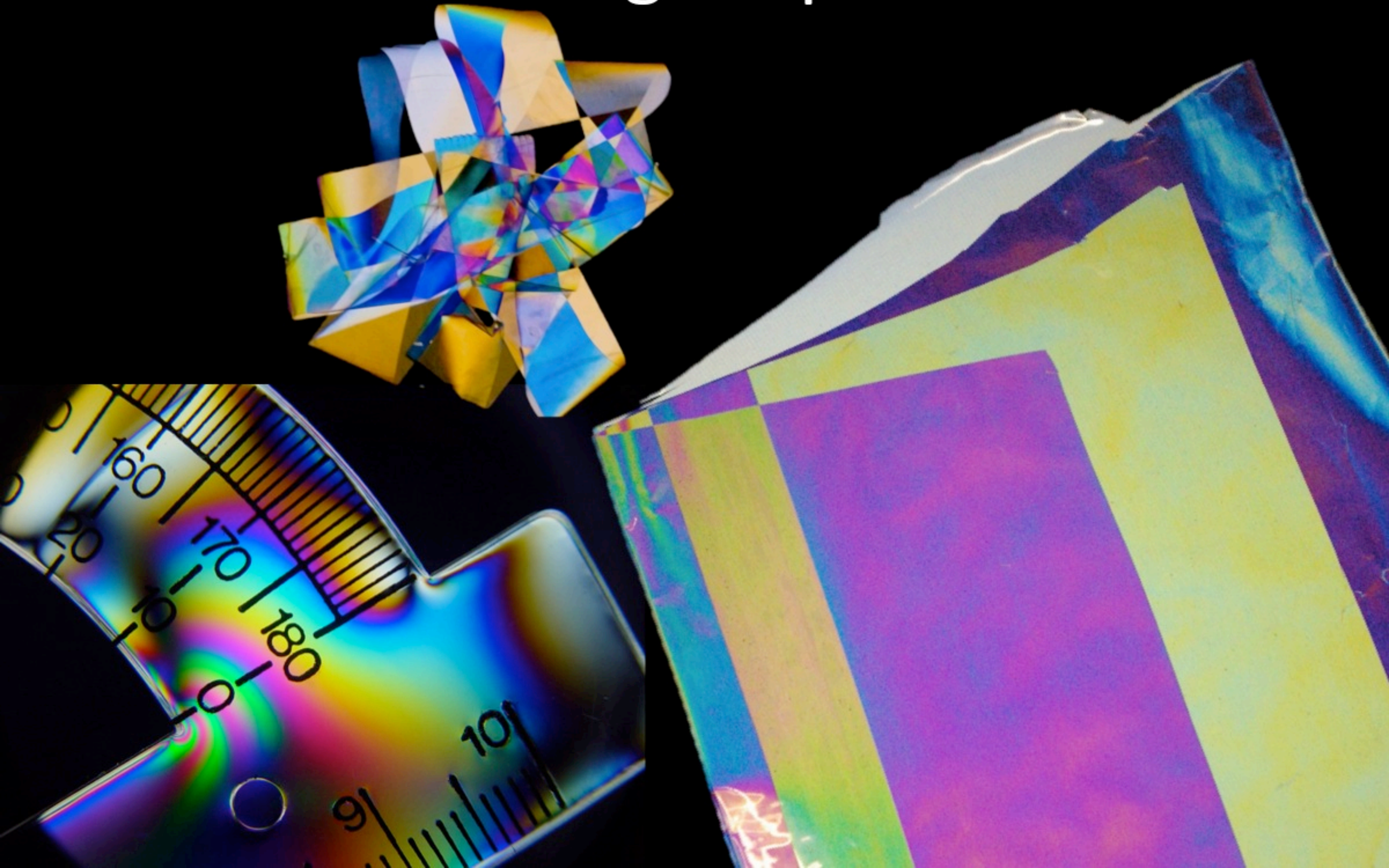


plastic polarizers



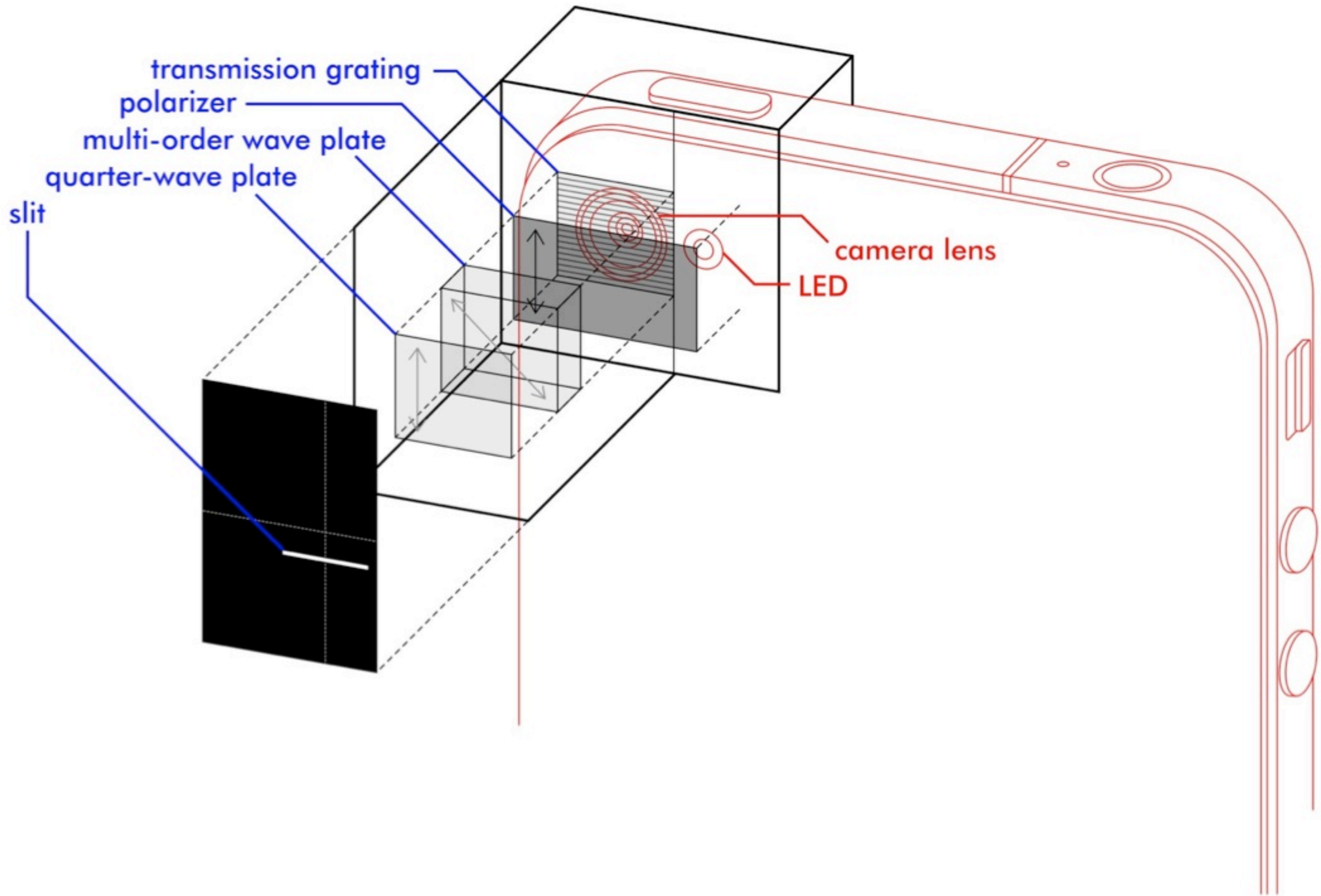
 **Polaroid**
Original Polarized Sunglasses

birefringent plastic





conceptual design





prototype





prototype



unpolarized sky (clouds) spectrum



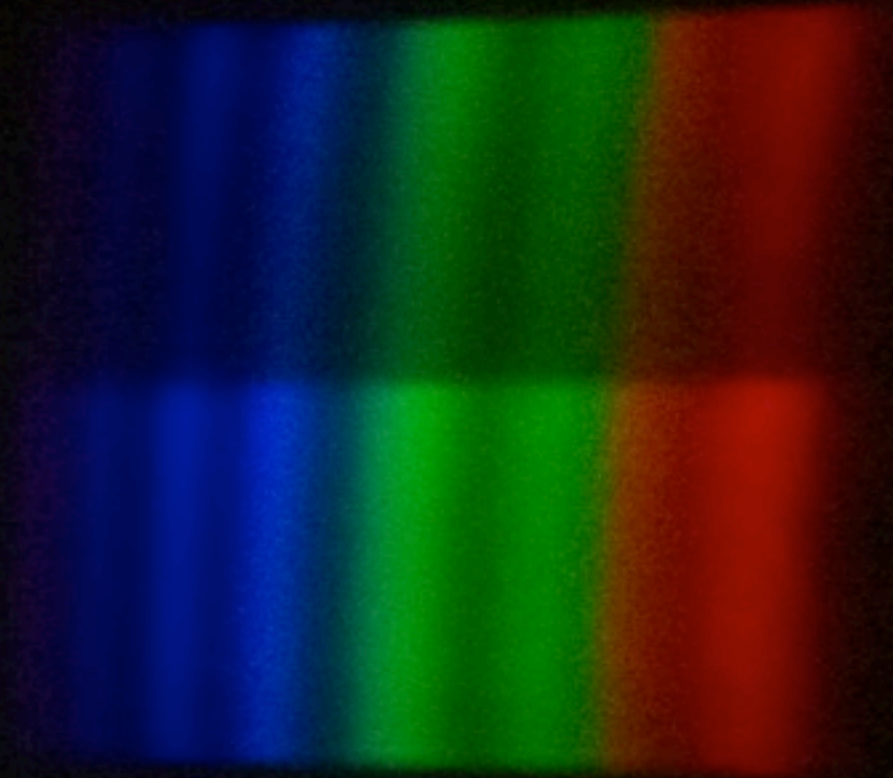
prototype



fluorescent lamp spectrum



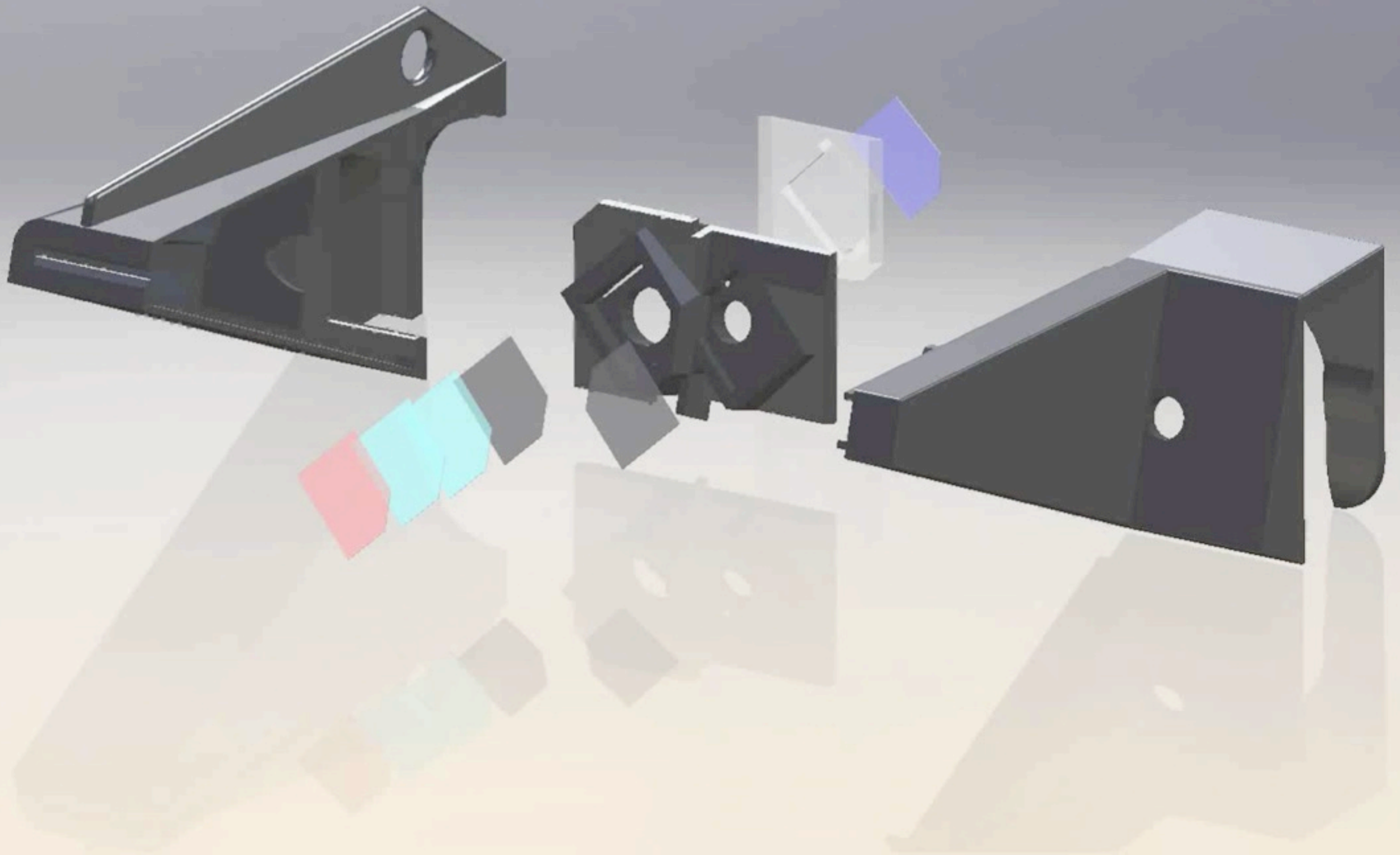
prototype



polarized sky spectrum



production

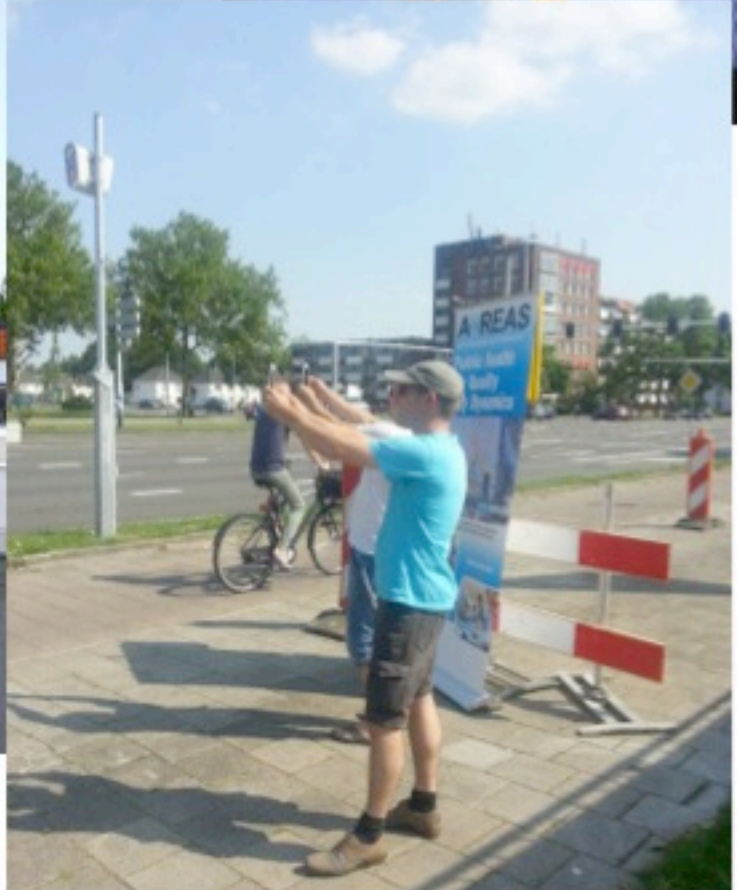
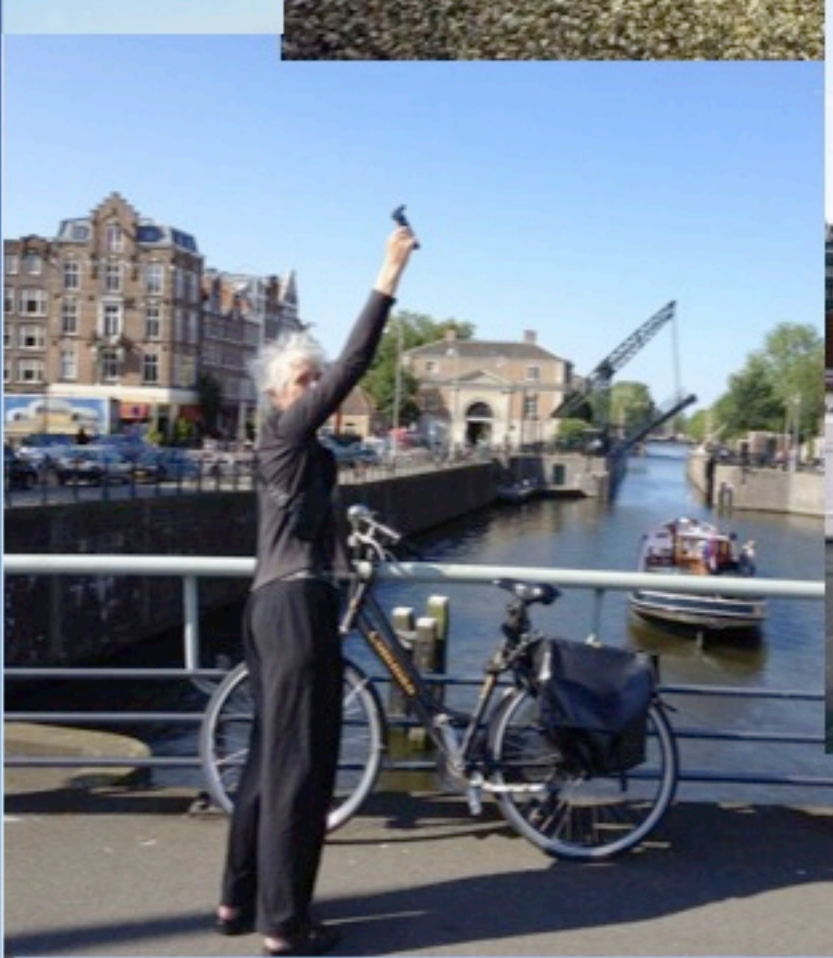


8 July 2013

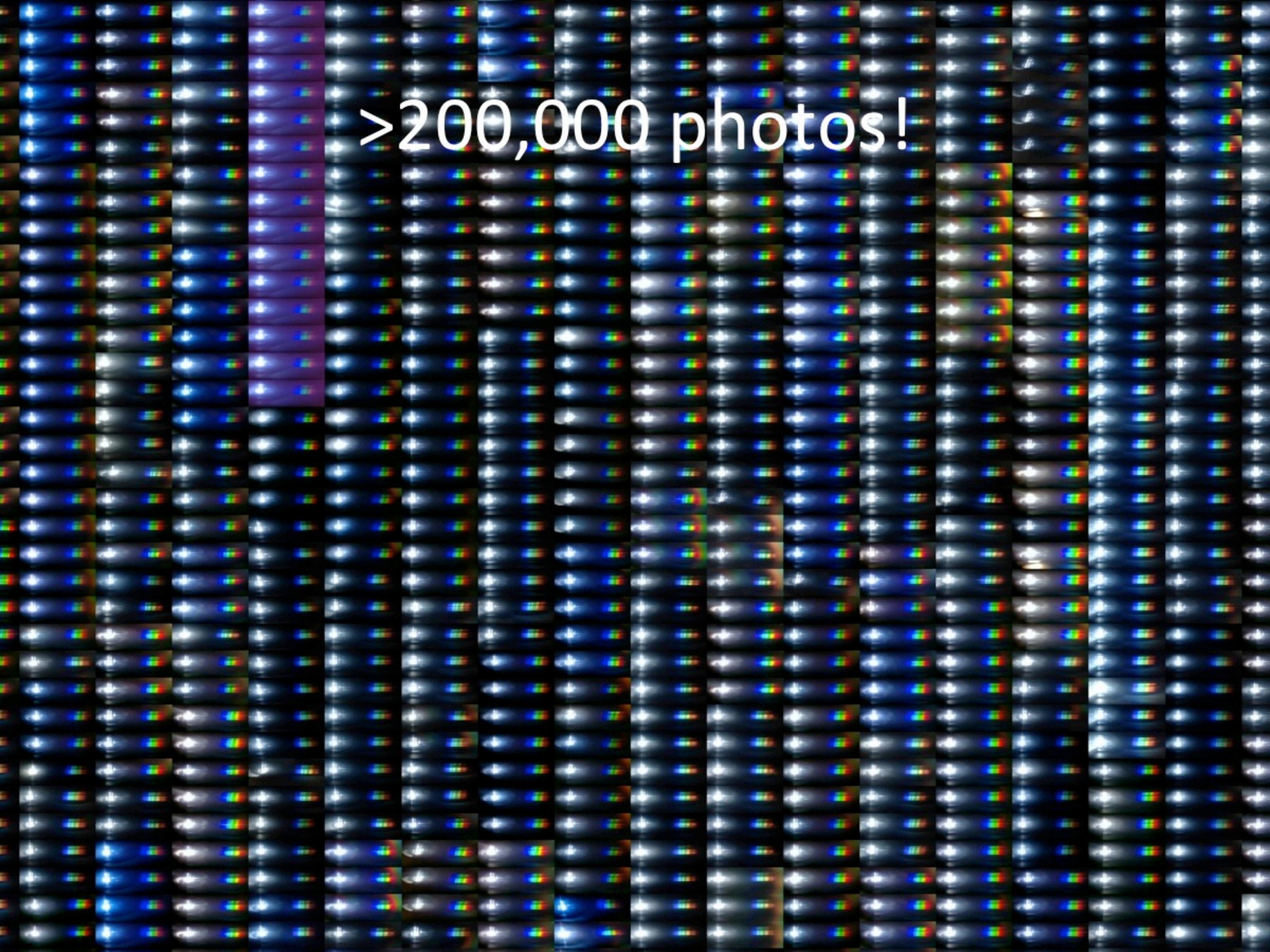


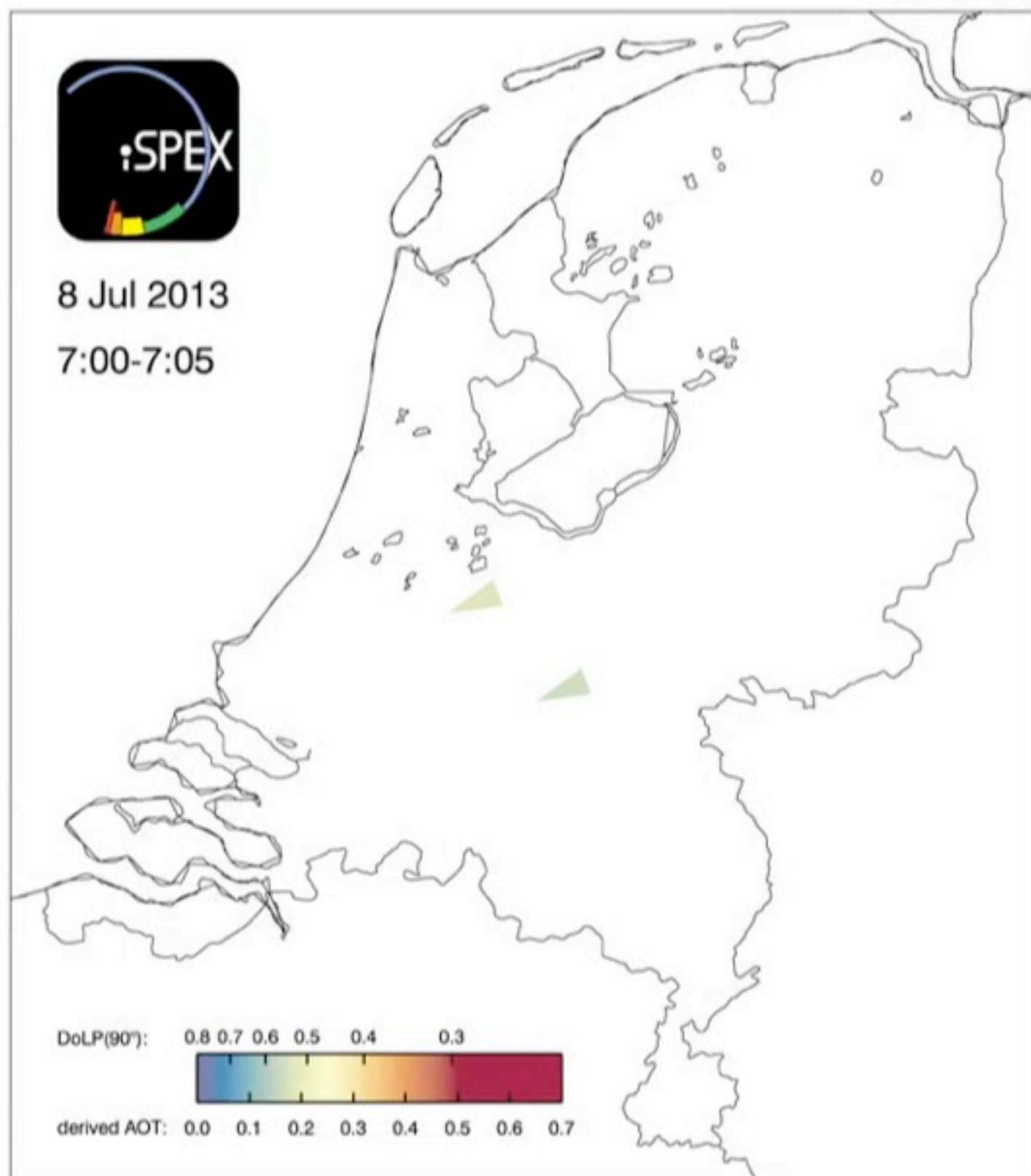
MODIS/AQUA
12:10 UTC

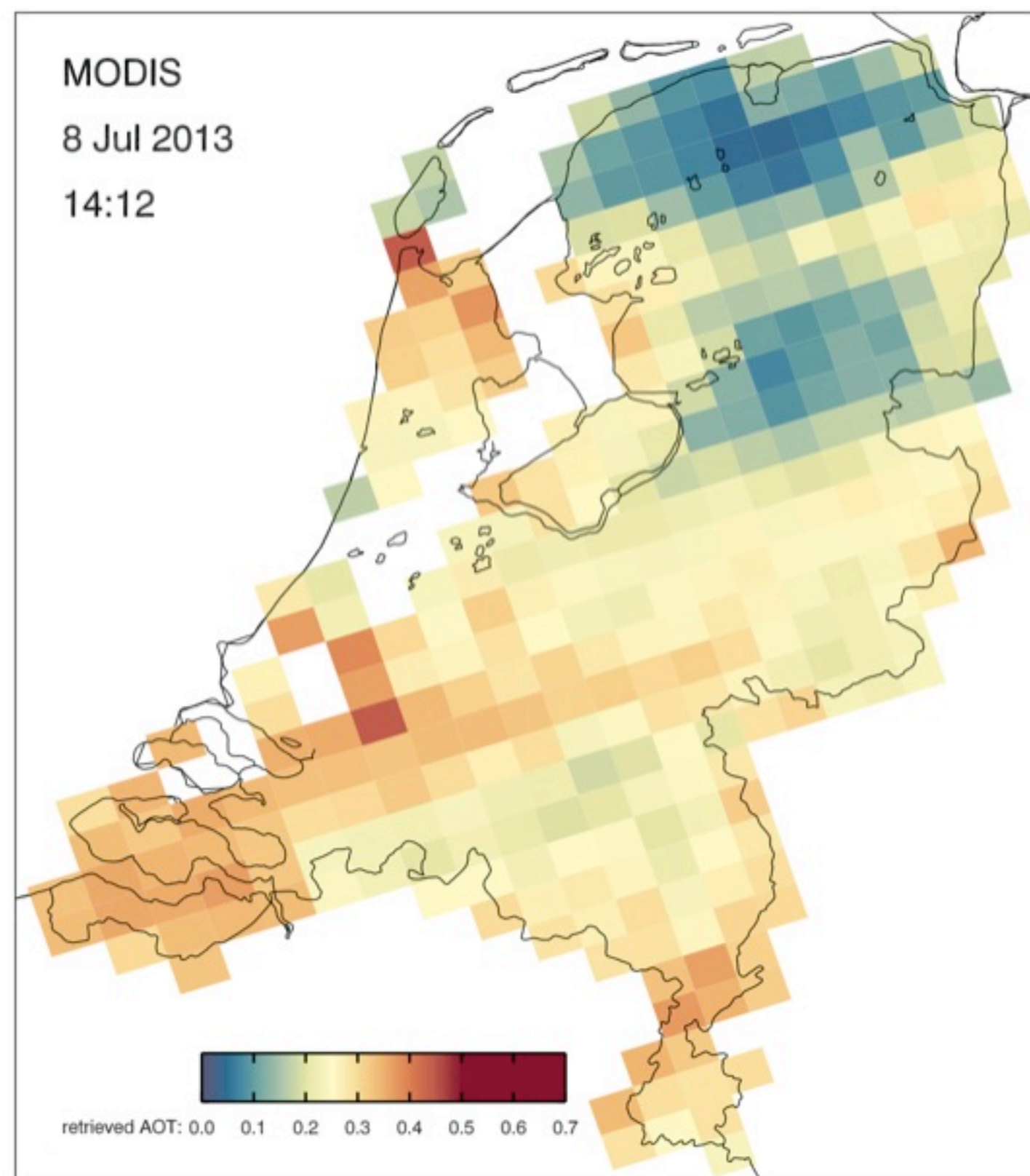
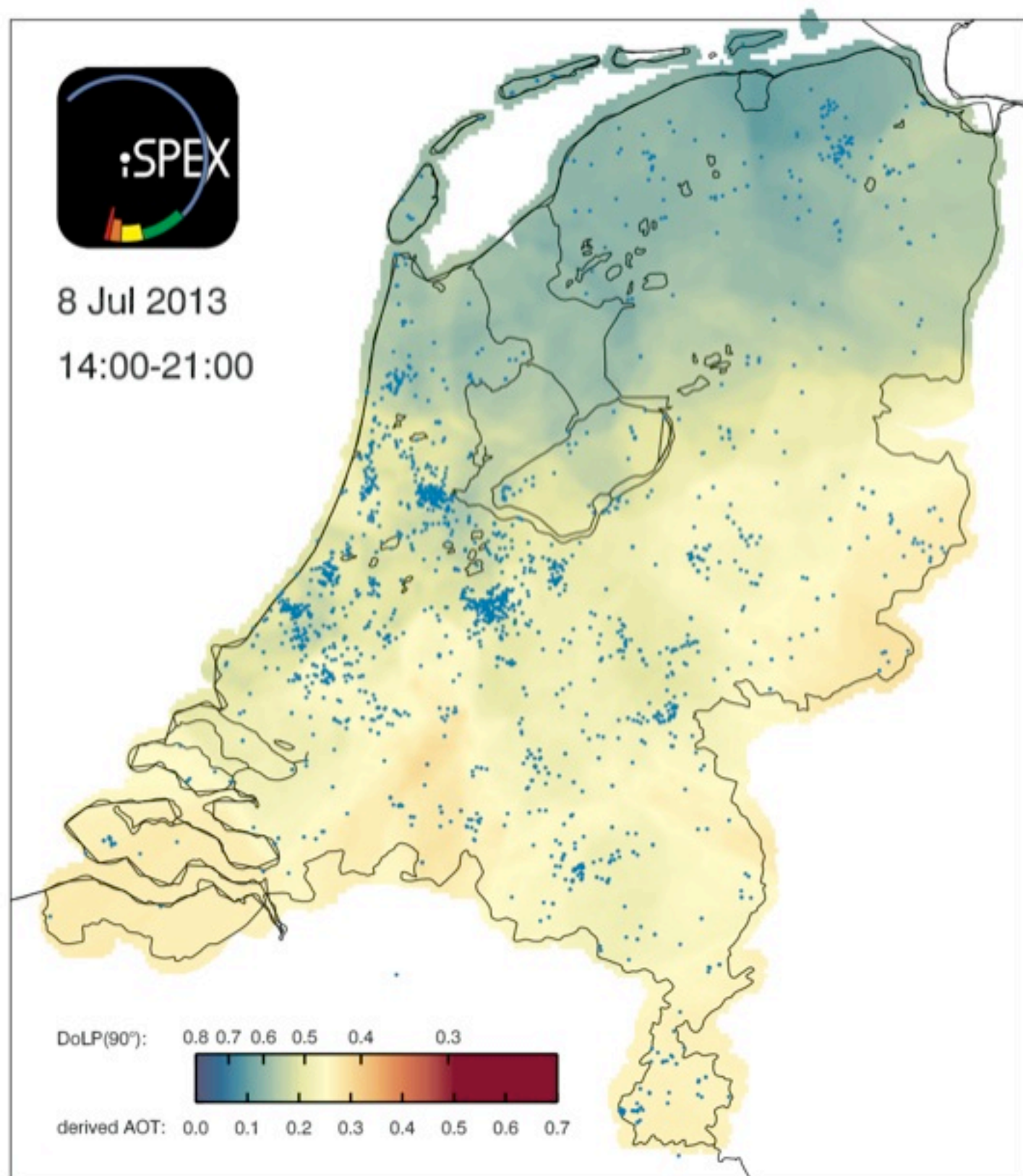




>200,000 photos!





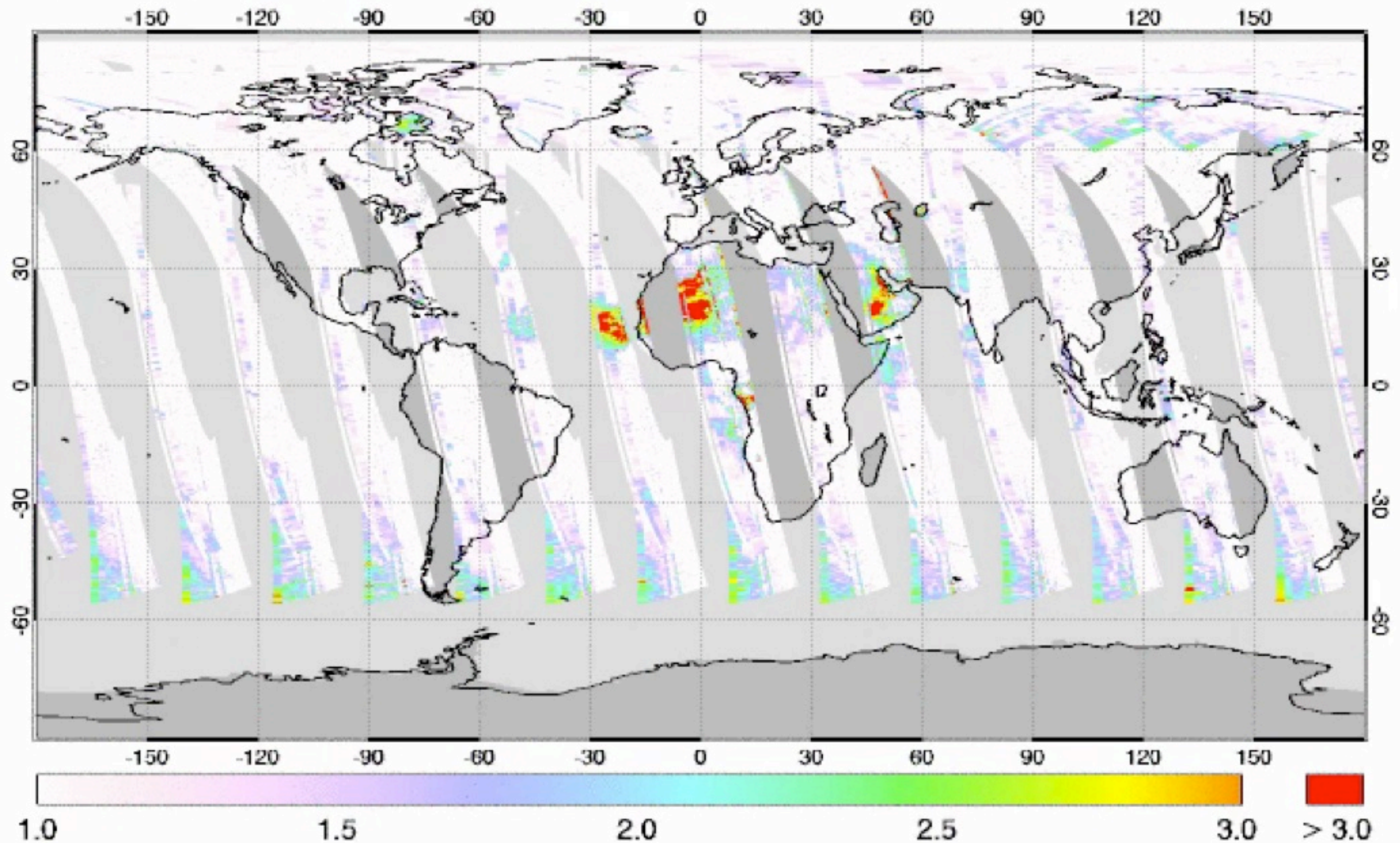


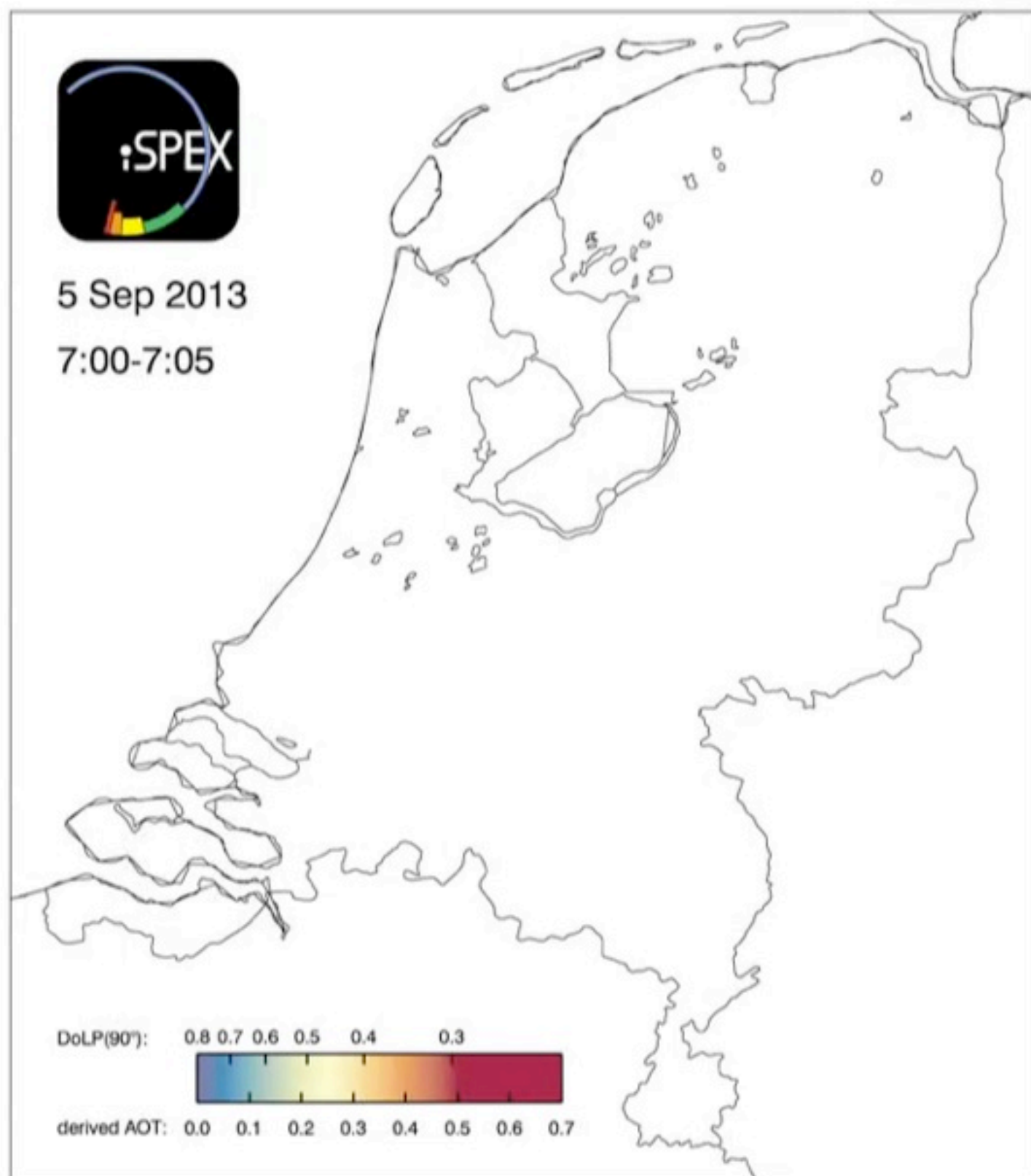
forest fires in North-America

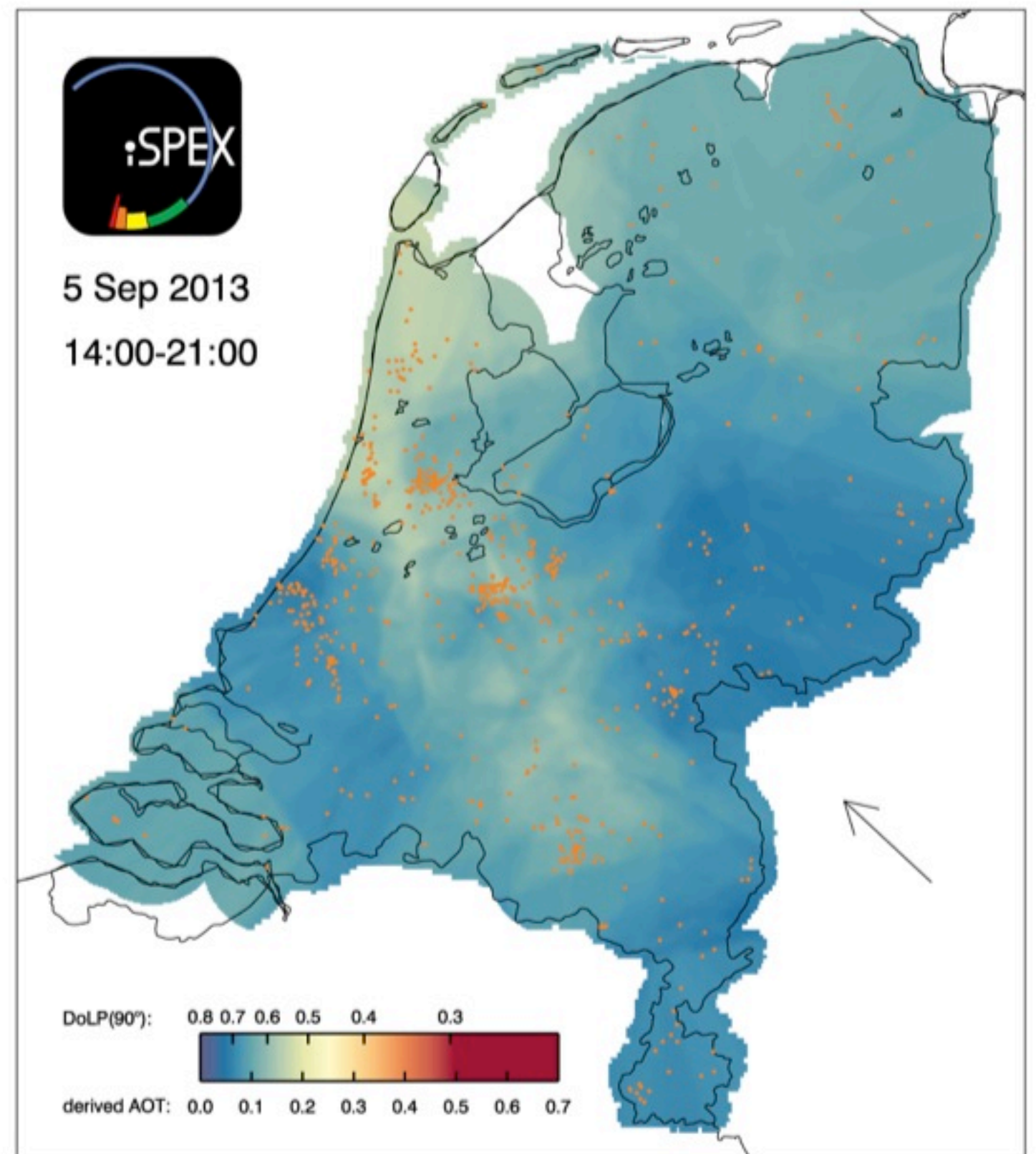
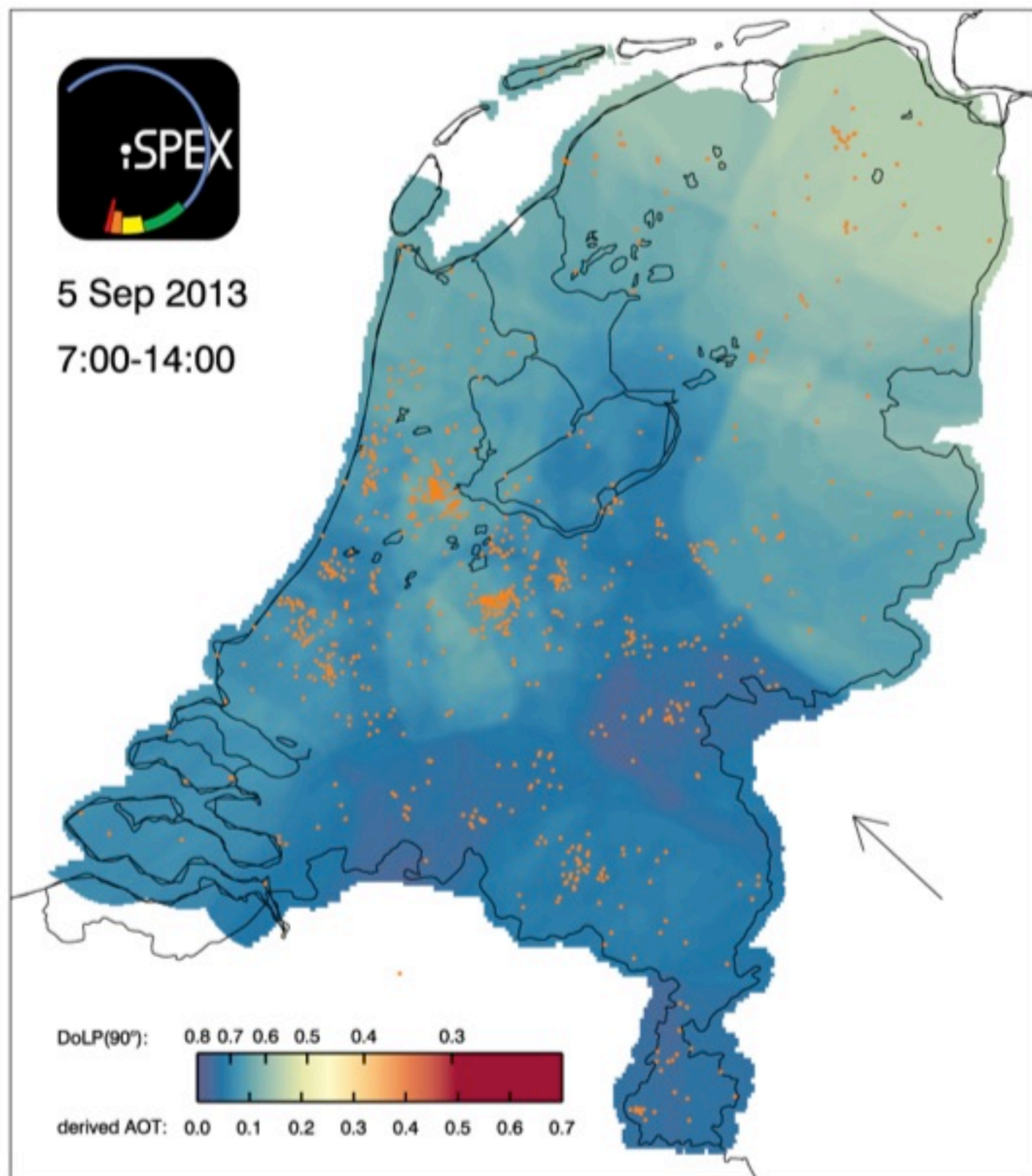
Aerosol index

16 June 2013

OMI – KNMI/FMI/NASA

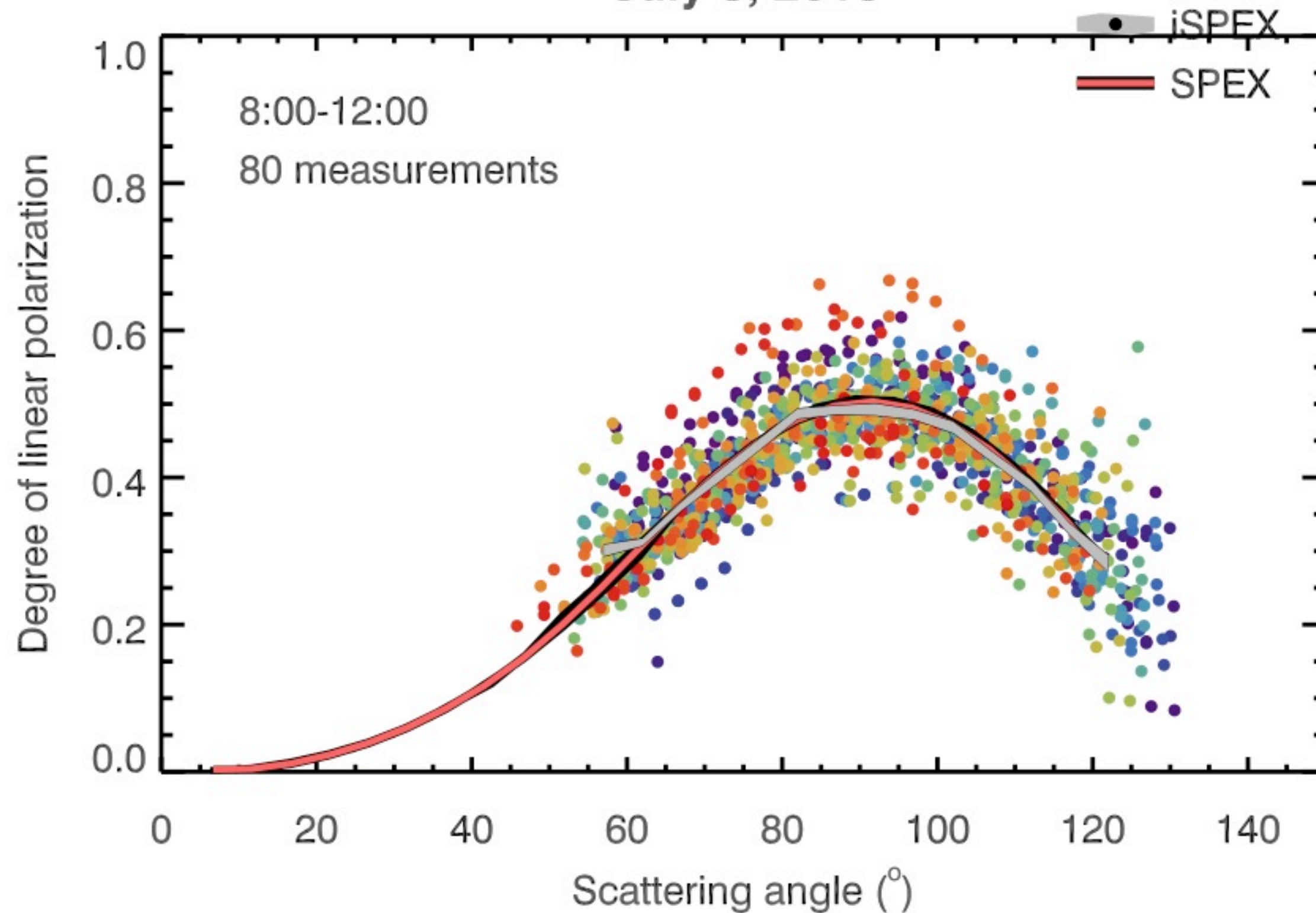




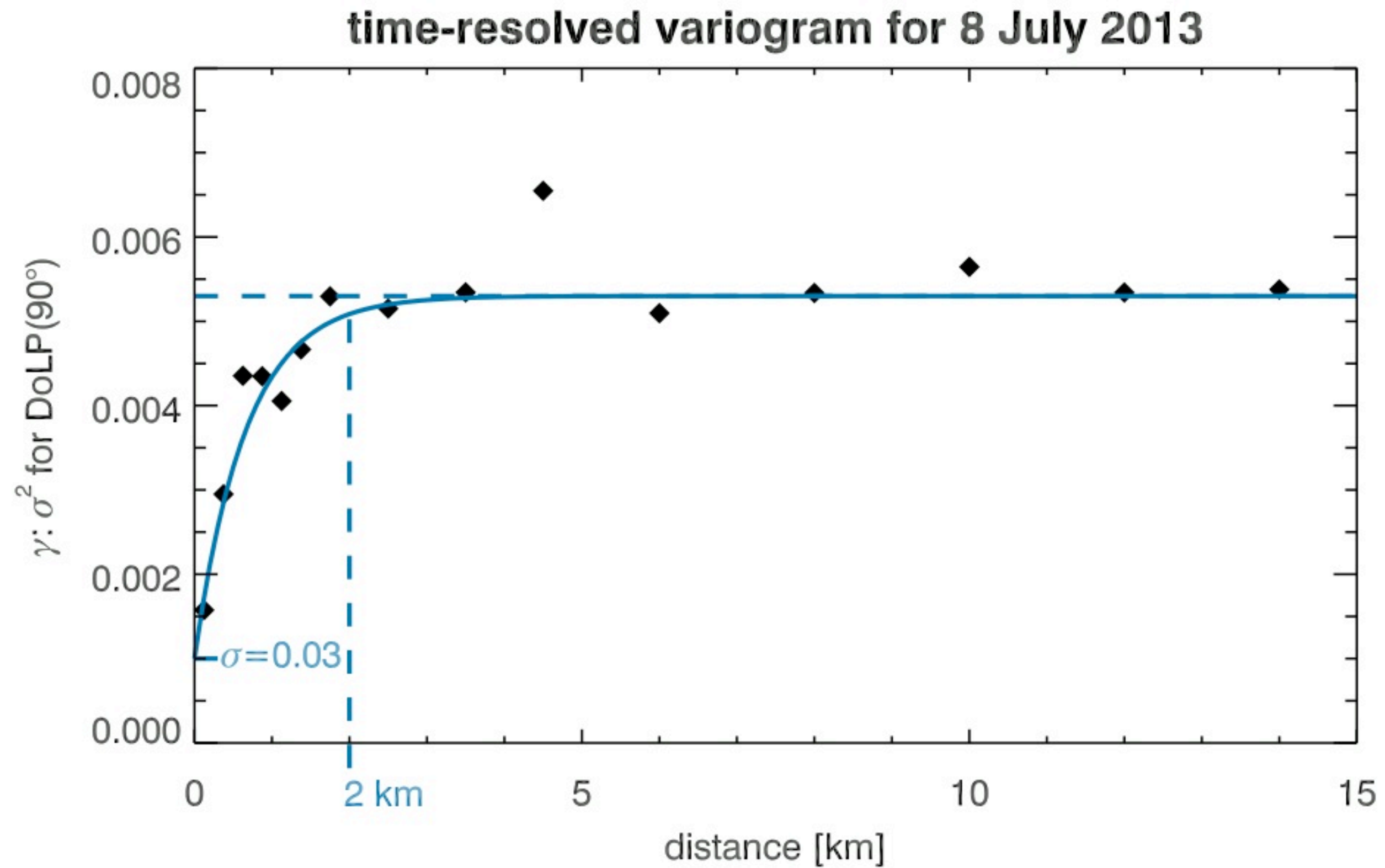


iSPEX accuracy

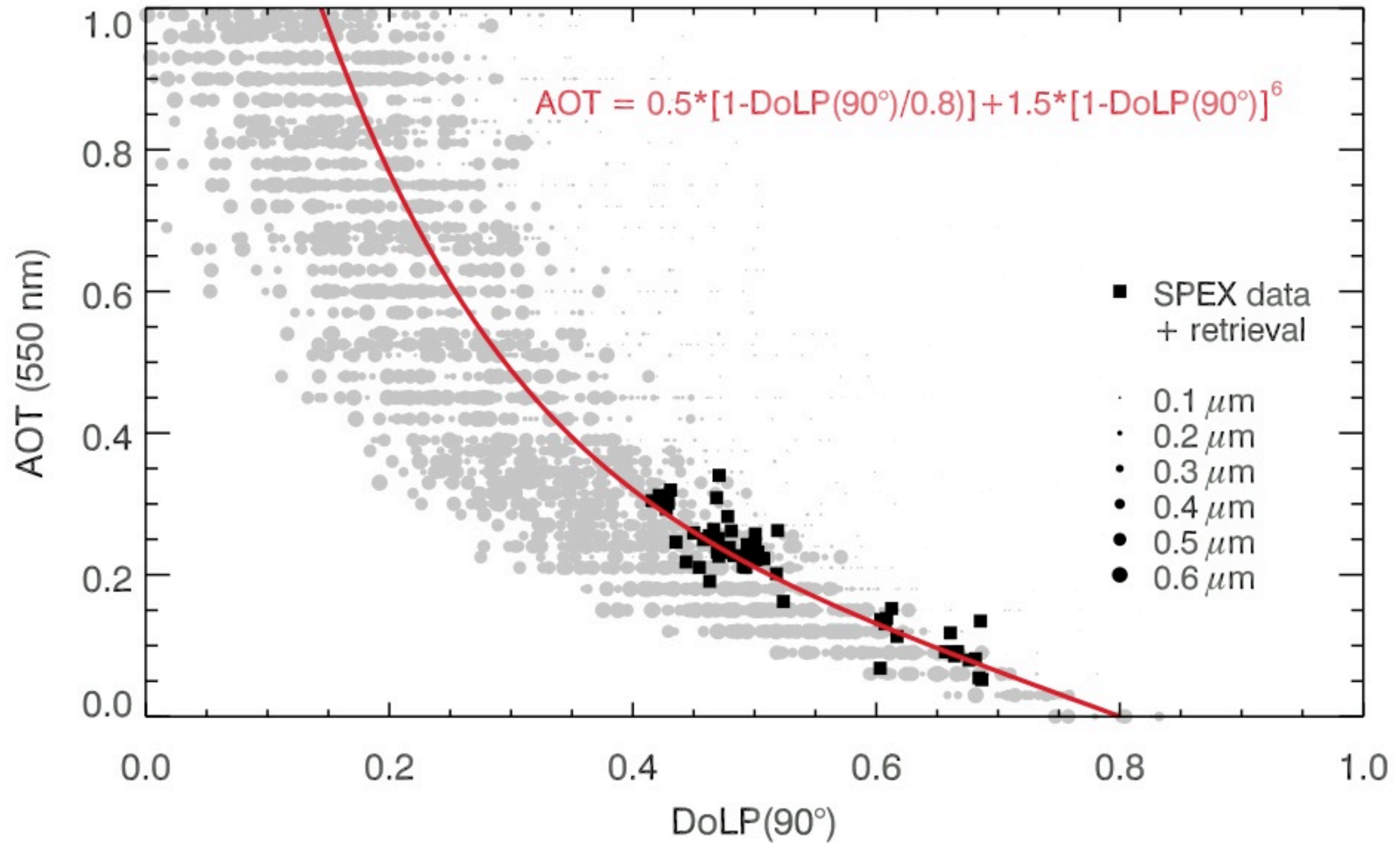
July 8, 2013

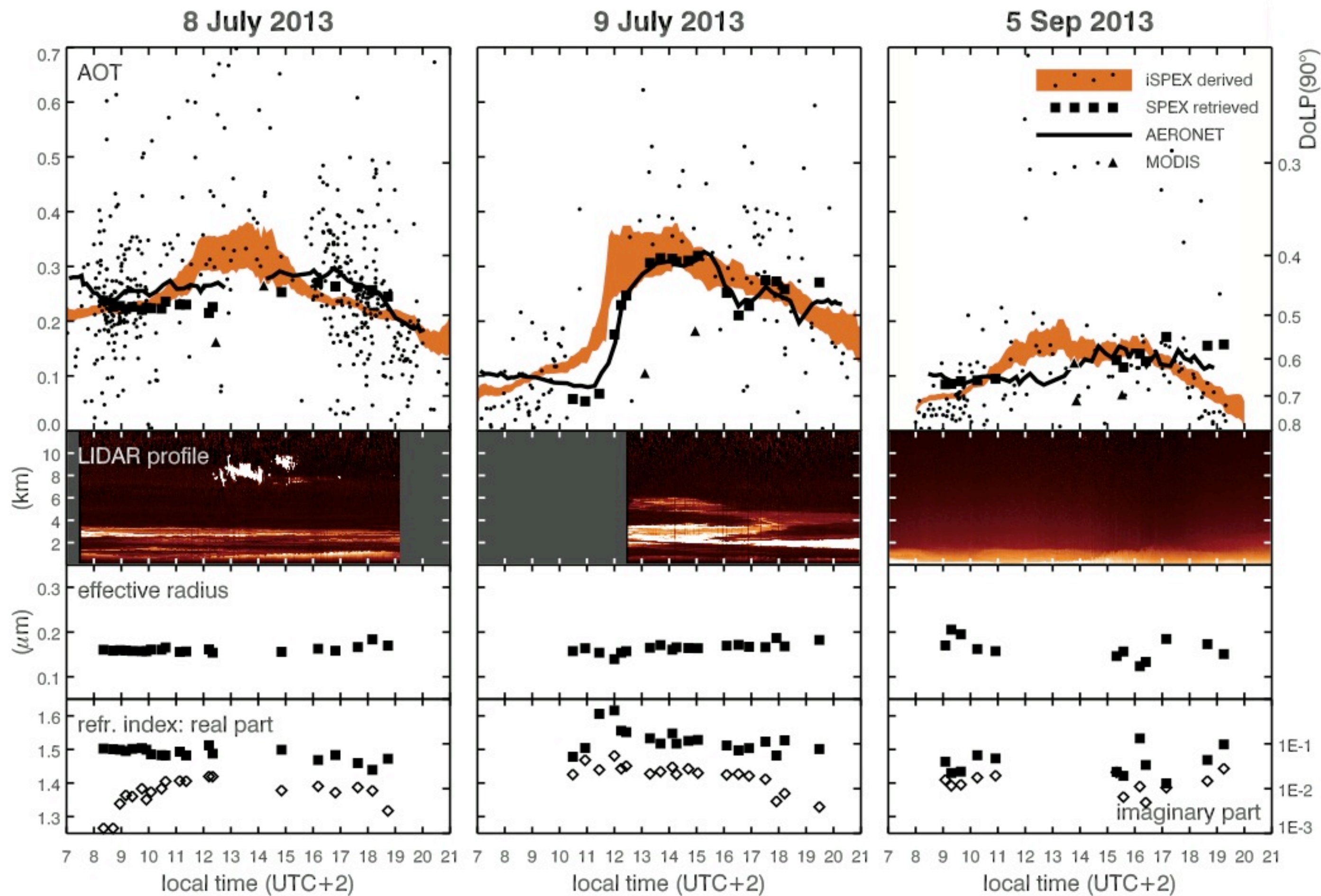


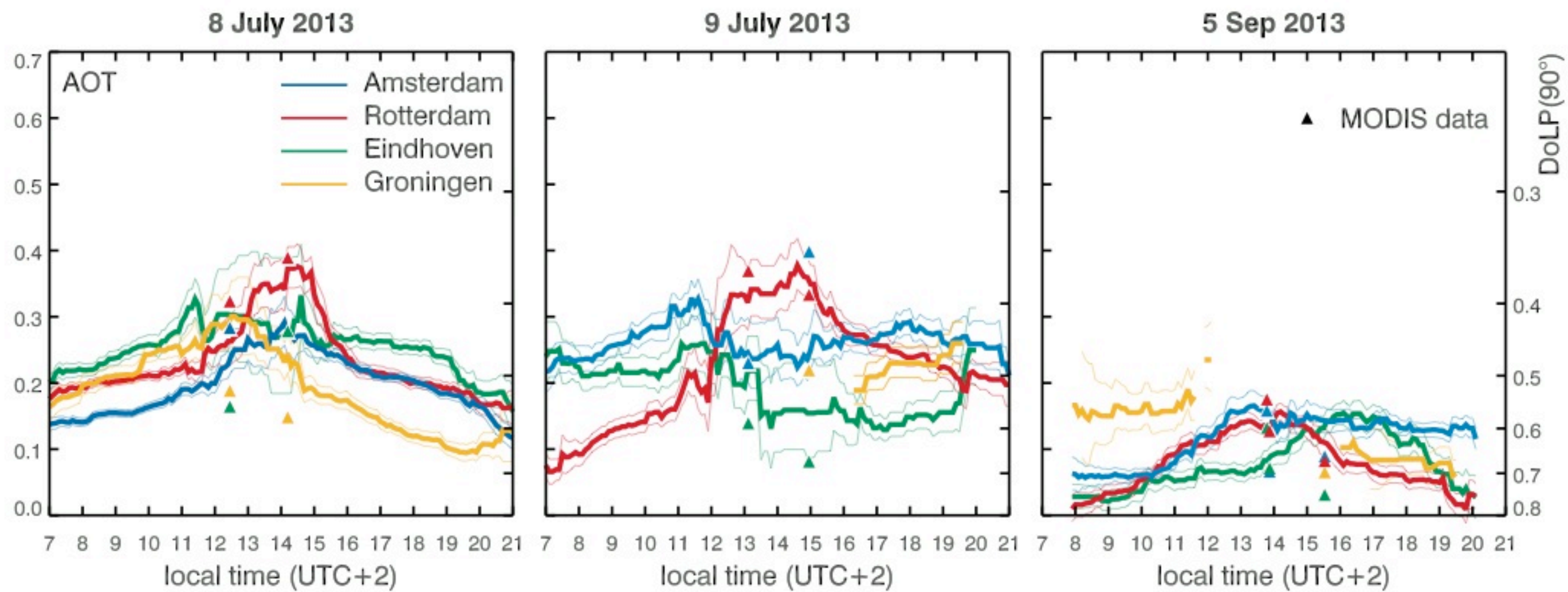
iSPEX spatial resolution



DoLP -> AOT







Key Points:

- The iSPEX add-on turns smartphones into aerosol measurement devices
- Thousands of iSPEX measurements across the Netherlands form AOT maps
- The iSPEX AOT data match MODIS and AERONET data and have 2 km resolution

Supporting Information:

- Readme
- Supporting Text and Figures S1–S6

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Mapping atmospheric aerosols with a citizen science network of smartphone spectropolarimeters

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Abstract To assess the impact of atmospheric aerosols on health, climate, and air traffic, aerosol properties must be measured with fine spatial and temporal sampling. This can be achieved by actively involving citizens and the technology they own to form an atmospheric measurement network. We establish this new measurement strategy by developing and deploying iSPEX, a low-cost, mass-producible optical add-on for smartphones with a corresponding app. The aerosol optical thickness (AOT) maps derived from iSPEX spectropolarimetric measurements of the daytime cloud-free sky by thousands of citizen scientists throughout the Netherlands are in good agreement with the spatial AOT structure derived from satellite imagery and temporal AOT variations derived from ground-based precision photometry. These maps show structures at scales of kilometers that are typical for urban air pollution, indicating the potential of iSPEX to provide information about aerosol properties at locations and at times that are not covered by current monitoring efforts.

1 Introduction

Our lives in many ways. They reduce our life expectancy by causing and
... et al., 2014; Krall et al., 2013; Chen et al., 2013;
... Climate Change, 2013; Rosenfeld
... traffic in the



sep-oct 2015



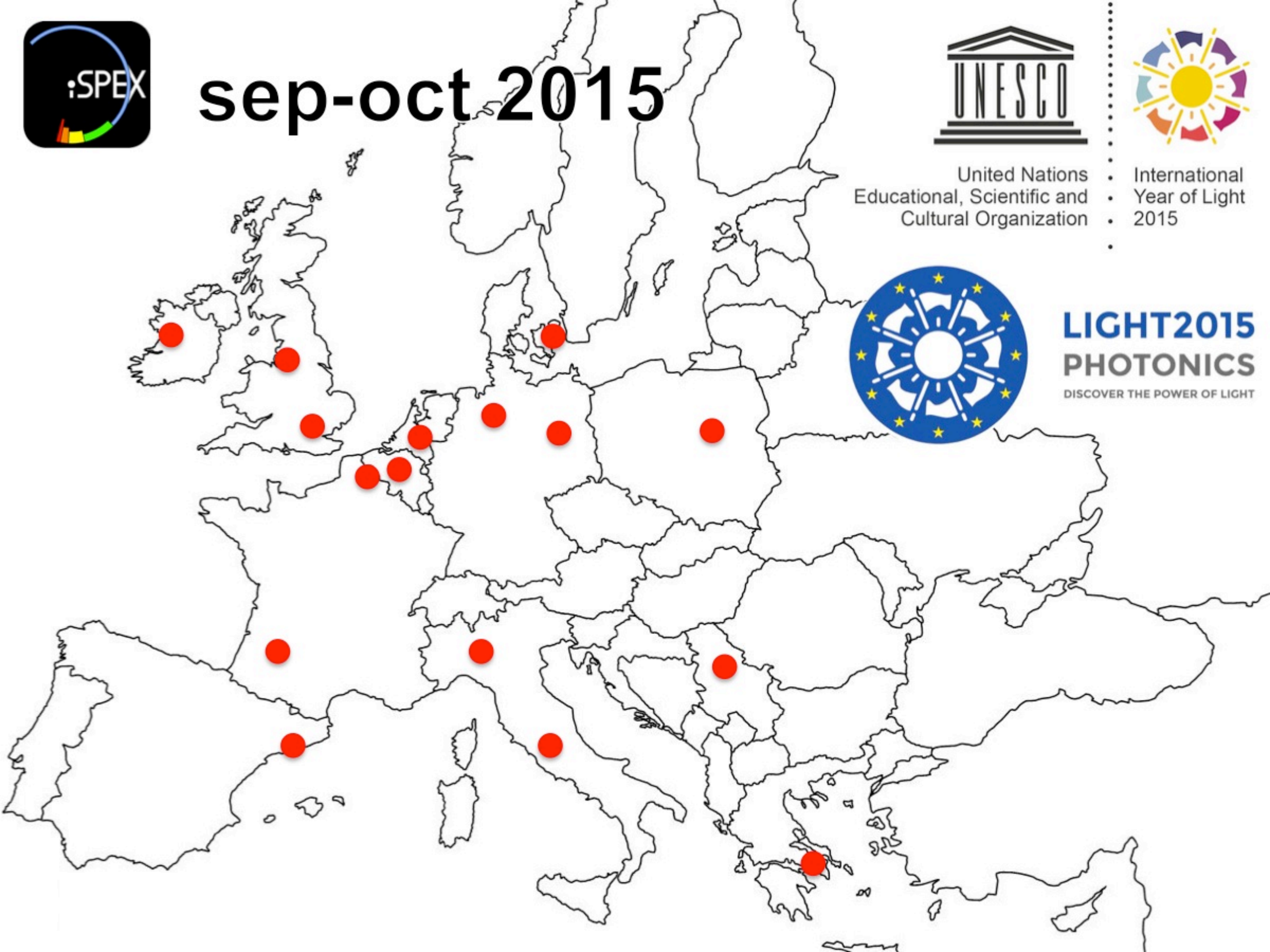
United Nations
Educational, Scientific and
Cultural Organization



International
Year of Light
2015



LIGHT2015
PHOTONICS
DISCOVER THE POWER OF LIGHT





iSPEX-EU 1 - 21 September 2015

2081 measurements

www.ispex-eu.org



next steps

- Generic design of add-on & app.
- Dual-beam polarimeter.
- Constrain AOT and particle size with relative radiometry.
- Retrieval of complex refractive index.
- Map pollution at city-level.
- Conquer the world.



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