ISPEX-EU: EUROPEAN CITIZENS MEASURE AIR POLLUTION WITH THEIR SMARTPHONE

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AND MANY OTHERS, INCLUDING:
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NASA'S AEROSOLS OVER THE WORLD

Animated aerosol dynamics (source: NASA)

MEASURING AEROSOLS WITH A SMARTPHONE

INTRODUCTIO
N

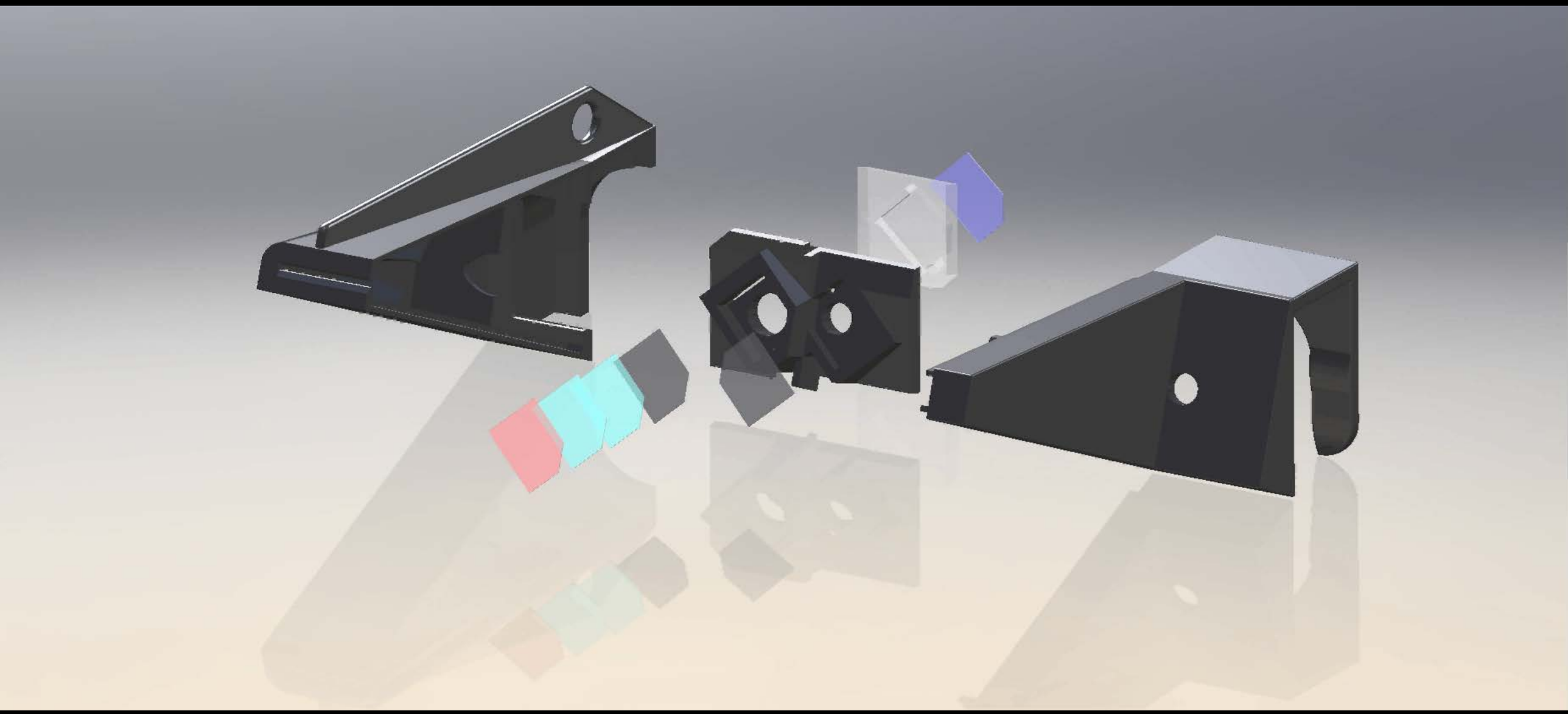
iSPEX introduction animation film

Depolarized light

Polarized light

DEVELOPING ISPEX...

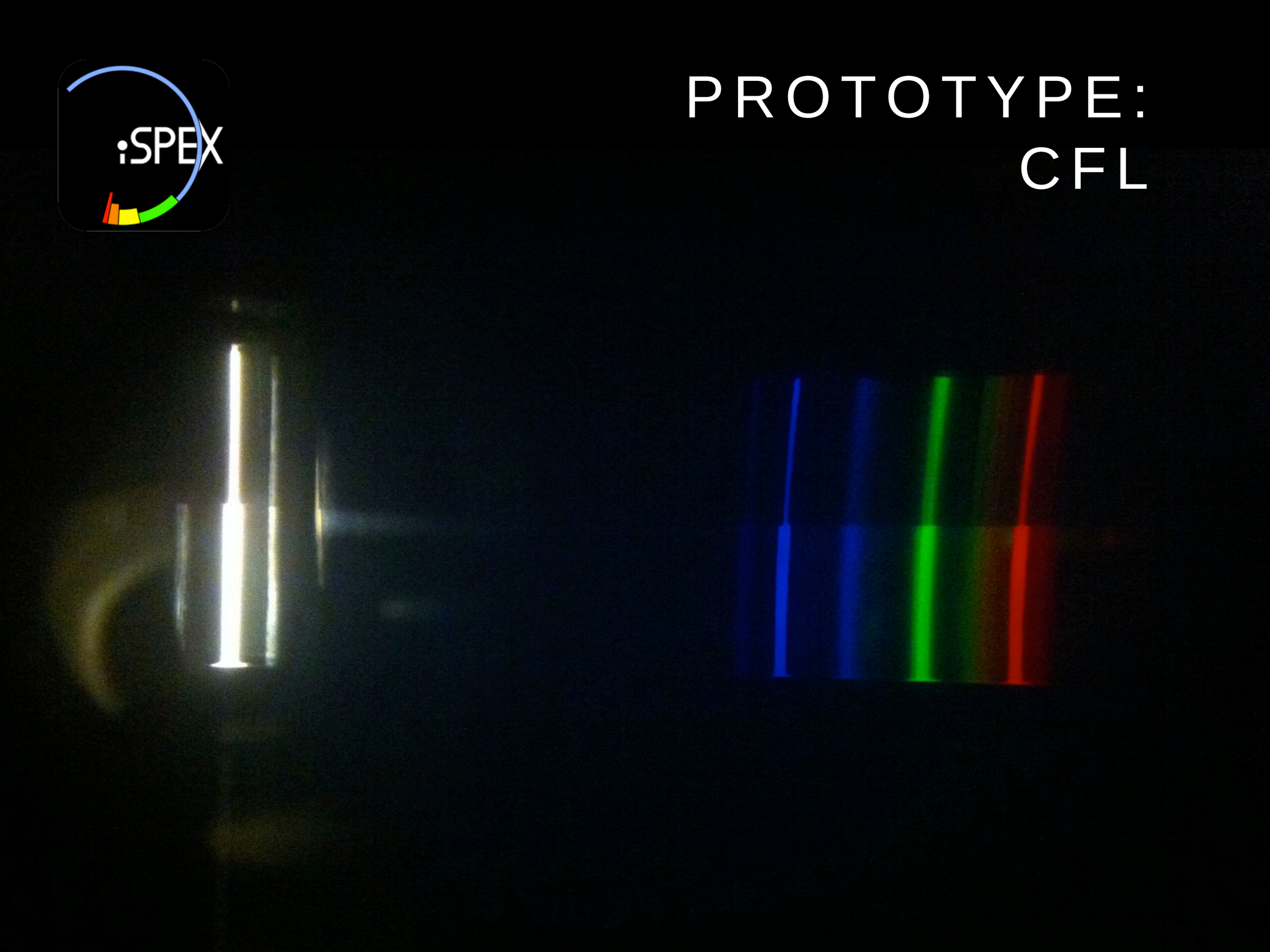
ISPEX PROTOTYPE



ISPEX
PROTOTYPE

PROTOTYPE: DEPOLARIZED CLOUDS

PROTOTYPE: CFL



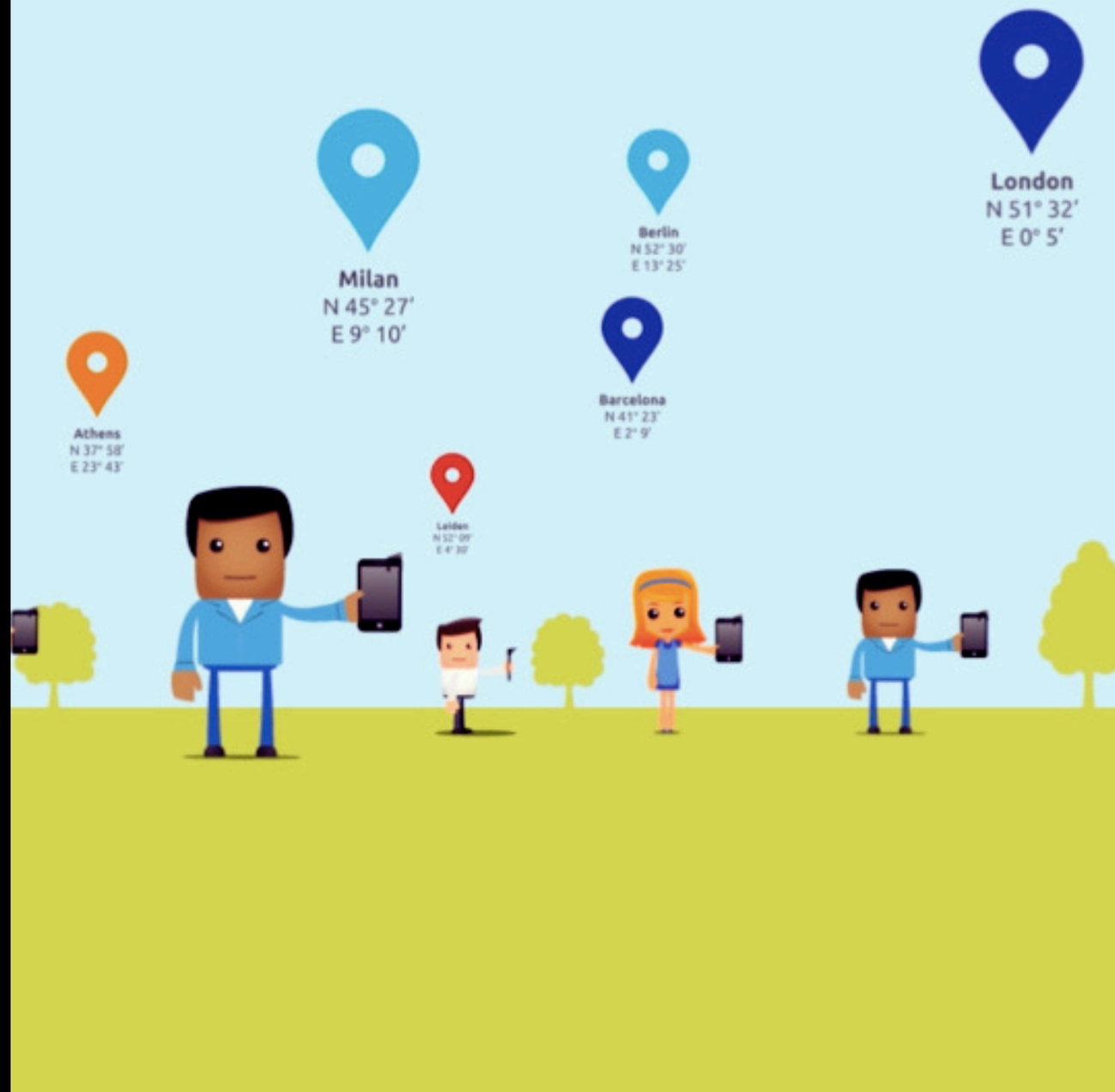
PROTOTYPE:
POLARIZED BLUE SKY

ISPEX INITIAL CAMPAIGN

Dutch consortium (Leiden Observatory, NOVA, KNMI, RIVM, SRON), *'Academische Jaarprijs 2012'*:

- Development add-on and app
- Production of 10.000 add-ons
- National measurement days on 8 July en 5 September 2013

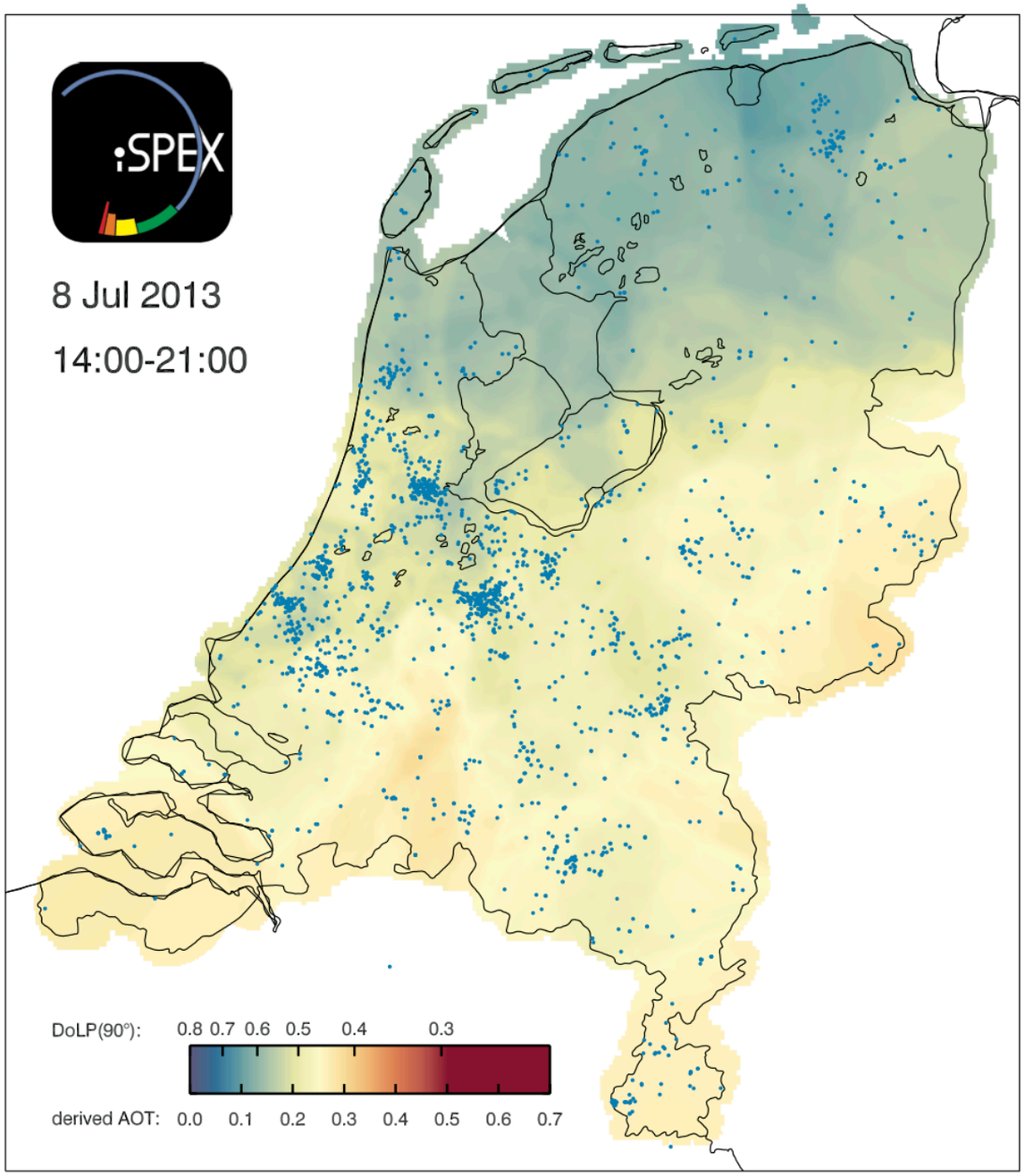
iSPEX [animation film](#) (source: APS Group)



>200,000 PHOTOS!

8 JULY 2013:

RESULTS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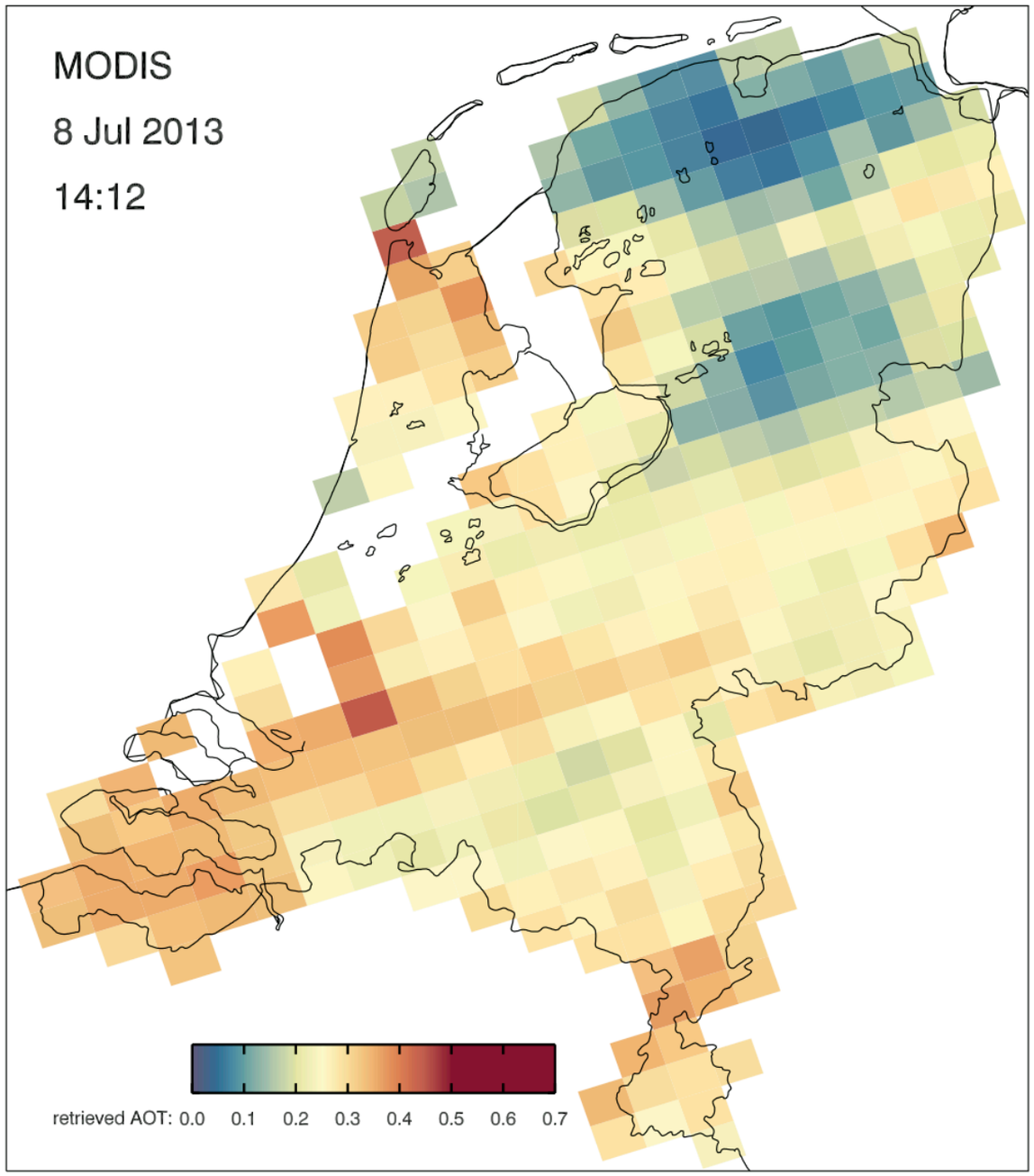
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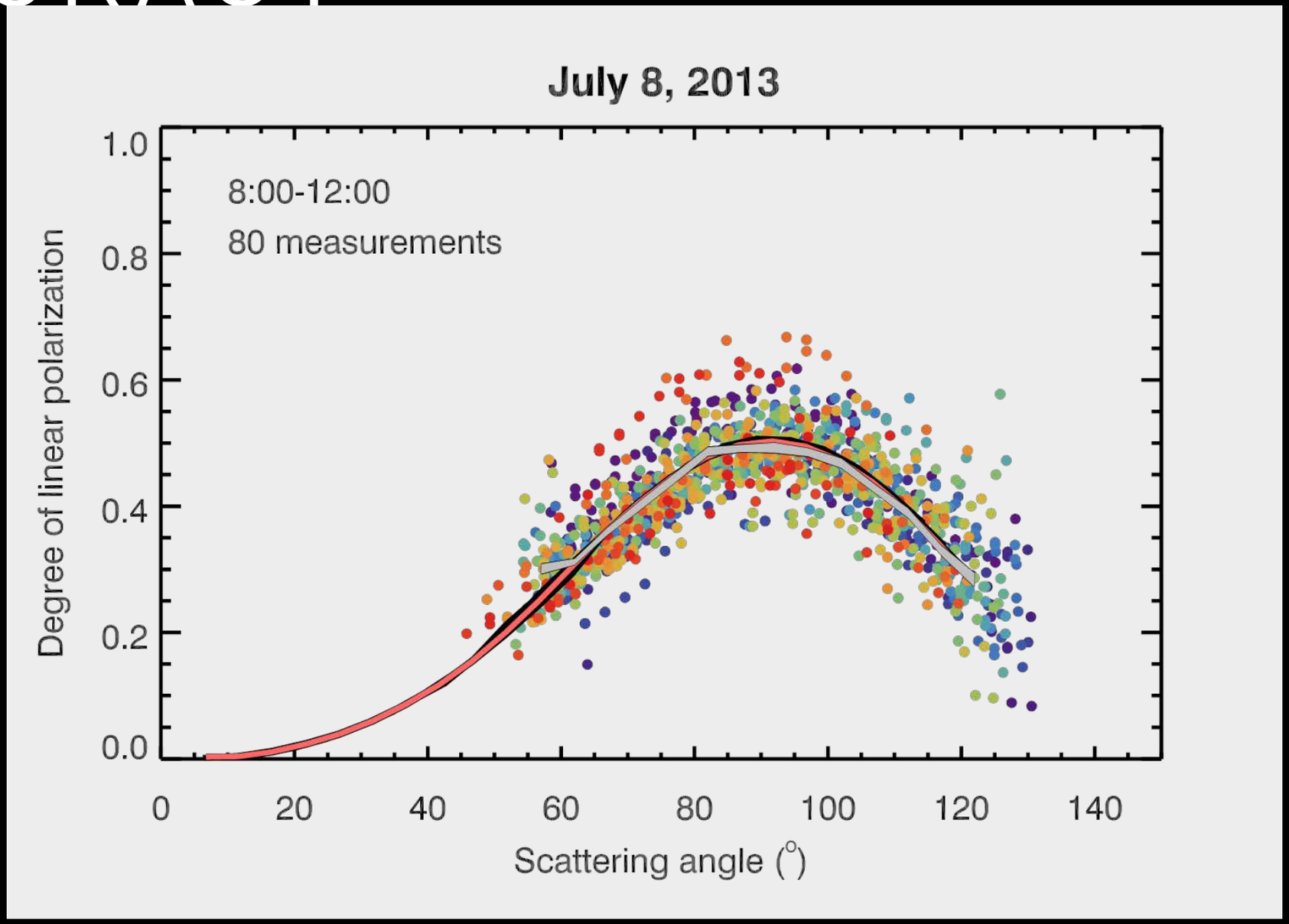
ISPEX ACCURACY



Snik, F., et al. (2014), Mapping atmospheric aerosols with a citizen science network of smartphone spectropolarimeters, Geophys. Res. Lett., 41, 7351–7358, doi:10.1002/2014GL061462

LIGHT2015: ISPEX-EU

A first European-wide citizen science campaign for the measurement of aerosols

- 1 September – 15 October 2015
- iSPEX observations on cloud-free days
- 9000 participants - citizens and scientists - in selected major cities

… a first step towards a worldwide network of citizens, scientists and others for the observation of air pollution

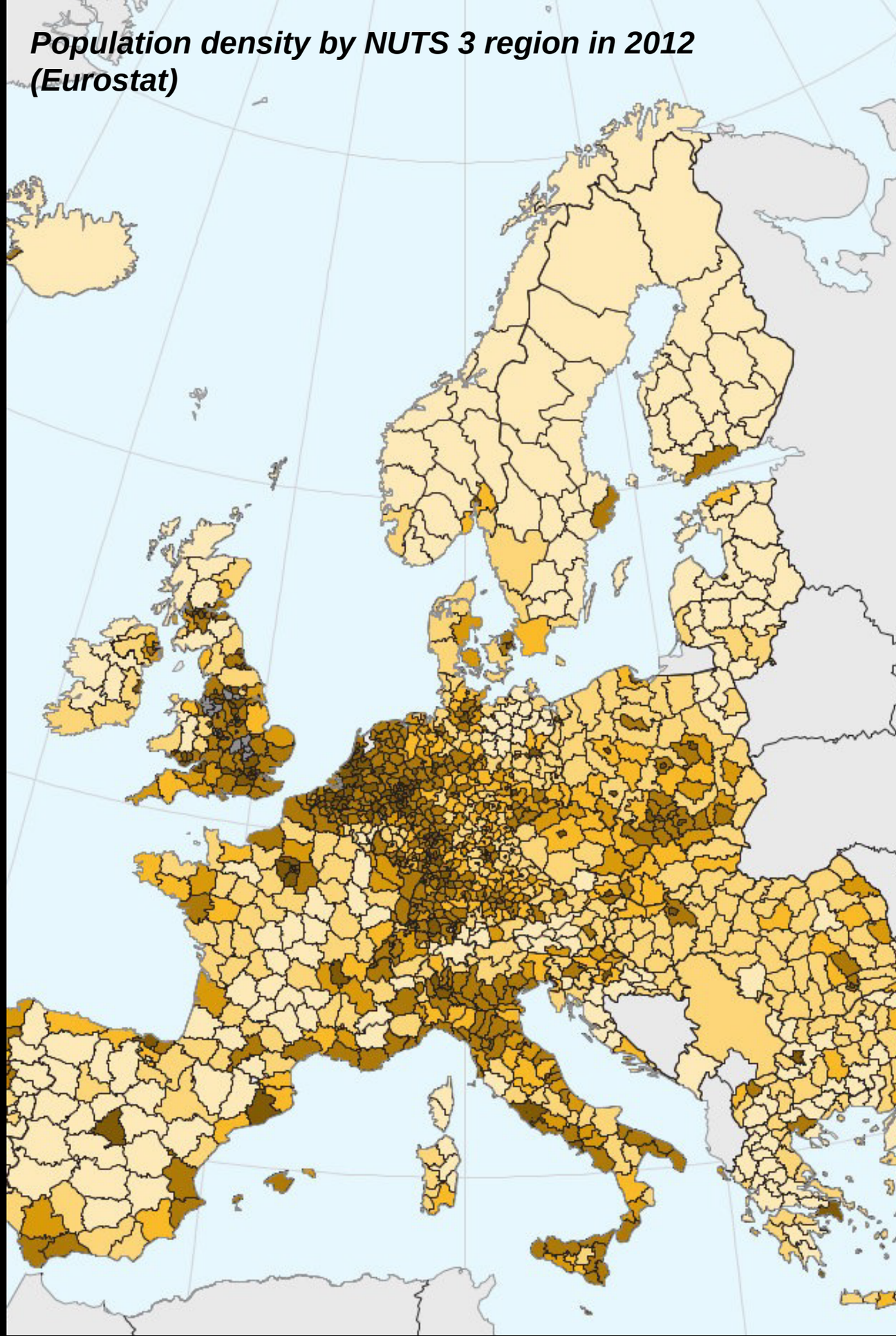
Smog, Paris, March 2014 (source: China

SELECTION OF CITIES

Criteria:

- Local organisation (mainly personal scientific and other contacts iSPEX team, air quality network)
- Population density (Eurostat)
- iPhone usage (Mobileplanet, Statcounter)
- Meteorology and air quality
- Europe representing distribution

… a challenge!



CITY CAMPAIGNS

Approach:

- Leiden Observatory: central role for distribution and campaign, incl. provision of training materials
- Local partners: distribution, training, motivating citizen participants
- 500-1000 add-ons per city

Goal:

Europe-wide citizen involvement in science through CS with iSPEX: (1) outreach and (2) pilot case for potential scientific use of CS data

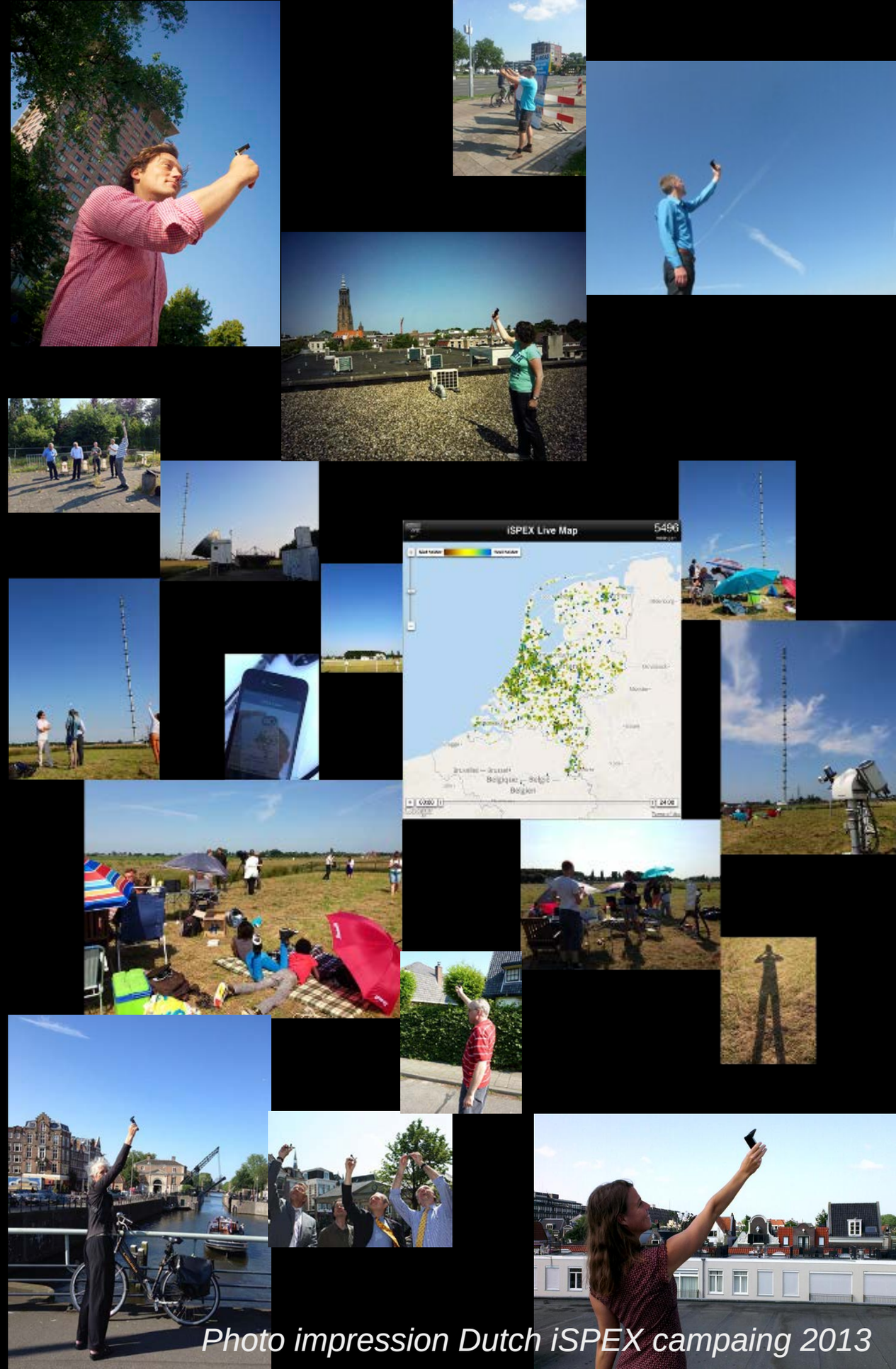


Photo impression Dutch iSPEX campaing 2013

LOCAL PARTNERS

1. Scientists involved in aerosol/air quality observation (e.g. AERONET, universities, EPA's)

2. Science outreach partners (e.g. Institute of Physics, observatories)

why:

- Scientific context, support, and potential future application

- Public outreach expertise and network

Goal: scientific and public outreach platform for iSPEX and related CS

National Observatory of Athens, Athens University, Athens (source: V. Amiridis, NOA, pers. comm.)

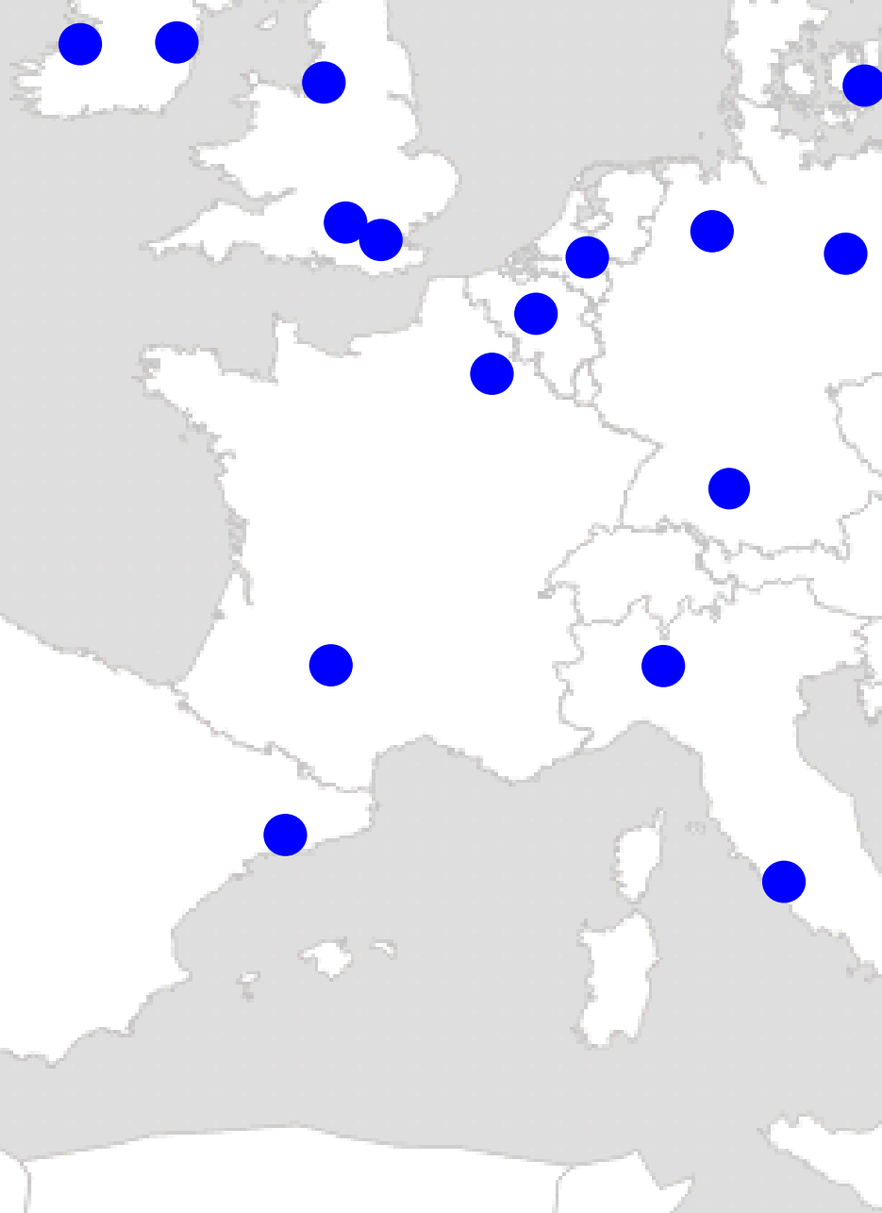
ISPEX GOES EUROPE

United Nations Educational, Scientific and Cultural Organization

International Year of Light 2015

LIGHT2015 PHOTONICS
DISCOVER THE POWER OF LIGHT

European Commission



ISPEX-EU CITIES

- Greece: Athens – NOA/IAASARS (partly included in BEYOND project)
- Spain: Barcelona – ICFO, CREAL, Barcelona Univ., Barcelona Supercomp. Center
- Serbia: Belgrade - Belgrade Univ. (EPL), Serbian Physics Society, Petnica
- Germany: Berlin – MINT Impuls, FU Berlin
- Denmark: Copenhagen – EPA Denmark
- Italy: Milan – Milan Univ., Italian Aerosol Society, Rome – ISAC-CNR, BARI – ARPA Puglia, Univ. di Bari,
- UK: London – IOP, STFC-RAL, Manchester – Univ. of Manchester
- France: Toulouse – IRAP, CNES, Observatoire de Mediterrane

Shot from iSPEX app V2.0 demonstration animation (source: APS Group)

AEROSOL MODELING DURING ISPEX-EU IN ATHENS

Modeling tool: COSMO-ART

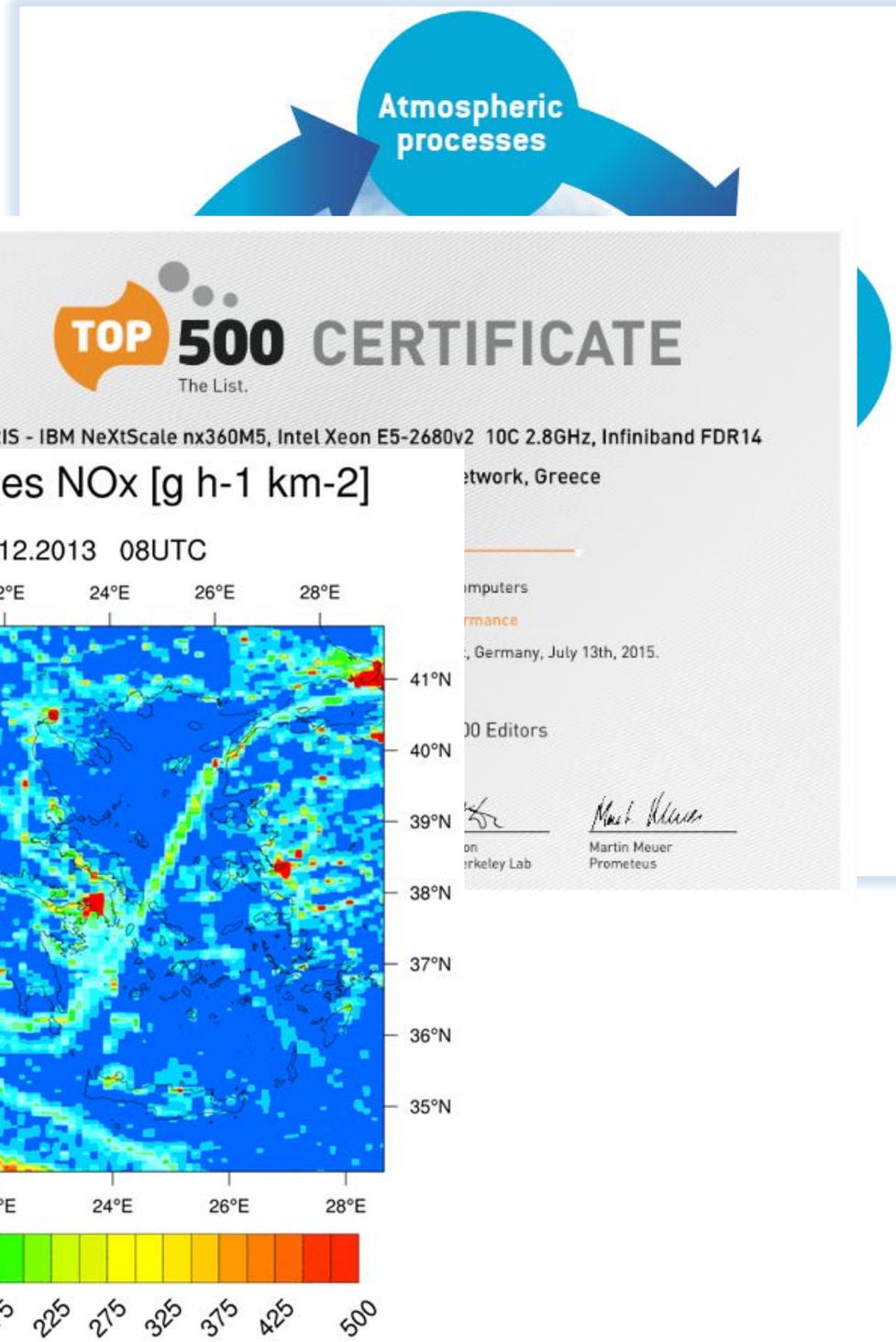
- Regional chemistry transport model online coupled meteorology (COSMO)

Collaborations for this action:

- EMPA, CH: *anthropogenic emission inputs (TNO-MACCII database)*
- German Weather Service: *meteorological inputs*
- Greek Research and Technology Network: *HPC resources (ARIS)*

Model setup for this action:

- High-resolution (<3 km) model application over Greece, centered in Athens



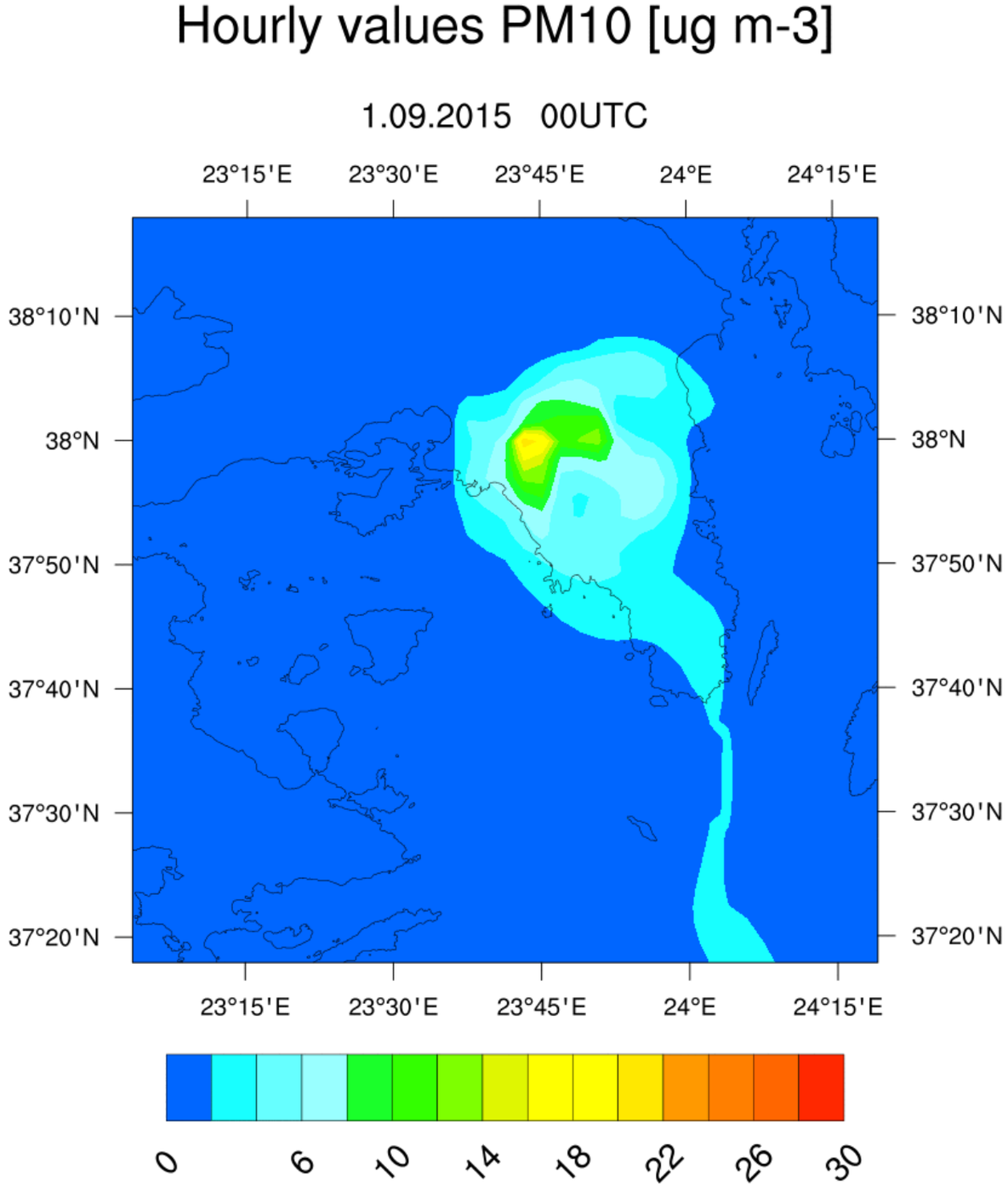
AEROSOL MODELING DURING ISPEX-EU IN ATHENS

Preliminary model output

- PM_{10} hourly concentrations 1-3 September

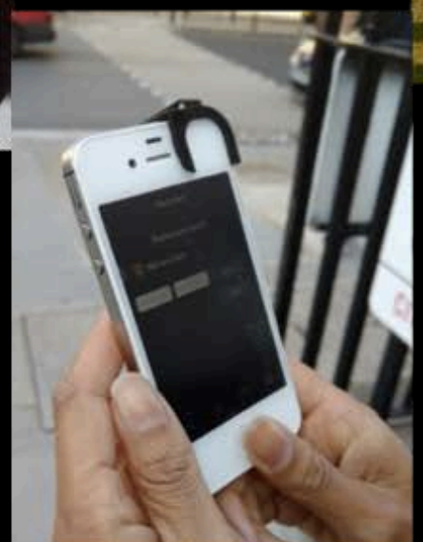
Ongoing work

- Full period simulation
- AOD outputs
- Chemical composition of PM10
- Aerosol feedbacks on atmospheric variables



SOCIAL MEDIA

ISPEX-EU 2015



ISPEX-EU IN THE MEDIA

Selection:

- The Observer, 30 August 2015

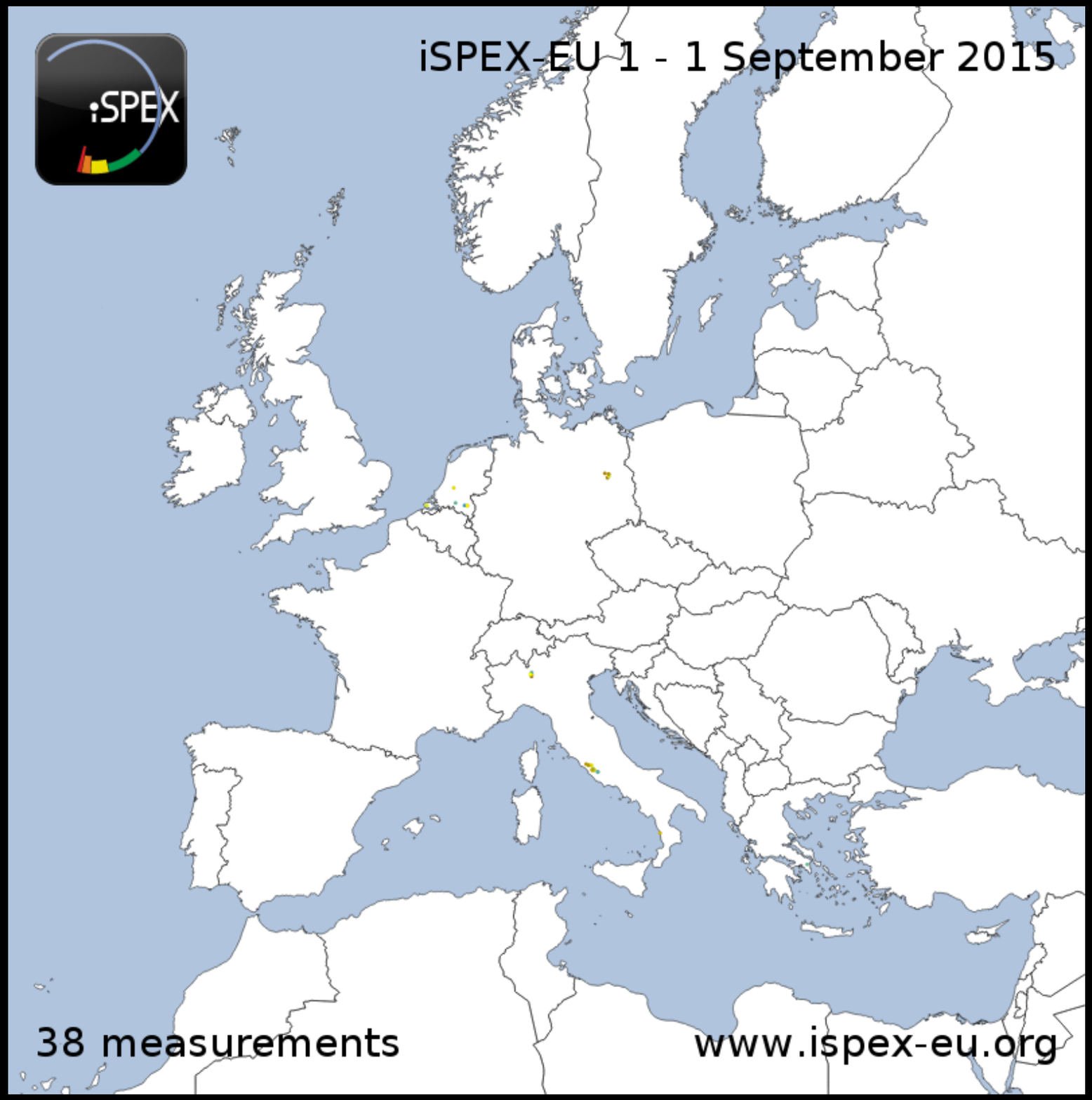
‘Wanted! An army of citizen scientists to tackle air pollution’

- BBC 4 Radio Inside Science Magazine, 3 September 2015
- Corriere della Serra, Milano Cronaca, 4 September 2015

‘Smog, parte il monitoraggio dei cittadini con lo smartphone’

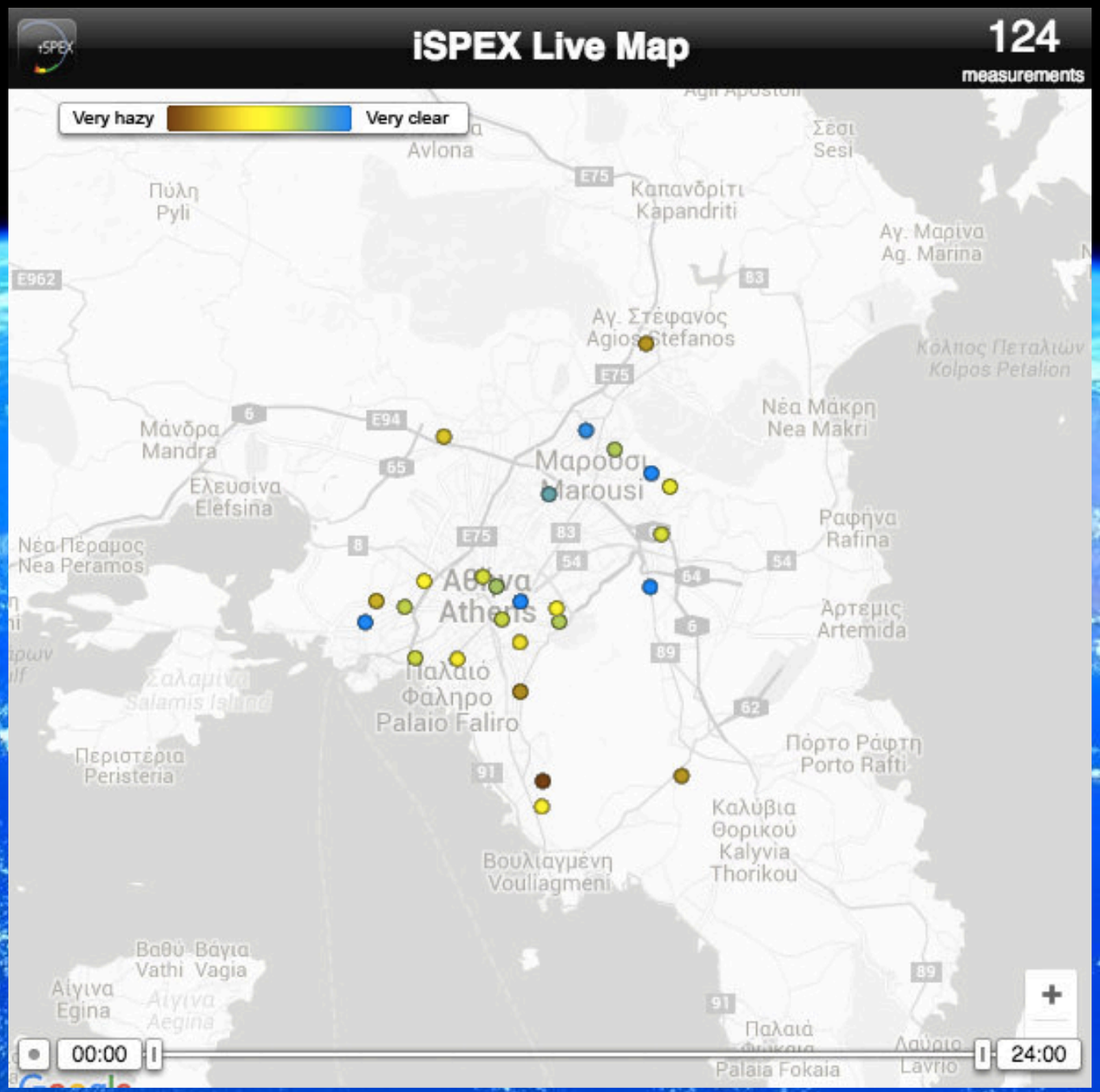
Bron: Corriere della Sera Milano, september 2015

PRELIMINARY RESULTS



Map with iSPEX-EU preliminary results

ISPEX-EU IN ATHENS



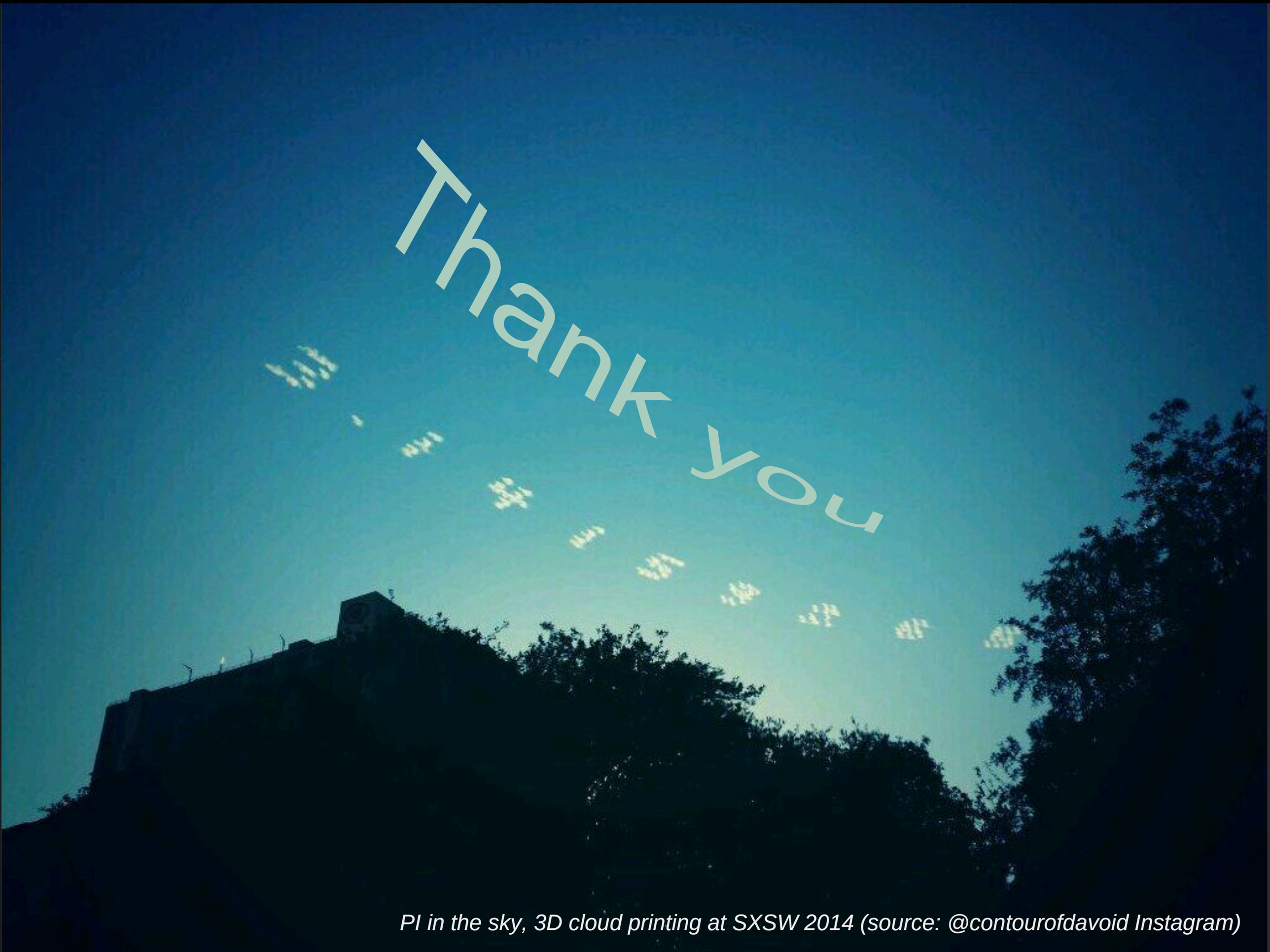
Mediterranean from ISS, 14 October 2015 (source: twitter)

ONE STEP BEYOND ISPEX

London and Zeeland as seen from the ISS
(photograph by NASA astronaut Ron Garan)

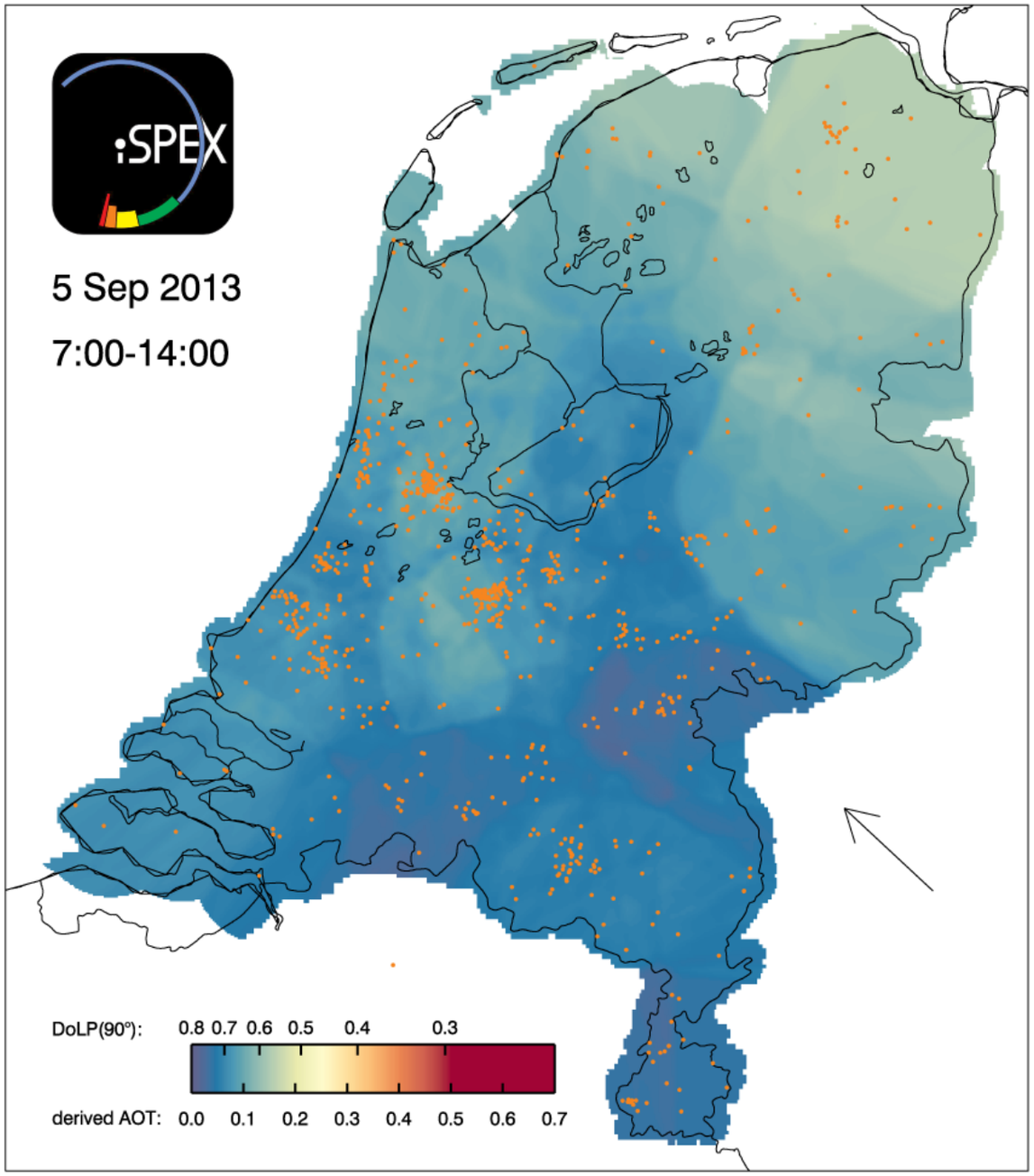
EXTRA

THANK YOU



PI in the sky, 3D cloud printing at SXSW 2014 (source: @contourofdavoid Instagram)

RESULTS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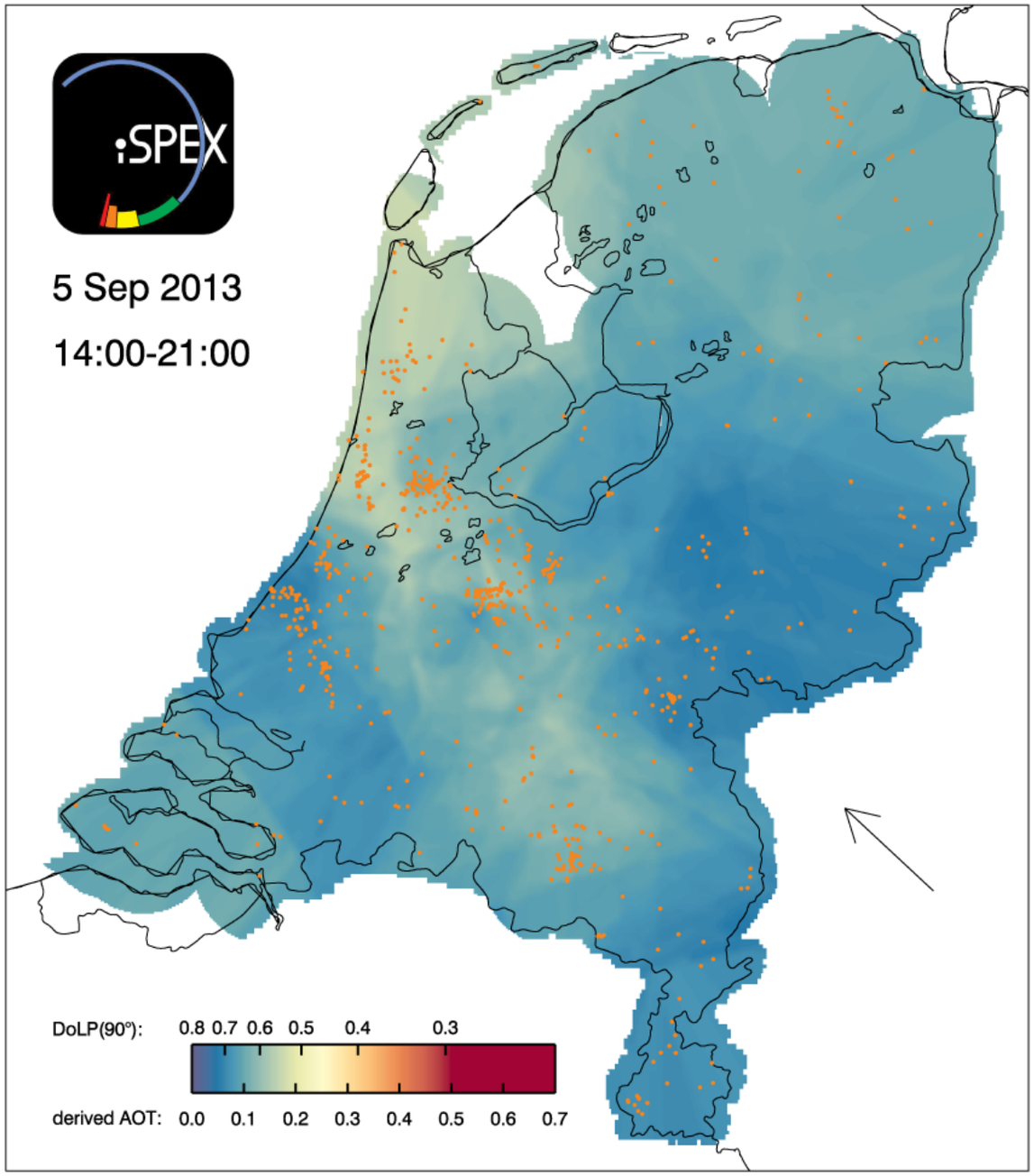
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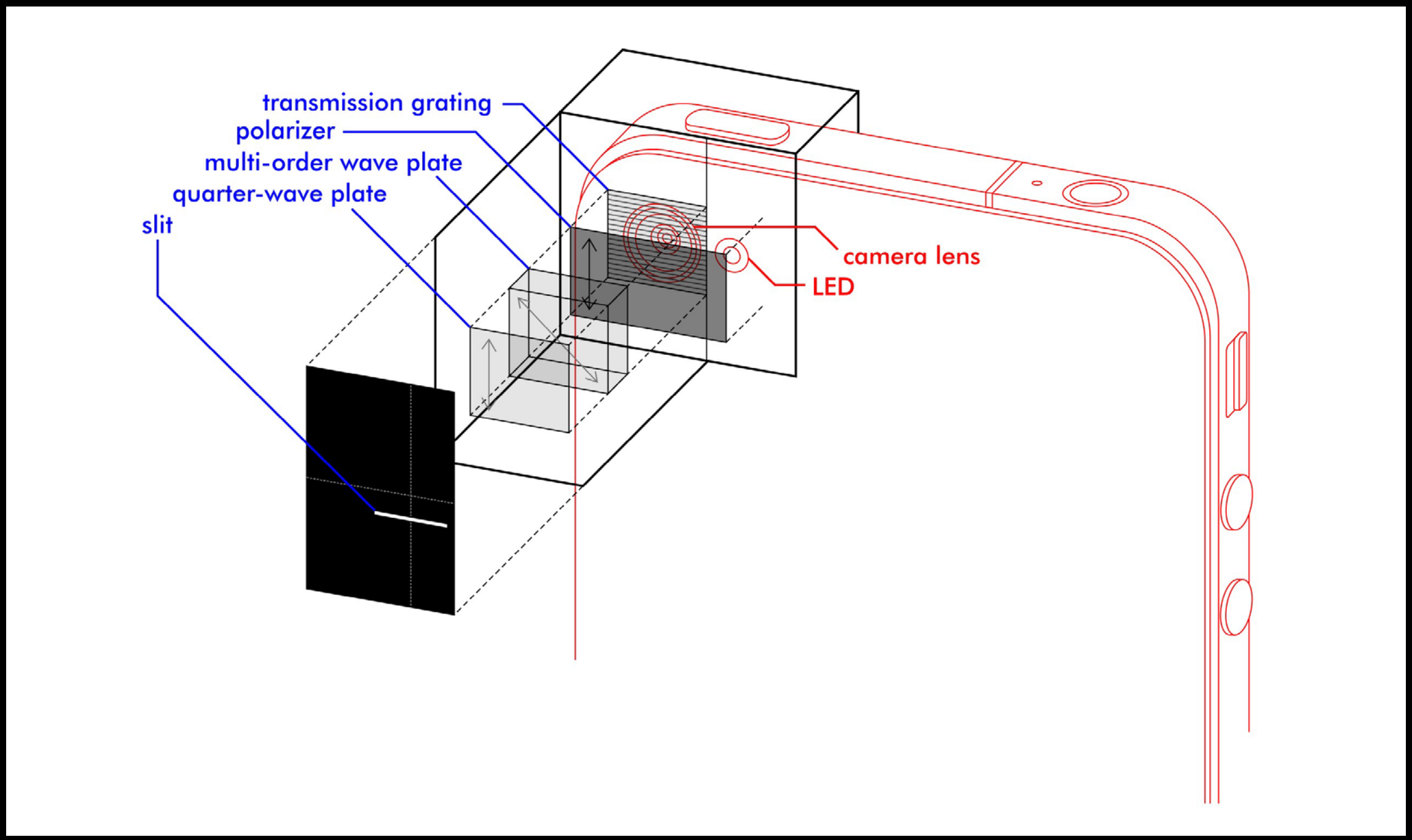
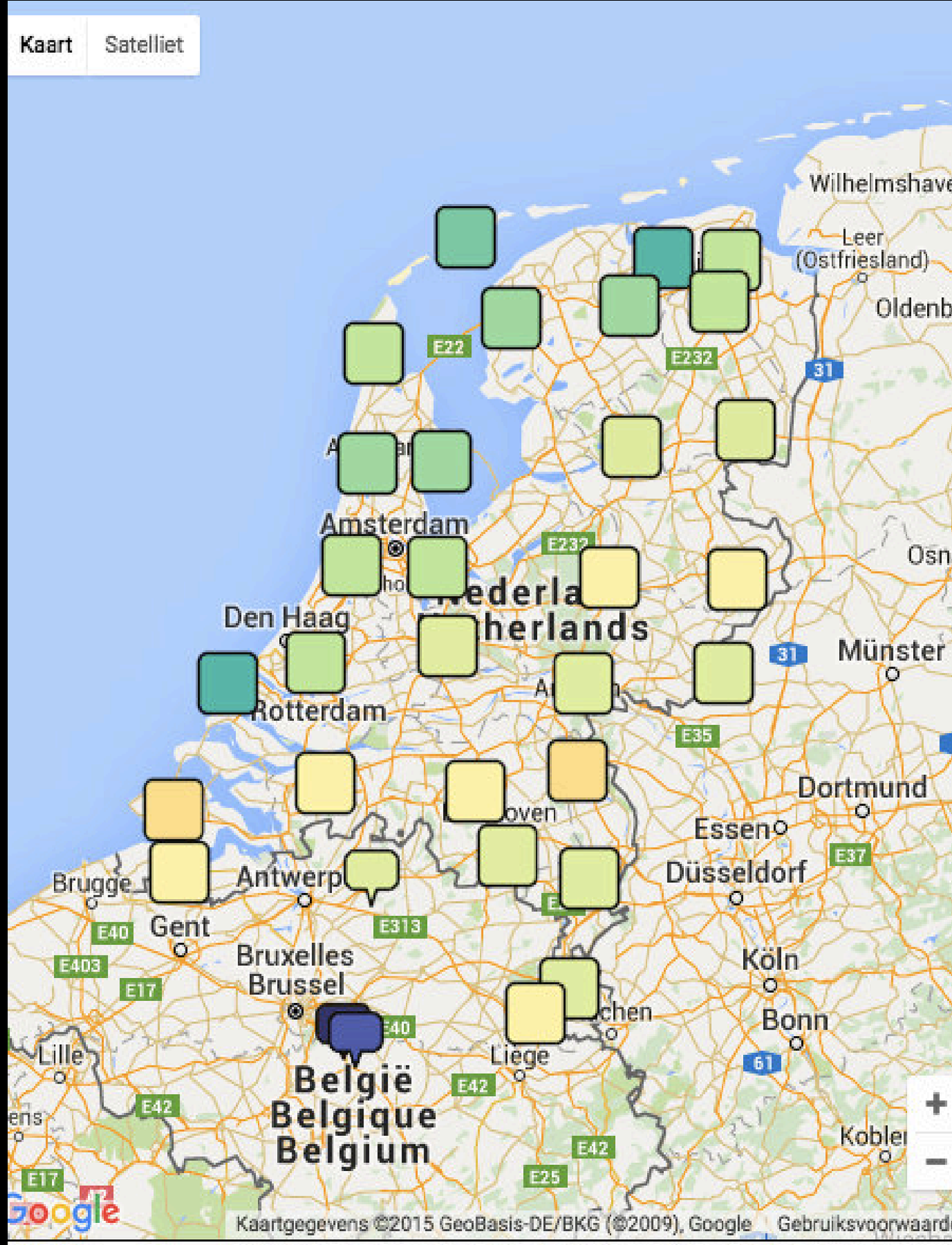
CONCEPTUAL DESIGN



POST-PROCESSED ISPEX DATA