

JIIIDE 2014

# V Jornadas Ibéricas de Infraestruturas de Dados Espaciais

Lisboa | 5 - 7 novembro 2014



INSTITUTO  
GEOGRÁFICO  
NACIONAL



JIIIE 2014



# Collaborative georeference of ISS night images for light pollution and energy consumption studies

Sánchez de Miguel, Alejandro; Gómez Castaño, José; Zamorano, Jaime; Navas, Rafael <sup>1</sup>

Lombraña, Daniel <sup>2</sup>

<sup>1</sup> Departamento de Astrofísica y CC. De la Atmósfera – Universidad Complutense de Madrid

<sup>2</sup> Crowdcrafting

crowd  
crafting



UNIVERSIDAD  
COMPLUTENSE  
MADRID

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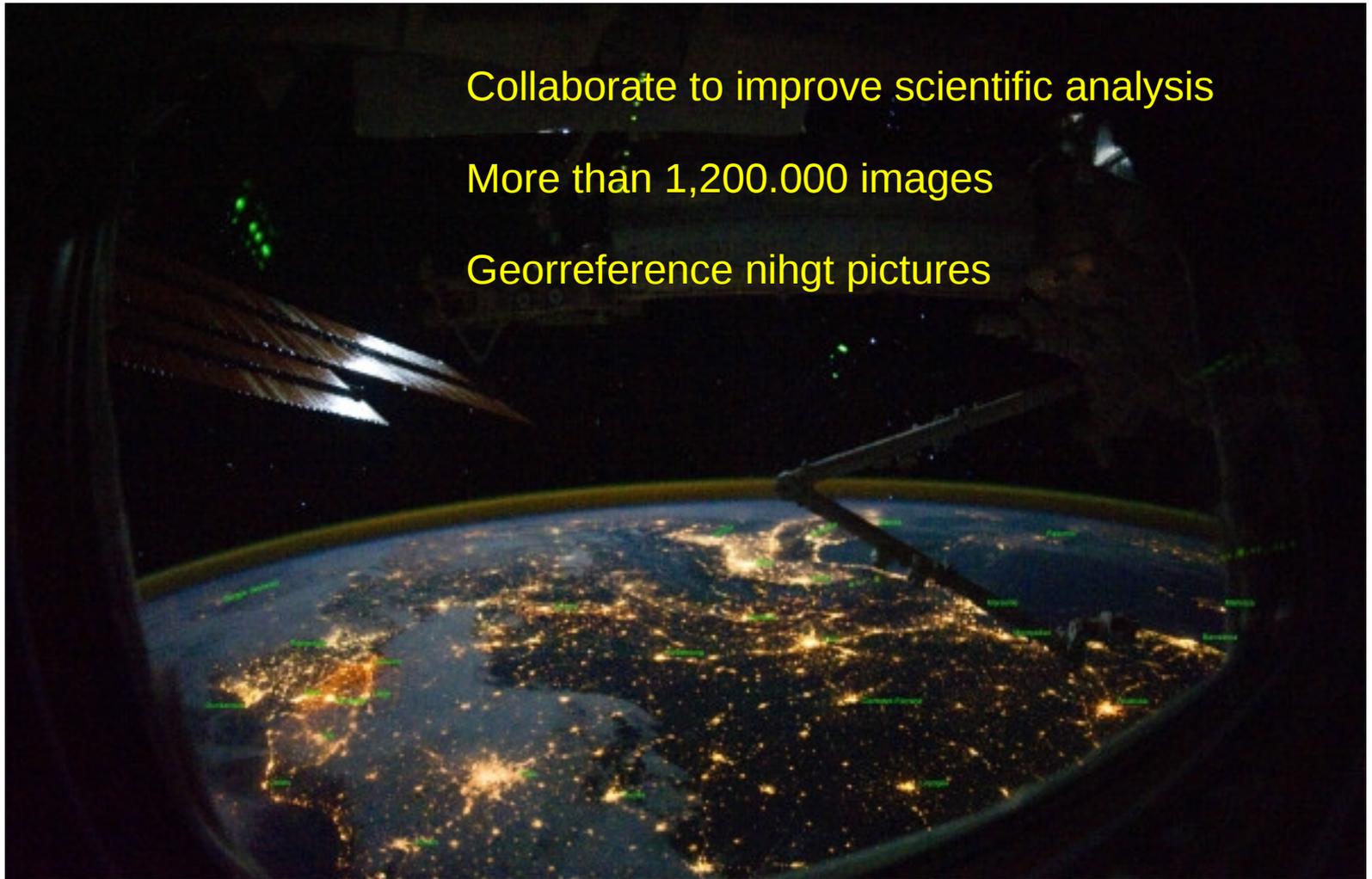
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- Image processing
- Developed Applications
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  - DarkSkies
  - LostAtNight
  - NightCitiesISS
- Data sources
- Crowdcrafting
- Participation results
- Image results



# Introducción



# Introducción



Collaborate to improve scientific analysis

More than 1,200.000 images

Georeference night pictures

ISS025E009810

# Introducción



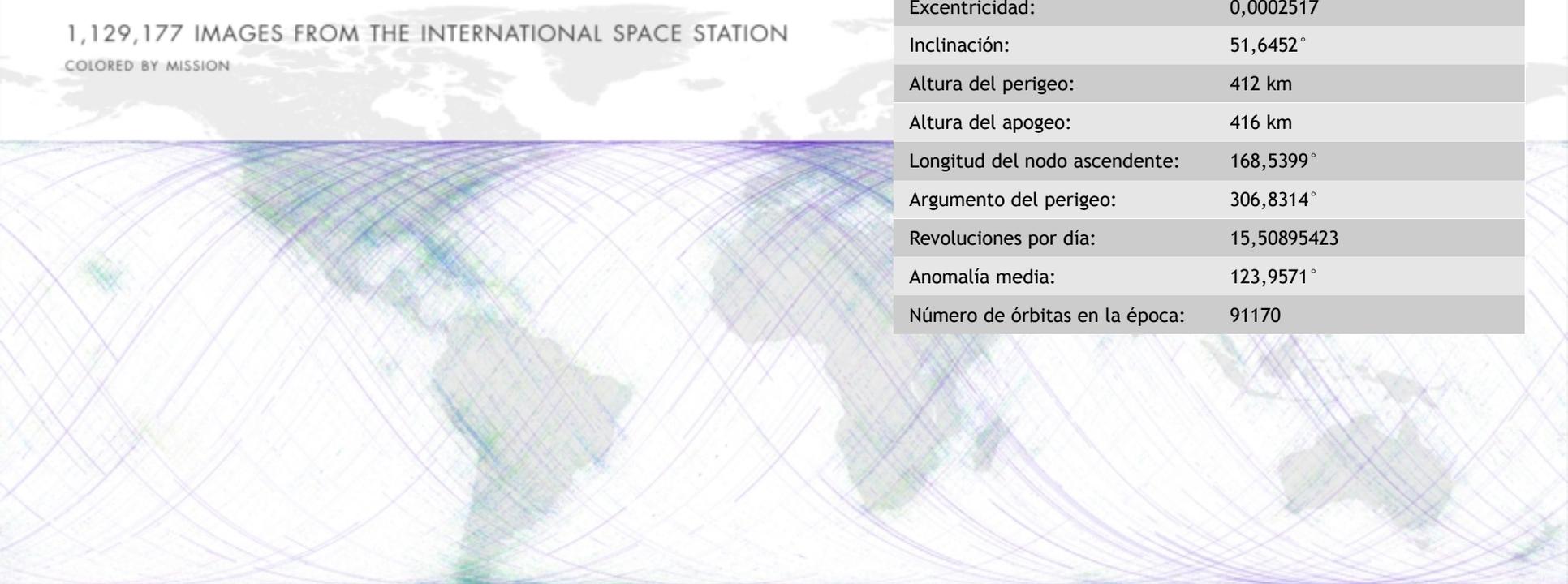
ISS025E009810



# Introducción

1,129,177 IMAGES FROM THE INTERNATIONAL SPACE STATION

COLORED BY MISSION



Época (UTC):	domingo, 26 de octubre de 2014 12:36:51
Excentricidad:	0,0002517
Inclinación:	51,6452°
Altura del perigeo:	412 km
Altura del apogeo:	416 km
Longitud del nodo ascendente:	168,5399°
Argumento del perigeo:	306,8314°
Revoluciones por día:	15,50895423
Anomalía media:	123,9571°
Número de órbitas en la época:	91170

MISSION NUMBER



[natronics.github.com/ISS-photo-locations/](https://github.com/natronics/ISS-photo-locations/)

JIIDE 2014



Two line elements

```
1 25544U 98067A 14299.52559916 .00018781 00000-0 32583-3 0 3068
2 25544 051.6452 168.5399 0002517 306.8314 123.9571 15.50895423911704
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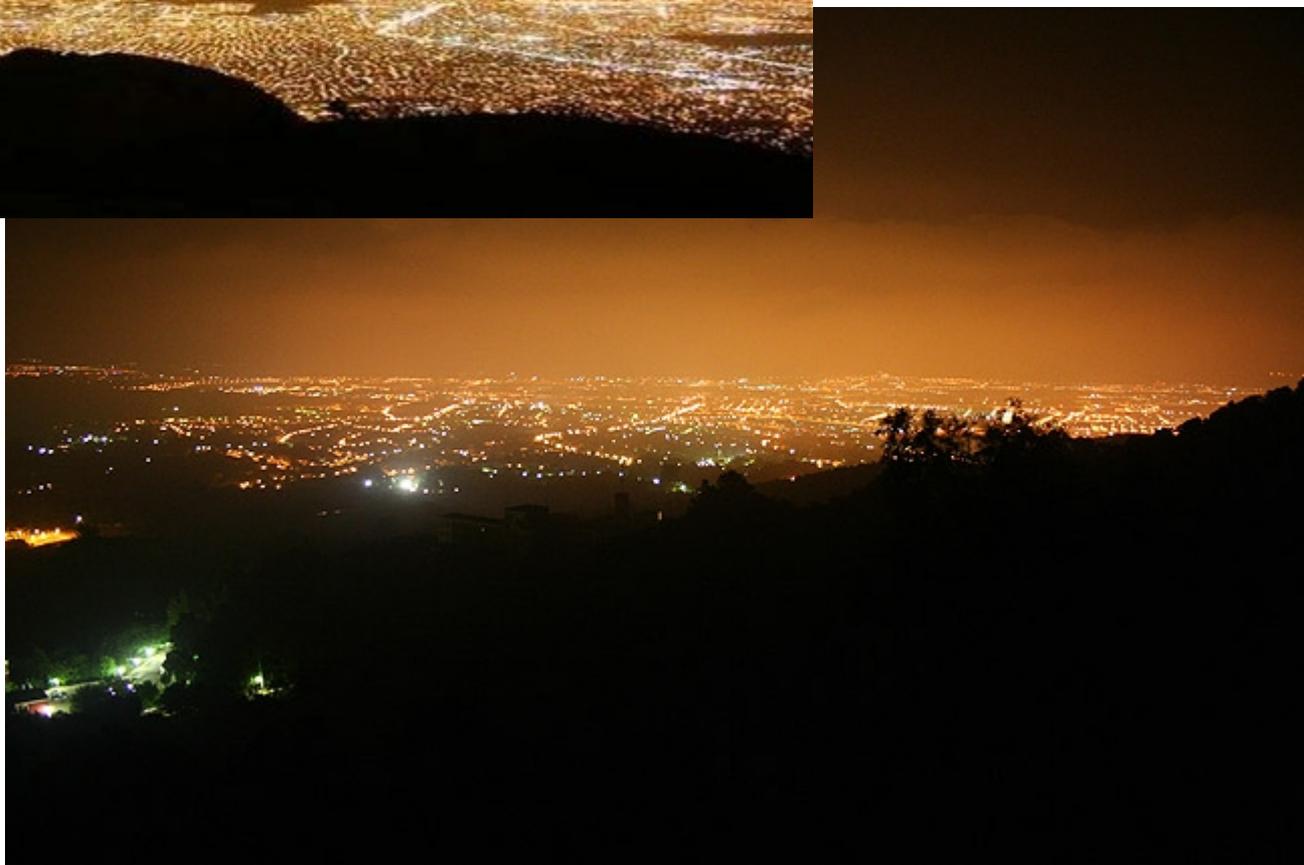
# Introducción



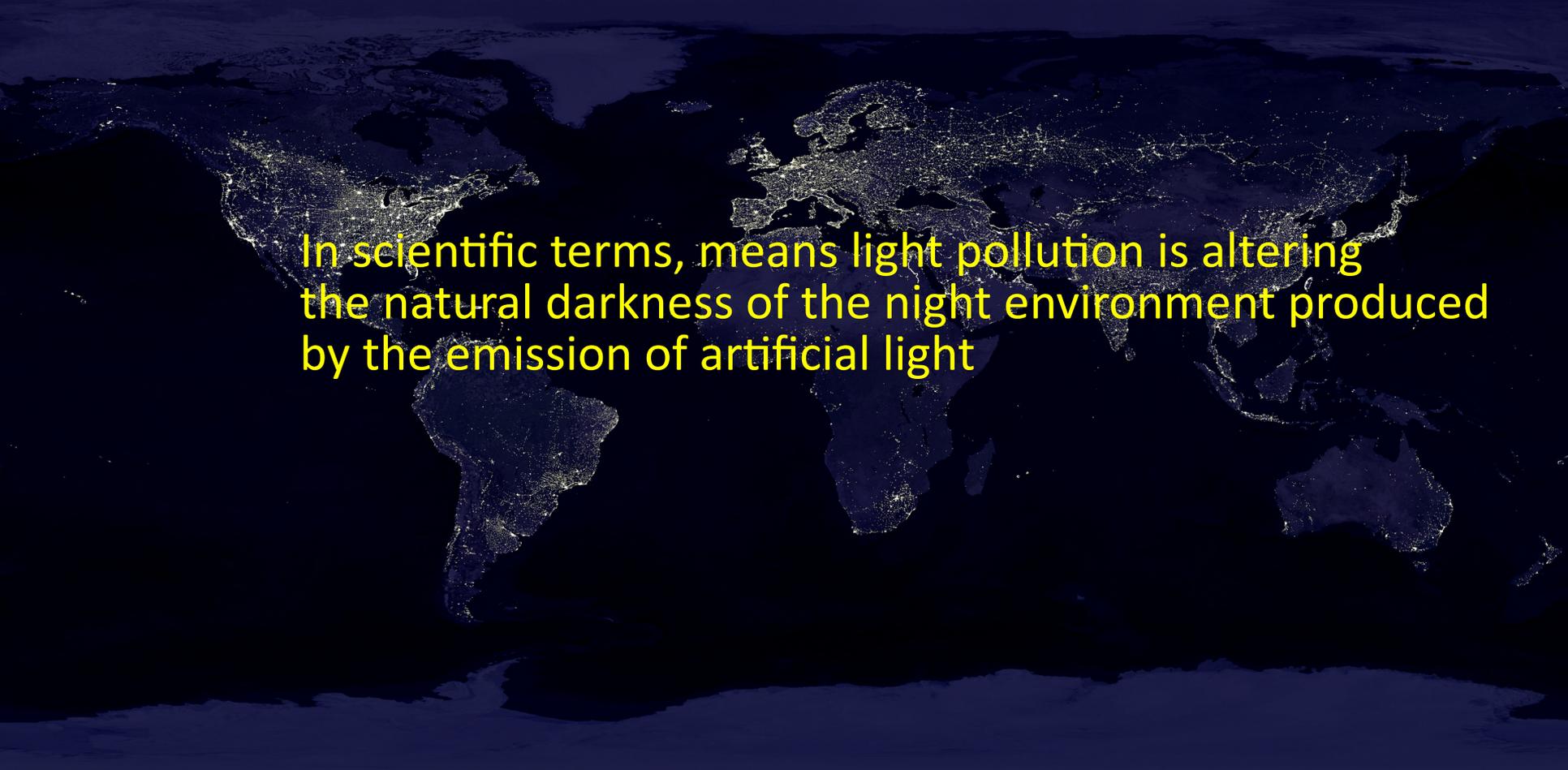
# Light pollution



# Light pollution



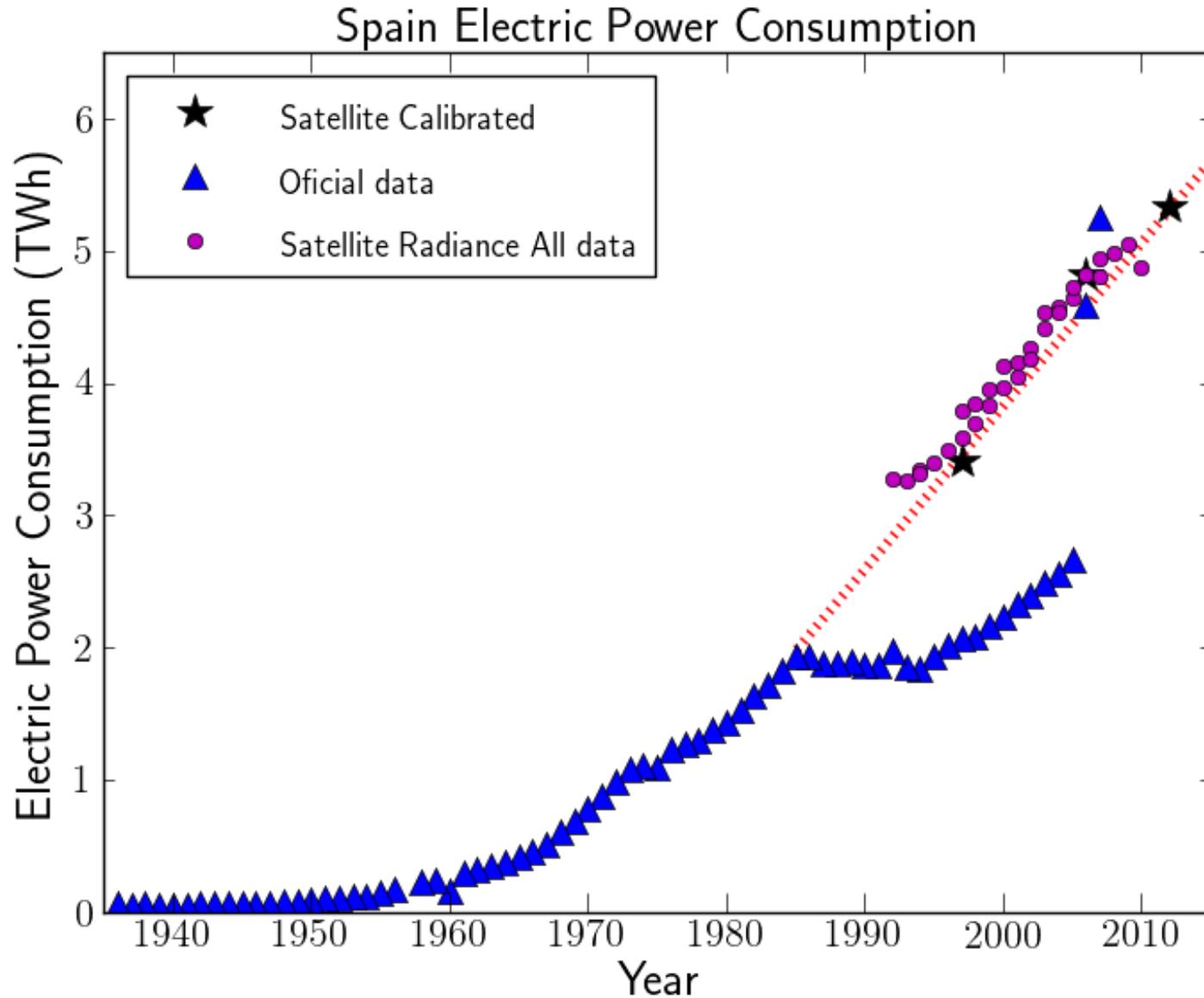
# Light pollution



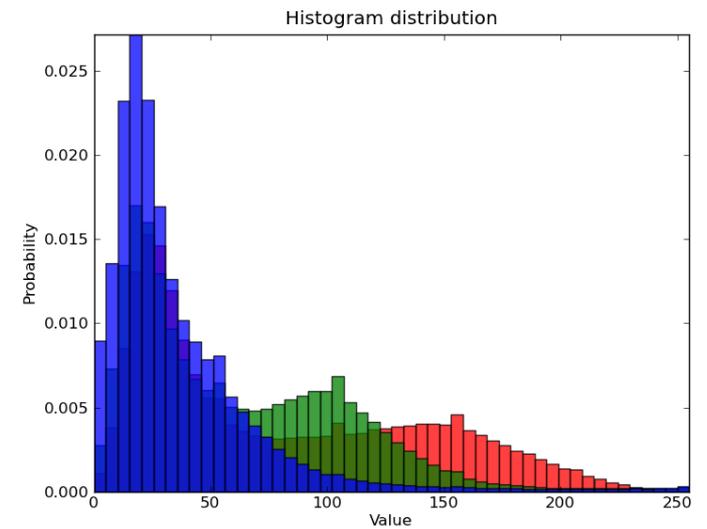
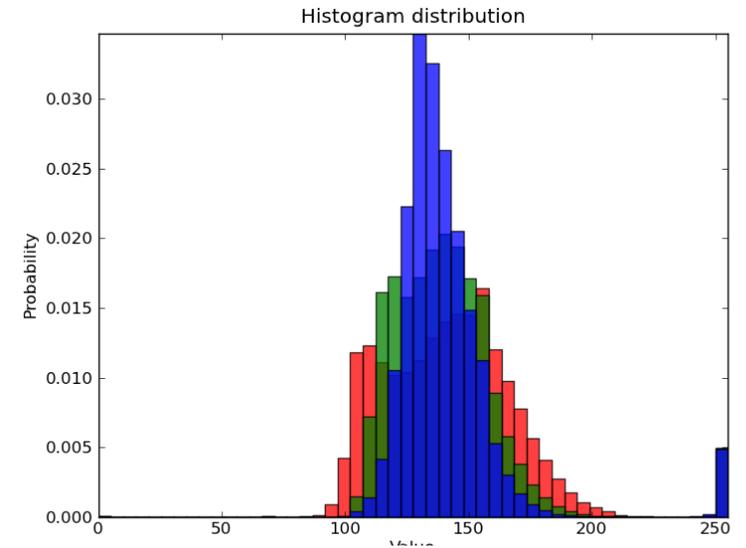
In scientific terms, means light pollution is altering the natural darkness of the night environment produced by the emission of artificial light



# Light pollution



# Image processing – Automatic analysis



# Image processing – Automatic analysis

eol.jsc.nasa.gov

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## The Gateway to Astronaut Photography of Earth

(NASA Crew Earth Observations)

**Find Photos**

**Collections**

**Information**

**For Fun**

**Videos**

**Connected**

**Request New Imagery**

### Earth Observation Team's Top Picks Today



# HDEV

Pause < > Showing 2 of 12

High Definition Earth Viewing (HDEV) System

**New Videos**



### Astronauts on Twitter

Recently Flown Astronauts on Twitter:



Reid Wiseman



Alexander Gerst



Max Suravev

Join the conversation



### Image Detective

An interactive hunt for the Earth location of astronaut imagery from space

"We catch a glimpse of a huge swirl of clouds out the window over the middle of the Pacific Ocean, or the boot of Italy jutting down into the Mediterranean, or the brilliant blue coral reefs of the Caribbean strutting their beauty before the stars. And...we experienced those uniquely human qualities: awe, curiosity, wonder, joy, amazement."  
(Russell L. Schweickart, Apollo Astronaut ("The Home Planet"))

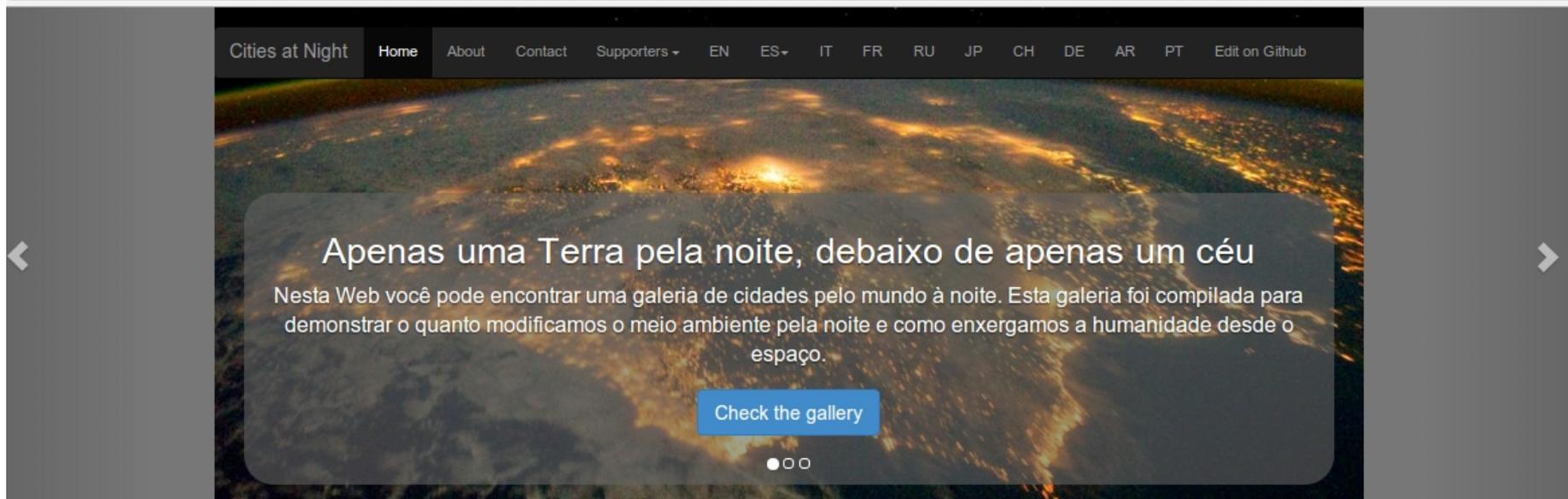
# Image processing – picture data

NASA PHOTO ID:	iss039e009160.NEF
GMT:	2014:04:02 21:06:27
MODEL:	NIKON D3S S/N: 2007931
NASA SN and Temp:	NASA#2007931
Firmware:	Ver.1.00
Image Size:	4288x2844
Compression:	Nikon NEF Compressed
Exposure Program:	Manual
Shutter:	1/8
Aperture:	2.8
Meter Mode:	Multi-segment
Shooting Mode:	Single-Frame
ISO Speed:	25600
AF Area Mode:	Single Area
Focal Length:	31.0 mm
Lens ID:	AF-S Zoom-Nikkor 28-70mm f/2.8D IF-ED
DOF:	14.11 m (4.38 - 18.49)
Focus Mode:	Manual
Focus Distance:	7.08 m
Subject Distance Range:	Unknown
Compensation:	0
Noise Reduction:	Off
Whitebalance:	Auto
Flash:	No Flash
Flash Mode:	Did Not Fire
Flash Commander Mode:	Off
Flash Compensation:	0
Flash Control Mode:	Off
Flash Group A Control Mode:	Off
Flash Group B Control Mode:	Off
Self Timer Time:	5 s



# Developed applications – Cities At Night

www.citiesatnight.org/index\_PT.html



## Cidades pela noite

Desde 2003, os astronautas estiveram fazendo fotos da Terra desde a Estação Espacial Internacional (ISS). Muitas destas imagens foram publicadas por diferentes meios de comunicação e pela Internet, em lugares como as contas de Twitter dos astronautas. Entretanto, a maioria das imagens ainda não foram publicadas e continuam em arquivos privados longe do olhar público. Criamos uma seção adicional em nossa [galeria](#) dedicada em mostrar mais de mil imagens de cidades no período da noite. Entretanto, ainda há centenas de milhares de fotos esperando a ser publicadas no arquivo. [Você pode ajudar.](#)

[View details »](#)

## Poluição Lumínica

A Poluição Lumínica causa diversos problemas. Seus efeitos podem ser medidos desde dentro dos nossos quartos à milhas de distância. A luz destrói a essência da escuridão noturna. Os humanos têm um medo ancestral da escuridão. Mas muita luz produz efeitos negativos no ecossistema e na nossa saúde.

Imagens de satélite ajudam a comparar e medir grandes áreas iluminadas. Com as cores das imagens tiradas pelos astronautas desde a Espaço espacial Internacional (ISS), podemos medir a eficácia da iluminação em muitas cidades do planeta.

[View details »](#)

## Ciência Cidadã

Ciência cidadã é uma ferramenta para a investigação científica e educacional. Enquanto você nos ajuda a classificar milhares de fotos dos astronautas, você pode aprender geografia e descobrir como é a Terra à noite. Nós humanos somos mais eficientes que os computadores na hora de reconhecer padrões, por isso qualquer cidadão pode fazer uma contribuição significativa.

Necessitamos voluntários para ajudar a separar e classificar as imagens, e identificar a localização das mesmas para criar mapas de contaminação lumínica.

Isso ajudará governos e autoridades a tomar decisões corretas para reduzir a contaminação.

# Developed applications – Cities At Night

## Galeria de cidades no período noturno



## Help us to locate cities

The first step is locate the city which appears in the picture. Here you can find where was the ISS at the moment when the picture was taken. Just click on any red dot and identify it <http://crowdcrafting.org/app/LostAtNight>



## Ajude-nos a geolocalizar as cidades

Clique em qualquer imagens e acesse a nossa app de georeferenciação. Selecione alguns pontos na imagem da ISS e localize os mesmos pontos no nosso mapa. essa informação nos permite identificar corretamente as estruturas da cidade. A app original está em <http://crowdcrafting.org/app/nightcitiesis>



# Developed applications – DarkSkies



COMMUNITY

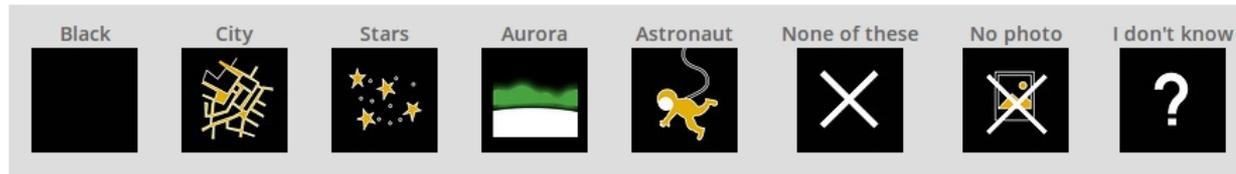
PROJECTS

ABOUT

jgcasta



CREATE YOUR PROJECT



Earth Science and Remote Sensing Unit, NASA-Johnson Space Center. "The Gateway to Astronaut Photography of Earth."



<http://crowdcrafting.org/app/darkskies/>  
<https://github.com/pmisson/darkskiesISS>

# Developed applications – LostAtNight



COMMUNITY [PROJECTS](#) ABOUT

jgcasta



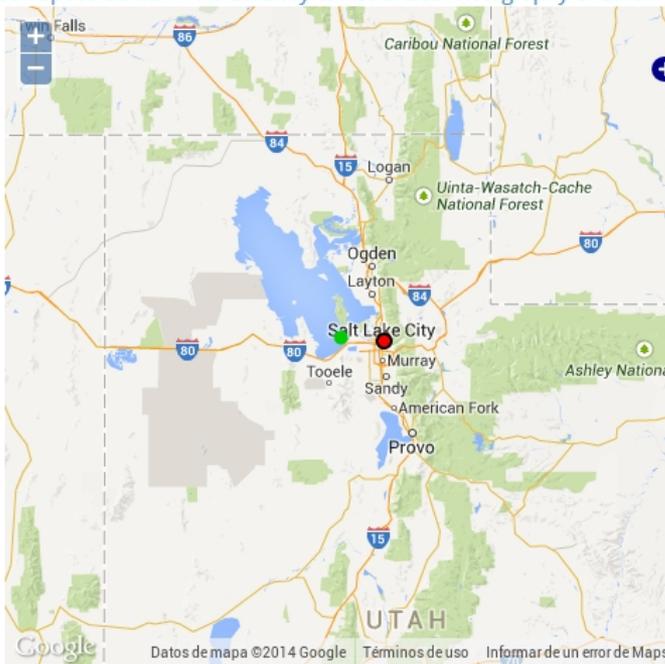
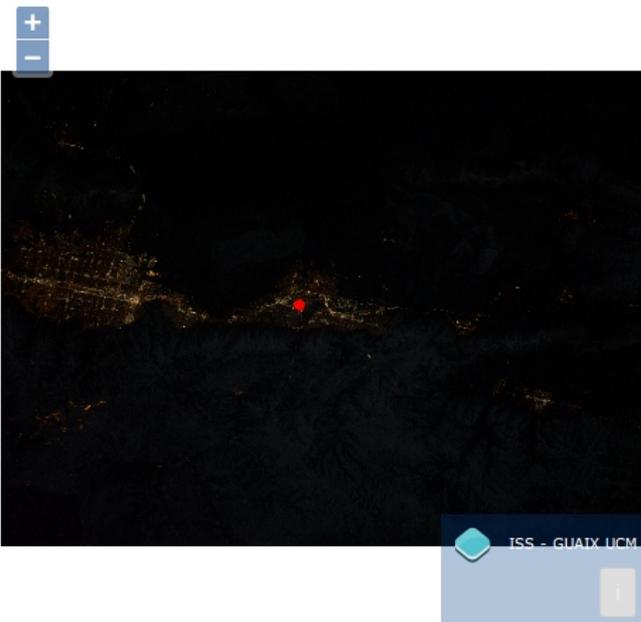
CREATE YOUR PROJECT

Save No photo I don't know

Sharp:  Good  Medium  Poor  Cloudy:  None  Less than 50%  More than 50%

Use the [+] and [-] buttons to Zoom In and Zoom Out. Keep Shift + Left mouse button pressed while moving the mouse will rotate the image.

ISS picture data - Earth Science and Remote Sensing Unit, NASA-Johnson Space Center. "The Gateway to Astronaut Photography of Earth."



Remove Selected



1991, 1437

Lon, Lat

-111.864917,40.7

2012 Night View from SNPP-VIIRS



tweet +5 Recomendar esto en Google

Me gusta Compartir A 37 personas les gusta esto.



<http://crowdcrafting.org/app/LostAtNight/>  
<https://github.com/jgcasta/lostatnight>

# Developed applications – NighthCitiesISS



COMMUNITY [PROJECTS](#) ABOUT

Jgcasta

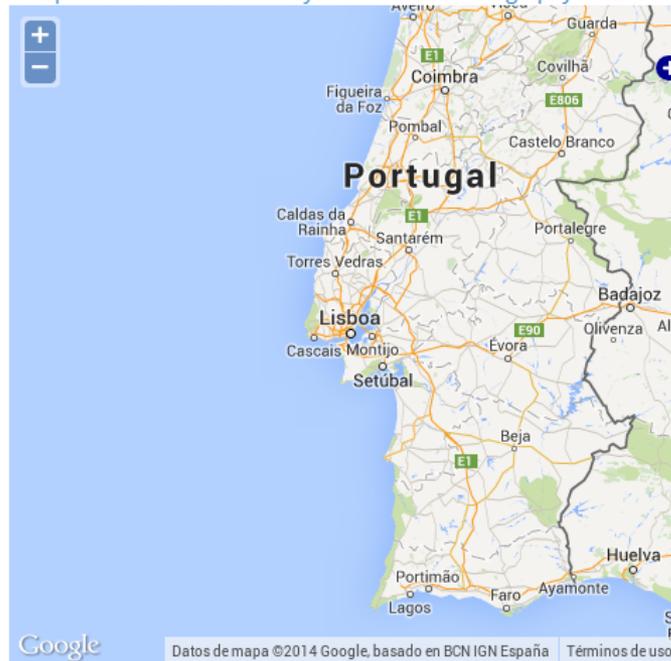


CREATE YOUR PROJECT

Save No photo I don't know

and Zoom Out. Keep Shift + Left mouse button pressed while moving the mouse will rotate the image.

ISS picture data - Earth Science and Remote Sensing Unit, NASA-Johnson Space Center. "The Gateway to Astronaut Photography of Earth."



Remove Selected

X,Y and Lon,Lat coordinates

--	--

2012 Night View from NPP-VIIRS. Red point indicates ISS nadir



Tweet 0

+7 Recomendar esto en Google

Me gusta Compartir A 265 personas les gusta esto.



<http://crowdcrafting.org/app/nightcitiesiss/>  
<https://github.com/jgcasta/nightcitiesiss>

# Data Sources

- ISS images
- ISS picture metadata
- OSM
- GoogleMaps
- VIIRS



eol.jsc.nasa.gov/sseop/clickmap/map083.htm

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## The Gateway to Astronaut Photography of Earth

(NASA Crew Earth Observations)

### Search All Astronaut Photography of Earth - Clickable Map

Latitude, Longitude Range: (30,-15) to (45,0)

An interactive map of the Iberian Peninsula showing astronaut photography locations. The map is overlaid with a grid of latitude and longitude lines. Key locations are marked with red dots and labeled: Bordeaux, Oporto, Lisbon, and Gibraltar. The map shows the terrain and the surrounding oceans.

Find Photos  
Collections  
Information  
For Fun  
Videos  
Connected  
Request New Imagery

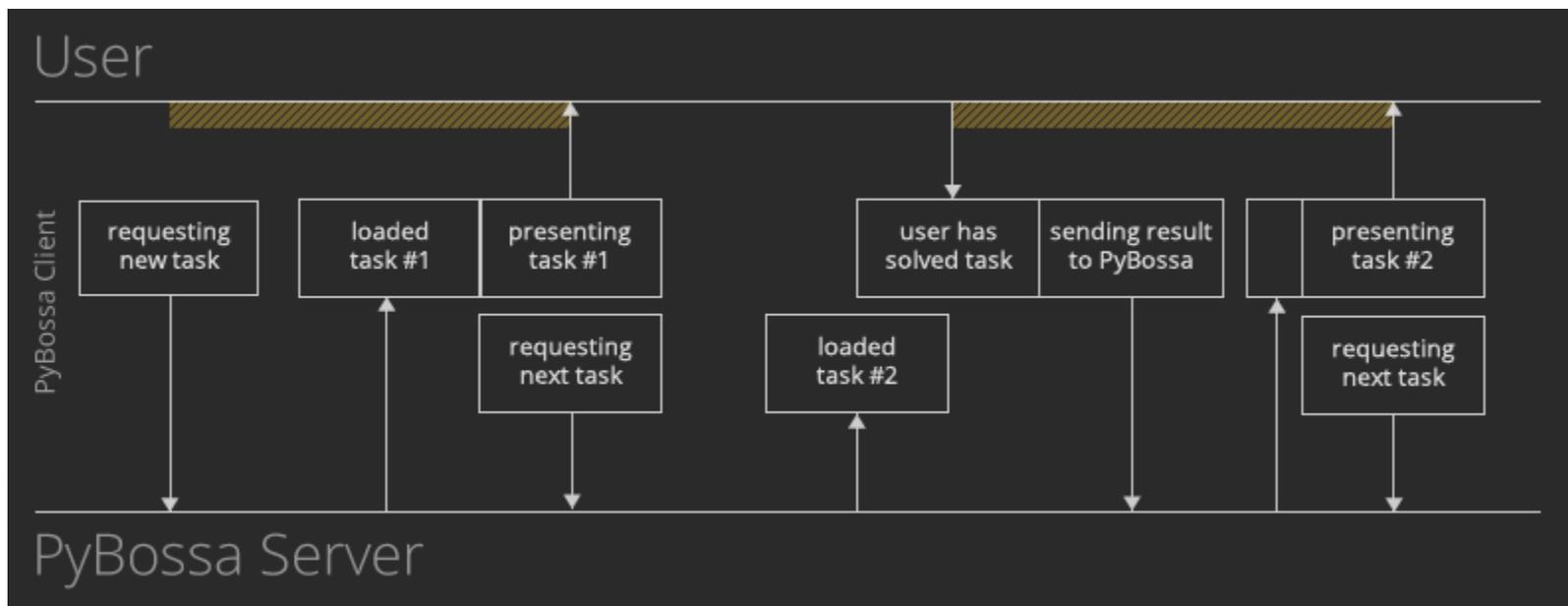
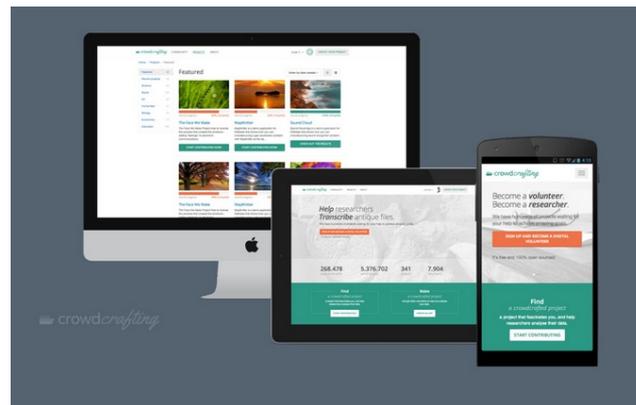
"We catch a glimpse of a huge swirl of clouds out the window over the middle of the Pacific Ocean, or the boot of Italy jutting down into the Mediterranean, or the brilliant blue coral reefs of the Caribbean strutting their beauty before the stars. And...we experienced those uniquely human qualities: awe, curiosity, wonder, joy, amazement."  
(Russell L. Schweickart, Apollo Astronaut ("The Home Planet"))



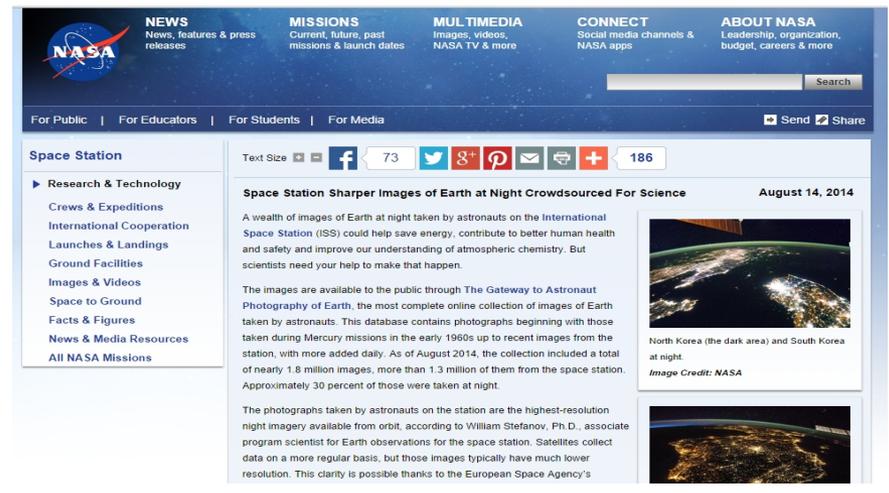
## Crowdcrafting and tools

# Science is too important to be left to scientists

HTML5  
Python  
QGIS  
PostGIS  
Open Source  
Open Science



# Results of participation



Other potential applications include evaluating lighting for road and public safety and correlating light pollution with effects on human health and biodiversity.

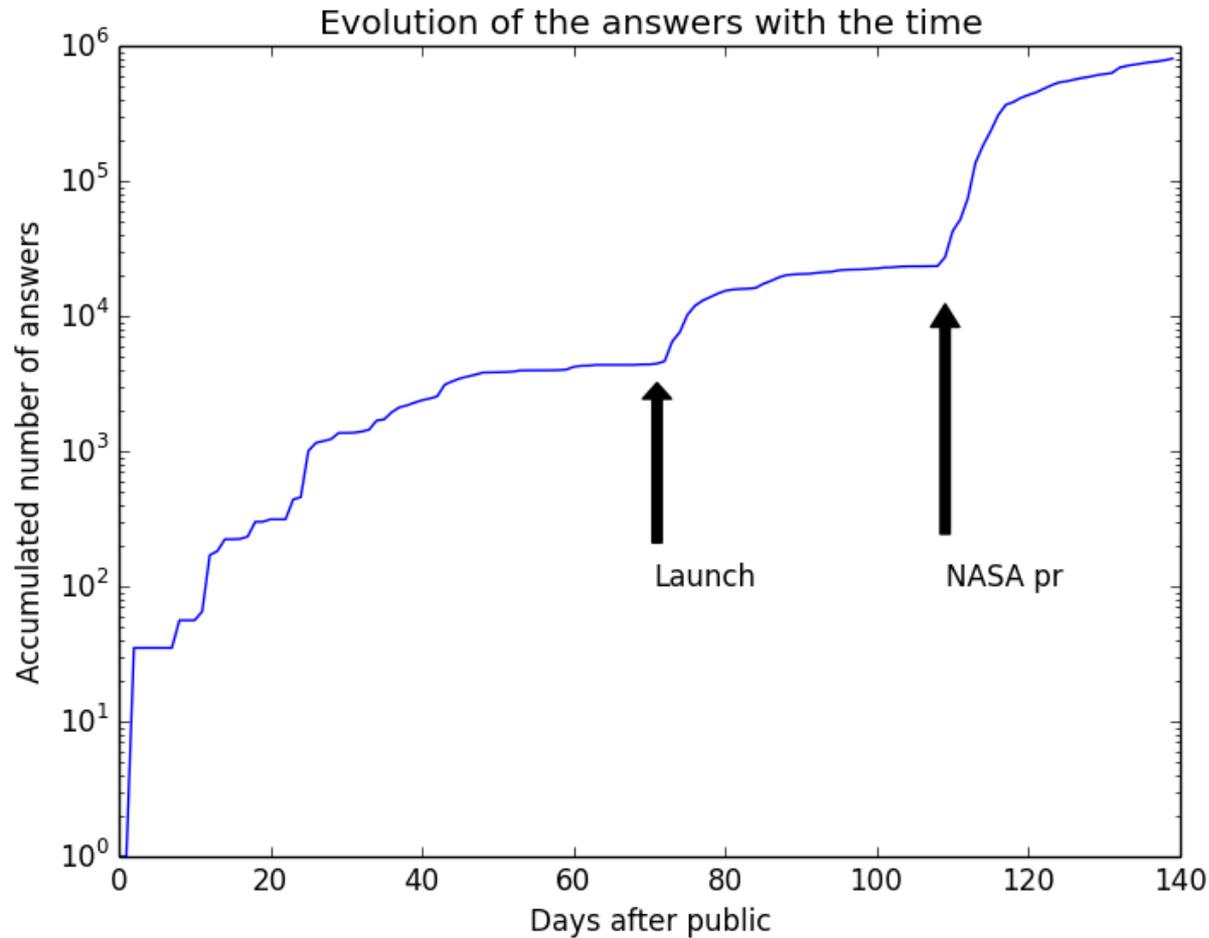
The atlas is a collaboration of UCM, Medialab Prado, Spanish Light Pollution Research Network, European Cooperation in AstroMadrid



## Results of participation – Country distribution

Country	Sesiones	
USA	68.522	35,98%
Spain	17.975	9,44%
Germany	14.861	7,80%
New Zealand	8.702	4,57%
United Kingdom	8.468	4,45%
Canada	8.203	4,31%
Italy	6.328	3,32%
Lithuania	4.391	2,31%
Denmark	4.027	2,11%
Australia	3.775	1,98%

## Results of participation



190000 unique sessions – 135000 images classified

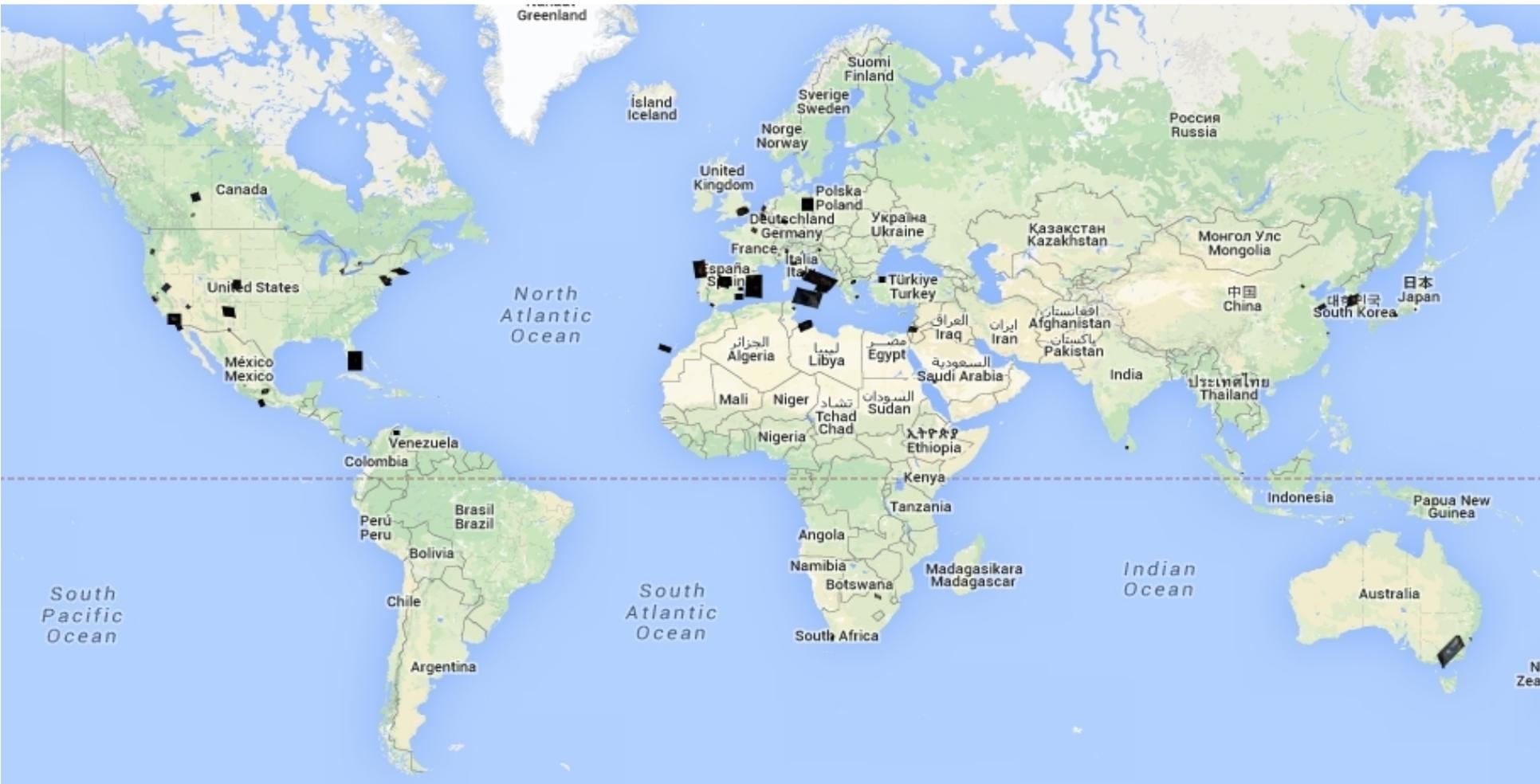


## Results of participation - Download data in JSON format

```
{
  "info": {
    "linkData": "http://eol.jsc.nasa.gov/scripts/sseop/photo.pl?mission=ISS037&roll=E&frame=17703",
    "link_big": "http://eol.jsc.nasa.gov/sseop/images/ESC/large/ISS037/ISS037-E-17703.JPG",
    "link_small": "http://eol.jsc.nasa.gov/sseop/images/ESC/small/ISS037/ISS037-E-17703.JPG",
    "citylat": "38.1156879",
    "focal": "400.0",
    "coordimage": "http://eol.jsc.nasa.gov/scripts/SSEOP/MapCoordinate/MapCoordinate.pl?
lat=38.8&lon=10.1",
    "idiss": "17703",
    "citylon": "13.3612671"
  },
  "n_answers": 20,
  "quorum": 0,
  "calibration": 0,
  "created": "2014-07-16T21:59:04.755231",
  "app_id": 1712,
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}
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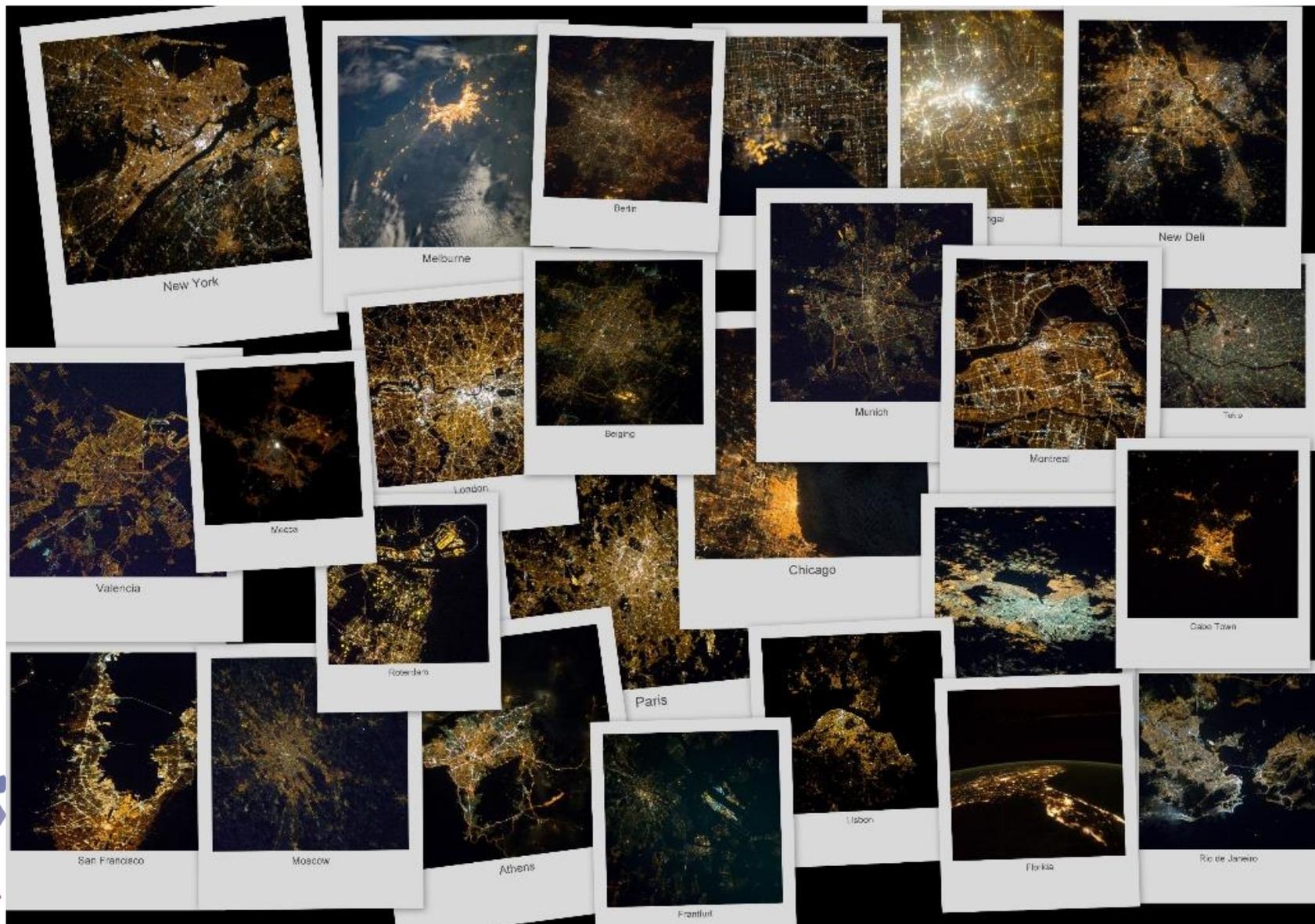
# Results of participation – Image visualization



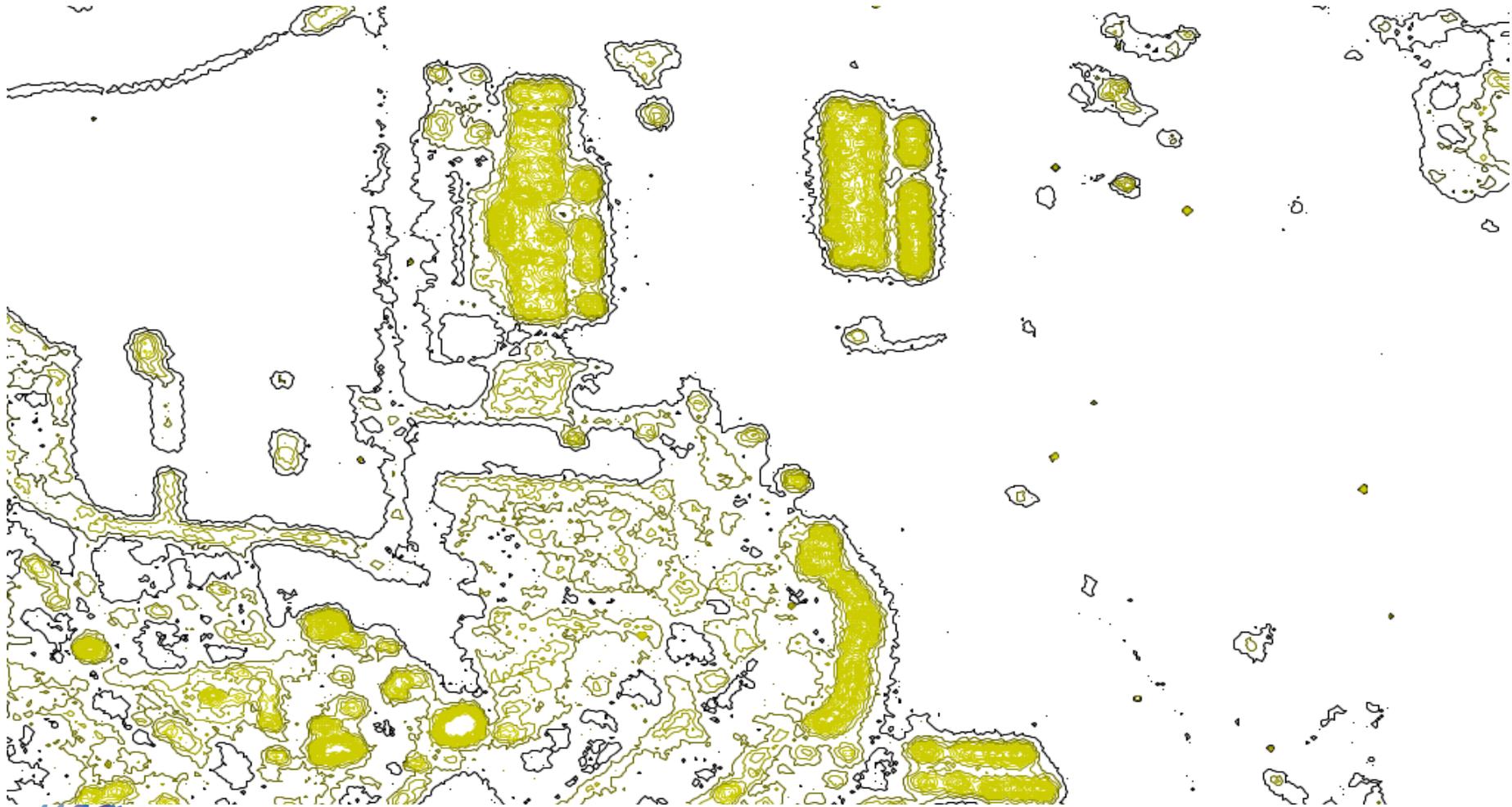
## Results of participation – Image visualization



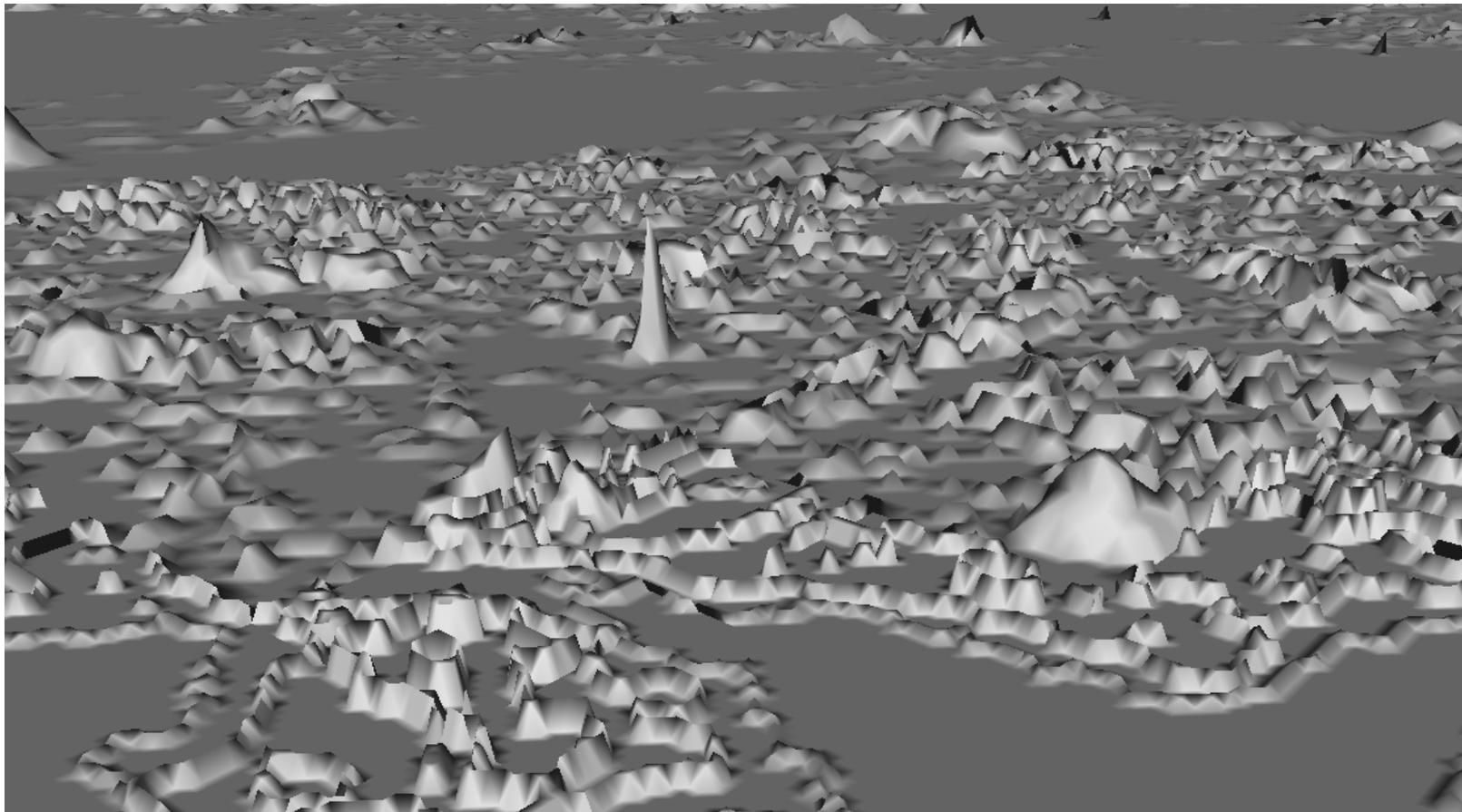
# Results of participation



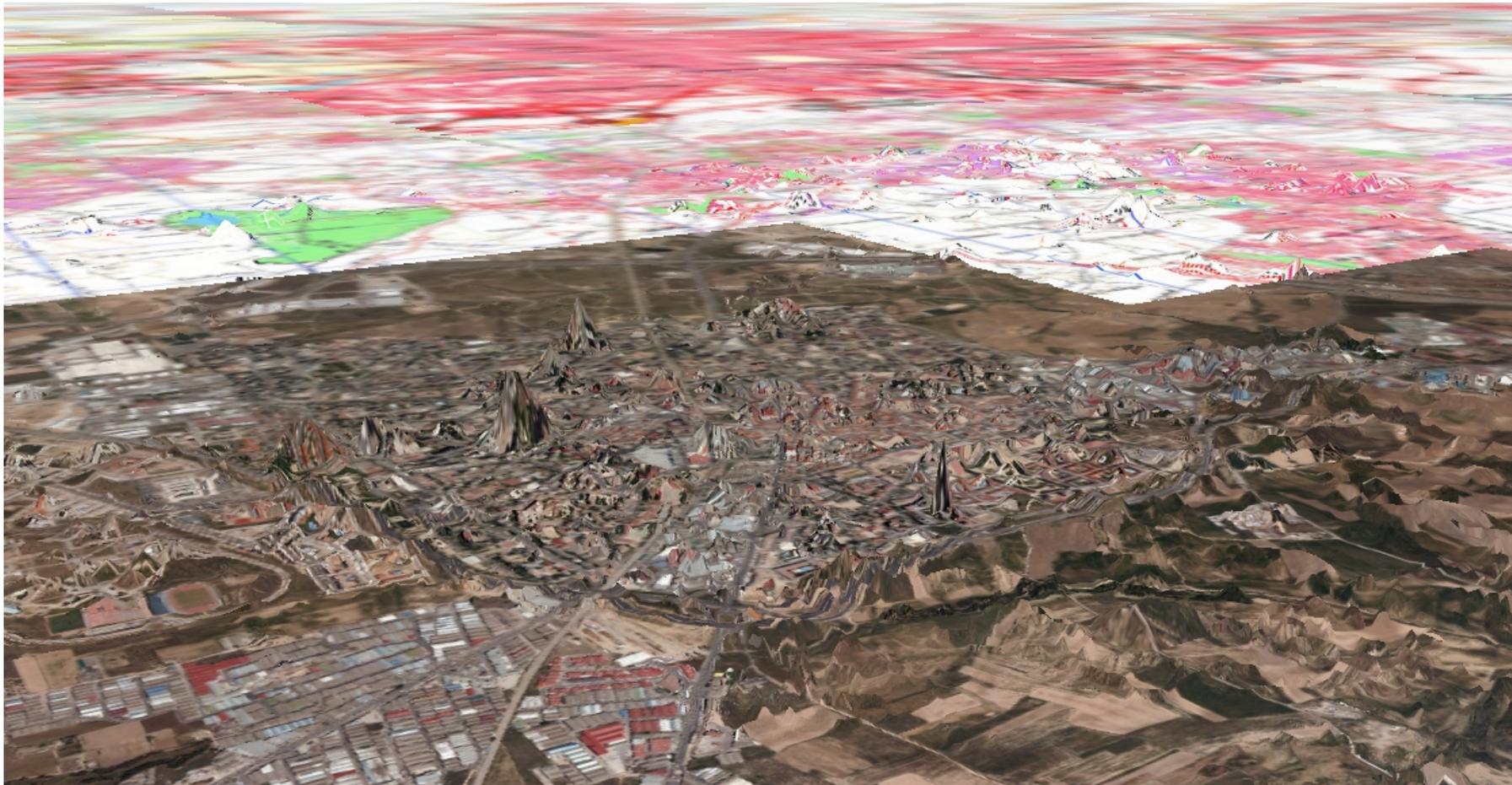
## Results of participation – Features identification



## Results of participation – Features identification



## Results of participation – Features identification



# Acknowledgments

People...lot of people....

NASA, ESA, MediaLabPrado, CSA-ASC Canada

TV, Press, Electronic Media



# Obrigado pela sua atenção

