esa

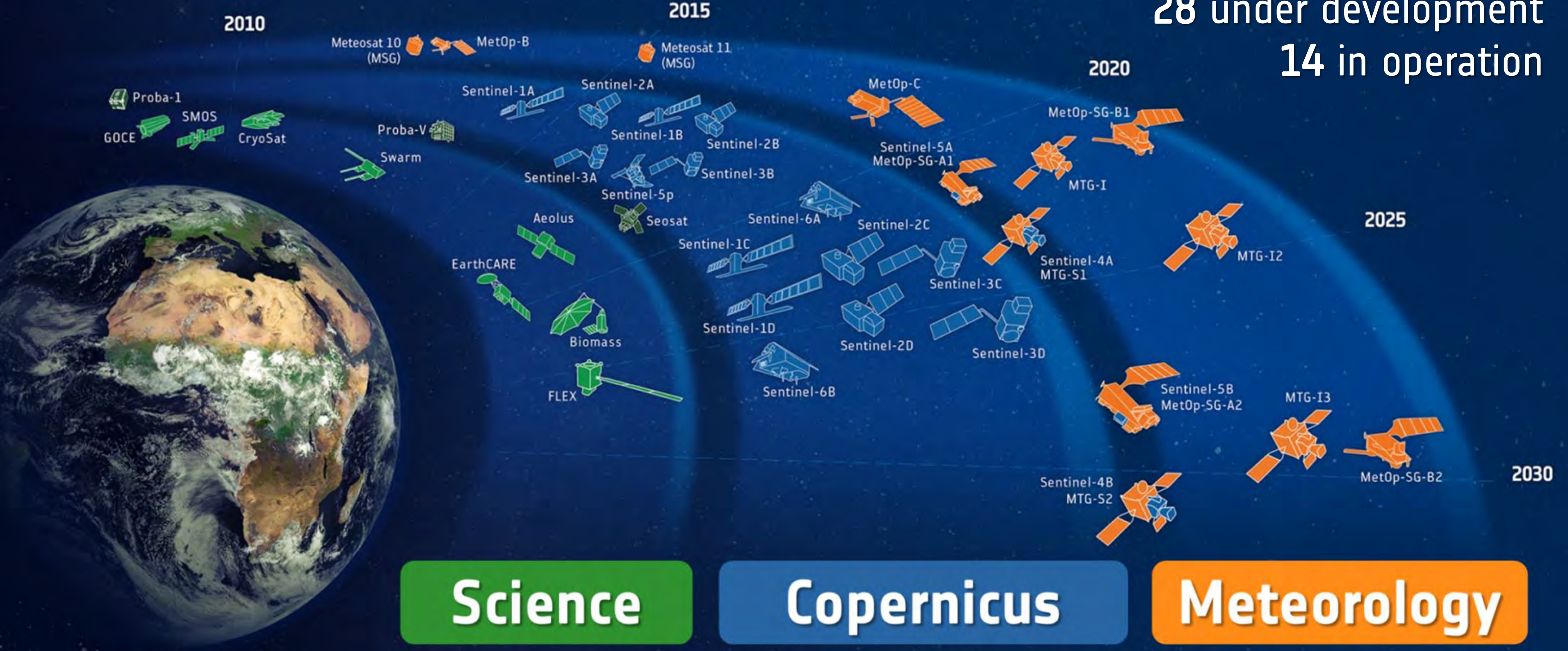
EO Science for Society
#EO4society

Global Challenges

The grand challenges that face humankind require more than ever that scientists advance their understanding of the planet, its processes and its interactions with human activities and translate that knowledge into information, policy advice and services for the benefit of citizens, their business and their lives.

ESA-DEVELOPED EARTH OBSERVATION MISSIONS

Satellites
28 under development
14 in operation

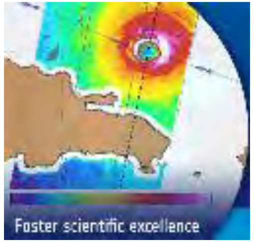


EO Science for Society (EOEP5 Block 4) built on successes of previous ESA exploitation activities:

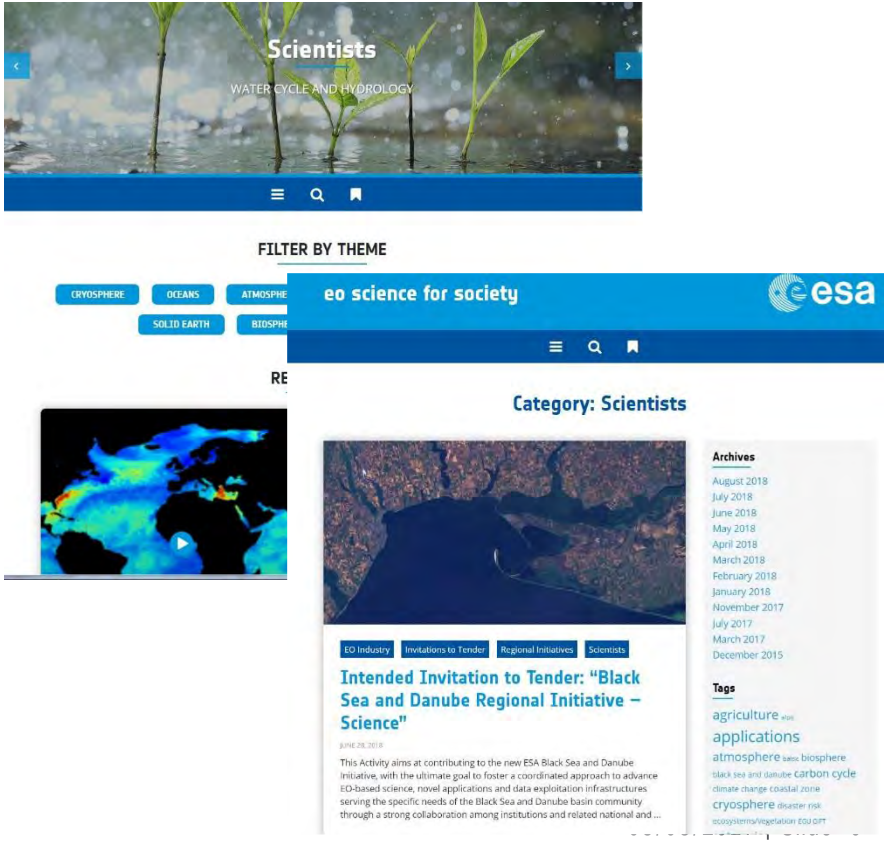
- adapting them to the new European EO context
- responding to recommendations of programmatic and scientific review.

MAIN OBJECTIVES

- Foster scientific excellence
- Pioneer new EO applications
- Stimulate downstream industry growth
- Support international responses to global societal challenges
- Develop platforms technical capabilities
- Build network of resources



eo4society.esa.int



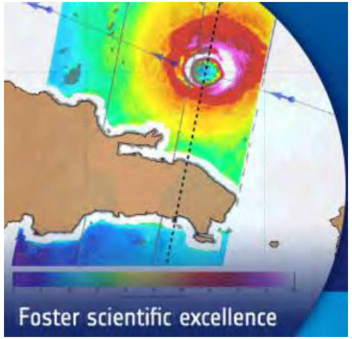
Opportunities – Open call

EO Science for Society Open call for proposals
EOEP-5 Block 4

- Permanently open call
- Framework to rapidly respond to new innovative ideas from bidders.
- No submission deadline.
- Applications:

http://emits.sso.esa.int/

EO Science for Society #EO4society



EO Scientific Data Exploitation: Action Lines

Engaging international Science community	Continuous dialogue with the international scientific community with special focus on the young generations
Developing Open Science Practices-Tools	Developing Open Science 2.0 activities and practices using latest tools and techniques
Advancing EO methods and Techniques	R&D studies maximizing scientific exploitation of EO missions in terms of new methods and products;
Advancing Earth System Science	Addressing major open questions in Earth system science in close collaboration with major international science efforts.
Translating Exploitation Results into Novel Mission concepts	Reinforcing the role of exploitation results as a driver for future missions

Feedback at next workshop

Thematic Workshops

Science User Recommendations

Work Plan Definition

PBEO Approval

Invitations to Tender

Advances in the Science and Applications of SAR Interferometry and Sentinel-1 InSAR Workshop

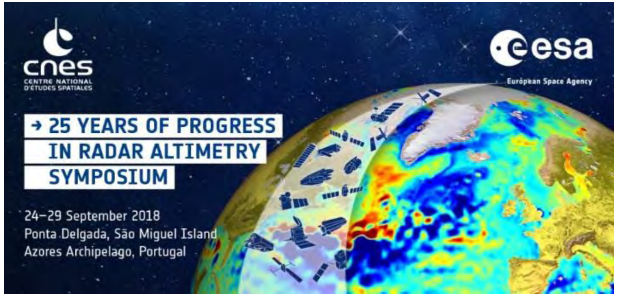
- 10th InSAR workshop organised by ESA
- 480 participants from 47 countries
- 5 days of workshop with 15 thematic and two poster sessions
- 160 oral presentations and 305 posters

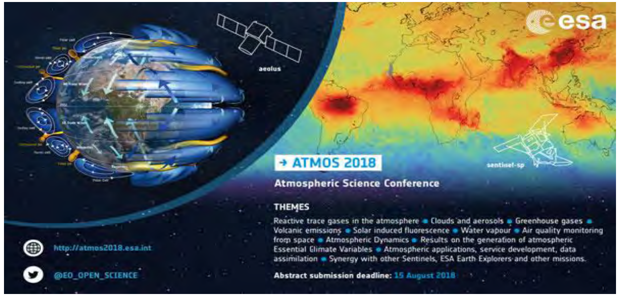
Photo: Eemil Praks

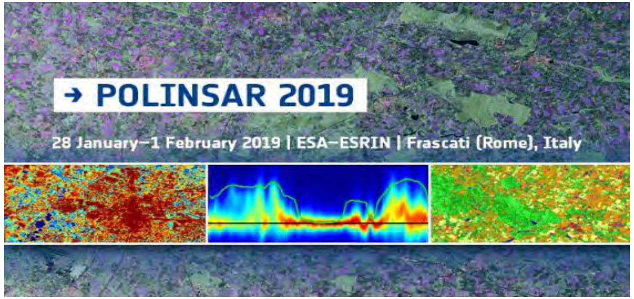
Photo: Eemil Praks

Engaging the International Science Community

Main Workshops and Conferences





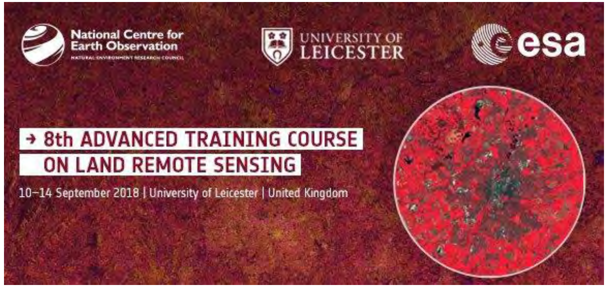


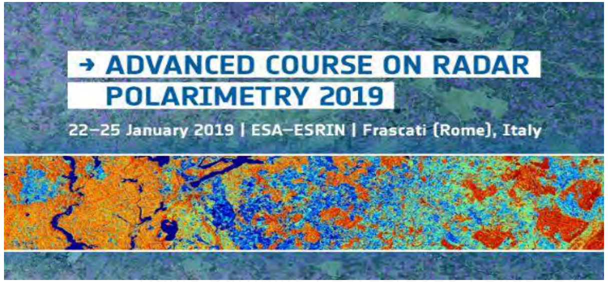
- *Presenting progress*
- *Reviewing scientific results*
- *Consult with the scientific community*
- *Getting recommendations*
- *Collecting feedback*
- *Driving future activities*
- *Networking*

Engaging the International Science Community

Planned Advance Training Events 2018

- 8th Advance Training on Land Remote Sensing, 10-14 September 2018, University of Leicester, UK
- 2nd Advance Training on Cryosphere Remote Sensing, 11-16 June 2018, University Centre in Svalbard, NO
- NASA-ESA Trans-Atlantic Training on LULC, Zagreb, June 2018
- Advance Course on Radar Polarimetry 2019, 22-25 January, 2019, ESA-ESRIN, Frascati, Italy
- 3rd Advance Training on Atmospheric Remote Sensing, TBD





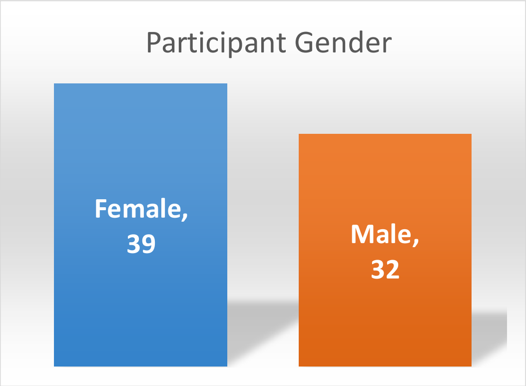
→ EARTH OBSERVATION SUMMER SCHOOL

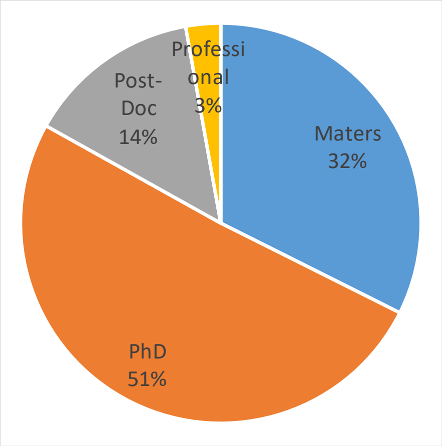
Earth System Monitoring & Modelling

30 July–10 August 2018 | ESA–ESRIN | Frascati (Rome) Italy

71 Participants from 20 countries

- Austria
- UK
- China
- Croatia
- Denmark
- Estonia
- Finland
- France
- Germany
- Greece
- India
- Italy
- Lebanon
- Nigeria
- Poland
- Portugal
- Romania
- Spain
- Sweden
- Turkey





Colour Code
Lecture
Practical Session
Social Event
Lunch / Coffee Break
Other


Dr. Anny Cazenave
LEGOS
Bio


Dr. Zoltán Vekerdy
ITC - University of Twente
Bio


Prof. Dr. Martin Visbeck
GEOMAR Helmholtz Centre for Ocean Research Kiel
Bio


Prof. Jörg Ebbing
Kiel University
Bio


Prof. Shaun Quegan
University of Sheffield
Bio


Prof. Amos Lawless
University of Reading
Bio


Dr Bob Brewin
PML
Bio


Prof. Leif Toudal Pedersen
DTU SPACE
Bio


Dr. Julia Marshall
Max Planck Institute of Biogeochemistry
Bio


Prof. Andrew Shepherd
University of Leeds
Bio


Dr. Marie-Hélène Rio
CLS
Bio


Dr. Giuseppe Consolini
INAF- Istituto di Astrofisica e Planetologia Spaziali
Bio


Dr. Bertrand Chapron
Ifremer
Bio


Dr. Jochem Verrelst
University of Valencia
Bio

IED - For O

EO Summer School 2018 - Programme Week 1

		Mon		Tue		Wed		Thu		Fri
time		30-Jul		31-Jul		01-Aug		02-Aug		03-Aug
09:00-10:00	D1L1	Welcome, intro to ESA and EOP **Diego Fernandez** **Chris Stewart**	D2L1	Remote sensing of sea ice **Leif Toudal**	D3L1	Satellite Oceanography: an integrated perspective Part 1 **Bertrand Chapron**	D4L1	Satellite Oceanography : an integrated perspective Part 2 **Bertrand Chapron**	D5L1	Satellite Oceanography: Observing ocean waves from Space **Bertrand Chapron**
10:00-11:00	D1L2	The Earth System; past and present **Anny Cazenave**	D2L2	Monitoring the water cycle over land: rainfall and surface energy balance **Zoltan Veckerdy**	D3L2	Ocean Circulation I: Introduction **Marie-Hélène Rio**	D4L2	How to measure 3 trillion tons of ice **Andrew Shepherd**	D5L2	Ocean Circulation III: The 3D perspective **Marie-Hélène Rio**
11:00-11:30		Coffee		Coffee		Coffee		Coffee		Coffee
11:30-12:30	D1L3	Sea level rise from space **Anny Cazenave**	D2L3	Monitoring the water cycle over land: water bodies and soil moisture **Zoltan Veckerdy**	D3L3	Ocean colour theory **Bob Brewin**	D4L3	Ocean Circulation II: Space and in-situ data synergy **Marie-Hélène Rio**	D5L3	Ocean colour and climate **Bob Brewin**
12:30-13:30	D1L4	Environmental Science and Sustainable Development **Martin Visbeck**	D2L4	**Visit to Phi-Experience**	D3L4	Remote sensing and modelling of sea ice **Leif Toudal**	D4L4	Ocean colour and the marine carbon cycle **Bob Brewin**	D5L4	Is Earth's sea ice declining? **Andrew Shepherd**
13:30-14:30		Lunch		Lunch		Lunch		Lunch		Lunch
14:30-15:30	D1P1	Opportunities for Integrated Ocean Observing **Martin Visbeck**	D2P1	Toolboxes (SNAP) **Chris Stewart** **Luca Demarchi** **Fabrizio Ramoino** **Magdalena Fitrzyk**	D3P1	Ocean Virtual Lab (OVL) **Fabrice Collard** **Lucille Gaultier** **Guillaume Le Seach**	D4P1	Ocean Virtual Lab (OVL) **Fabrice Collard** **Lucille Gaultier** **Guillaume Le Seach**	D5P1	Ocean Virtual Lab (OVL) **Fabrice Collard** **Lucille Gaultier** **Guillaume Le Seach**
15:30-16:30	D1P2	Tooboxes (SNAP) **Chris Stewart** **Luca Demarchi** **Fabrizio Ramoino** **Magdalena Fitrzyk**	D2P2		D3P2		D4P2		D5P2	
16:30-17:00		Coffee		Coffee		Coffee		Coffee		Coffee
17:00-18:00	D1P3	Toolboxes (SNAP) **Chris Stewart** **Luca Demarchi** **Fabrizio Ramoino** **Magdalena Fitrzyk**	D2P3	Toolboxes (SNAP) **Chris Stewart** **Luca Demarchi** **Fabrizio Ramoino** **Magdalena Fitrzyk**	D3P3	Ocean Virtual Lab (OVL) **Fabrice Collard** **Lucille Gaultier** **Guillaume Le Seach**	D4P3	Ocean Virtual Lab (OVL) **Fabrice Collard** **Lucille Gaultier** **Guillaume Le Seach**	D5P3	Ocean Virtual Lab (OVL) **Fabrice Collard** **Lucille Gaultier** **Guillaume Le Seach**
		Cocktail Reception (18:00 - 19:30)						Hosted Dinner (18:00 - 20:30)		

Dr. Lucille Gaultier
OceanDataLab

Bio

Dr. Miguel Mahecha
Max Planck Institute of Biogeochemistry

Bio

Dr. Fabrice Collard
OceanDataLab

Bio

Dr. Hans Permana
Brockmann Consult GmbH

Bio

Dr. Ewan Pinnington
University of Reading

Bio

Dr. Natalie Douglas
University of Reading

Bio

Zackary Bell
University of Reading

Bio

Dr. Javier Amezcua
University of Reading

Bio

EO Summer School 2018 - Programme Week 2

		Mon		Tue		Wed		Thu		Fri
time		06-Aug		07-Aug		08-Aug		09-Aug		10-Aug
09:00-10:00	D6L1	The role of the global carbon cycle in the Earth System **Shaun Quegan**	D7L1	Monitoring and Modelling of Land Surface Processes **Jochem Verrelst**	D8L1	Combining models and data to quantify the terrestrial carbon cycle **Shaun Quegan**	D9L1	Satellite gradiometry for geophysical research **Jorg Ebbing**	D10L1	Linking Solid Earth and cryosphere in Antarctica **Jorg Ebbing**
10:00-11:00	D6L2	Monitoring and Modelling of Land Surface Processes **Jochem Verrelst**	D7L2	Observing the terrestrial carbon cycle **Shaun Quegan**	D8L2	Monitoring and Modelling of Land Surface Processes **Jochem Verrelst**	D9L2	Effects of Magnetosphere-Ionosphere Coupling in the Polar Ionosphere **Giuseppe Consolini**	D10L2	Complexity and Turbulence in the Polar Ionosphere **Giuseppe Consolini**
11:00-11:30		Coffee		Coffee		Coffee		Coffee		Coffee
11:30-12:30	D6L3	Atmospheric carbon dioxide: watching the earth breathe **Julia Marshall**	D7L3	Atmospheric methane: untangling an enigma **Julia Marshall**	D8L3	Atmospheric inversions: tracking down the sources and sinks **Julia Marshall**	D9L3	Joint inversion of satellite and other geophysical data **Jorg Ebbing**	D10P1	Innovation in Earth Observation **Iarla Kilbane-Dawe**
12:30-13:30	D6L4	Introduction to Physical Principles for Earth System Data Lab (ESDL) Practicals **Miguel Mahecha**	D7L4	Data Assimilation (DA): An introduction to data assimilation **Amos Lawless**	D8L4	Data Assimilation (DA): Variational data assimilation and the ensemble Kalman filter **Amos Lawless**	D9L4	Data Assimilation (DA): Applications of data assimilation and current challenges **Amos Lawless**	D10P2	**Closure of course**
13:30-14:30		Lunch		Lunch		Lunch		Lunch		Lunch
14:30-15:30	D6P2	Earth System Data Lab (ESDL) **Hans Permana** **Miguel Mahecha**	D7P1	Earth System Data Lab (ESDL) **Hans Permana** **Miguel Mahecha**	D8P1	DA Practical **Amos Lawless** **Ewan Pinnington** **Natalie Douglas** **Javier Amezcua** **Zackary Bell**	D9P1	DA Practical **Amos Lawless** **Ewan Pinnington** **Natalie Douglas** **Javier Amezcua** **Zackary Bell**		
15:30-16:30	D6P3		D7P2		D8P2		D9P2			
16:30-17:00		Coffee		Coffee		Coffee		Coffee		
17:00-18:00	D6P4	Earth System Data Lab (ESDL) **Hans Permana** **Miguel Mahecha**	D7P3	Earth System Data Lab (ESDL) **Hans Permana** **Miguel Mahecha**	D8P3	DA Practical **Amos Lawless** **Ewan Pinnington** **Natalie Douglas** **Javier Amezcua** **Zackary Bell**	D9P3	DA Practical **Amos Lawless** **Ewan Pinnington** **Natalie Douglas** **Javier Amezcua** **Zackary Bell**		

Colour Code
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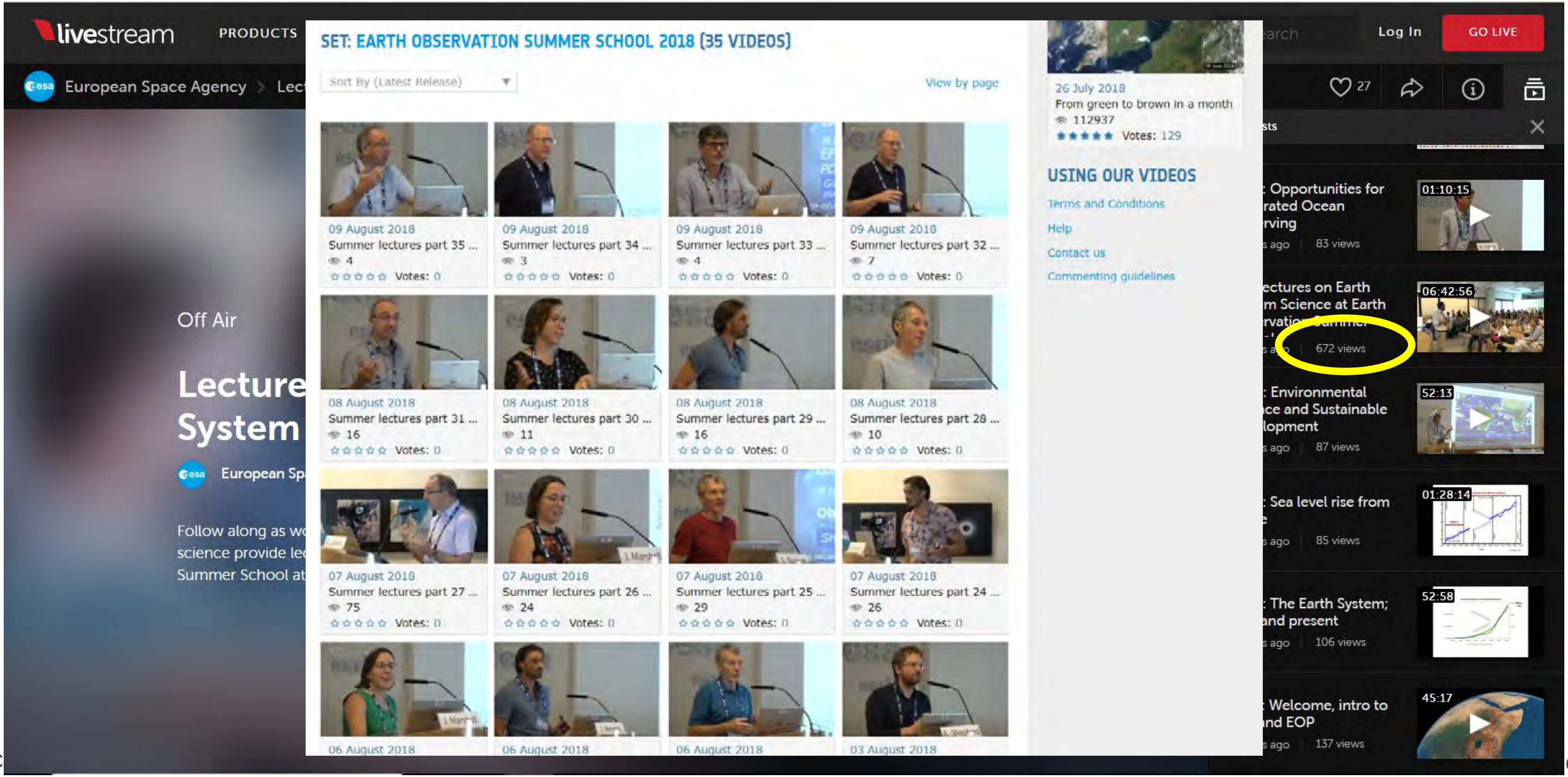
Practical Session
Social Event
Lunch / Coffee Break
Other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Summer lectures part 34 ...
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26 July 2018
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Votes: 129
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: The Earth System;
and present
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: Welcome, intro to
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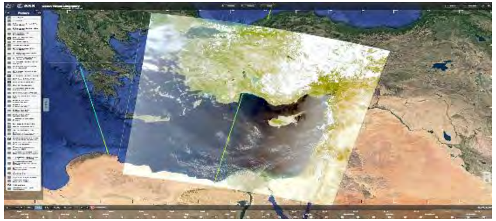
ESA ToolBoxes

- SNAP: Visualisation & processing of Sentinel 1, 2 and 3 data and other optical data and SAR data; http://step.esa.int/

- Delay-Doppler Altimetry Studio (DeDop): provide means to users to understand and use the low levels of Altimetry data and how these data are processed, by providing them with a Fully Adaptable and Configureable DDP and a friendly user interface. http://dedop.org/

- Broadview Radar Altimetry Toolbox (BRAT): facilitates the processing of radar altimetry data; reads all previous and current altimetry missions' data; http://earth.esa.int/brat.

- ESA Atmospheric Toolbox (BEAT): aims to provide scientists with tools for ingesting, processing, and analyzing atmospheric remote sensing data; http://www.stcorp.nl/beat/download/



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brat
BROADVIEW RADAR ALTIMETRY TOOLBOX

Engaging the International Science Community

The Living Planet Fellowship call 2017

- Supporting the next generation of ESA PIs (young scientists at post-doc level);
- Support leading edge research activities for 2 years in a co-funding scheme (ESA contribution up to 99KEuro).
- Main focus on scientific excellent: innovative EO methods, novel products, new Earth system science results;
- Foster concrete research actions towards the achievement of the challenges of the ESA science strategy.
- Promote better interactions and links between ESA and the next generation of scientists in member states via stages in ESA and other European research centres;

CLOSED

EO Scientific Data Exploitation: Action Lines

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Developing Open Science Practices-Tools	Developing Open Science 2.0 activities and practices using latest tools and techniques
Advancing EO methods and Techniques	R&D studies maximizing scientific exploitation of EO missions in terms of new methods and products;
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Translating Exploitation Results into Novel Mission concepts	Reinforcing the role of exploitation results as a driver for future missions

ESA SAR MOOC "Echoes in Space"

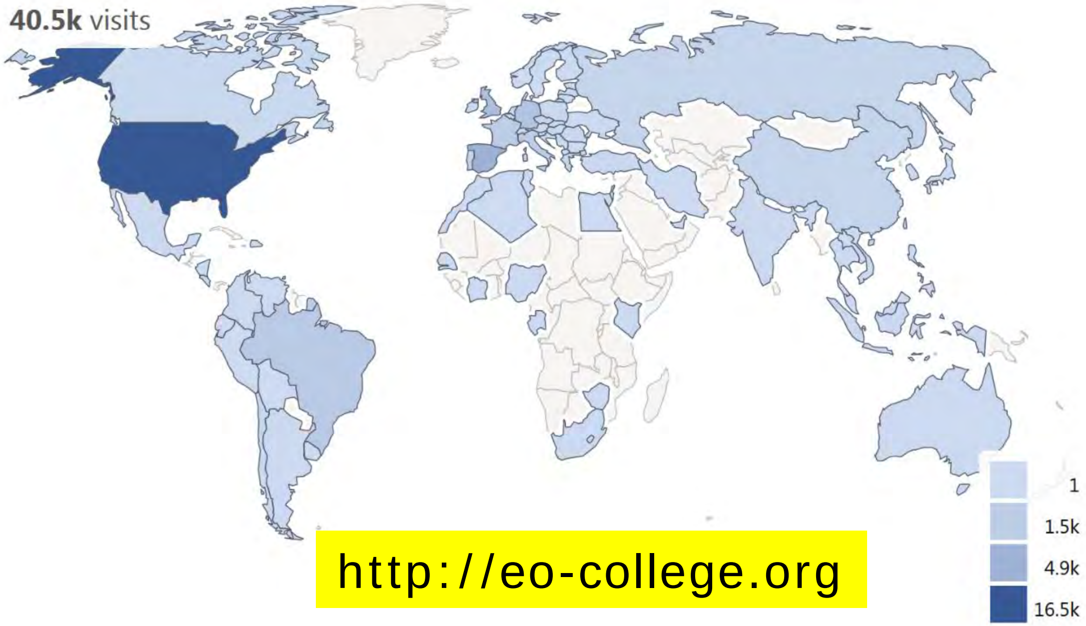
First SAR MOOC, began 9th October 2017

Due to last for 5 weeks

Assumes no previous knowledge of SAR

The content is divided into modules including:

1. History of SAR remote sensing
2. SAR geometry
3. Land applications of SAR
4. Water applications of SAR
5. SAR applied to hazard monitoring

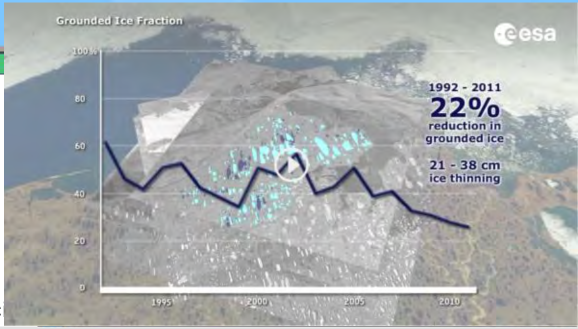


http://eo-college.org

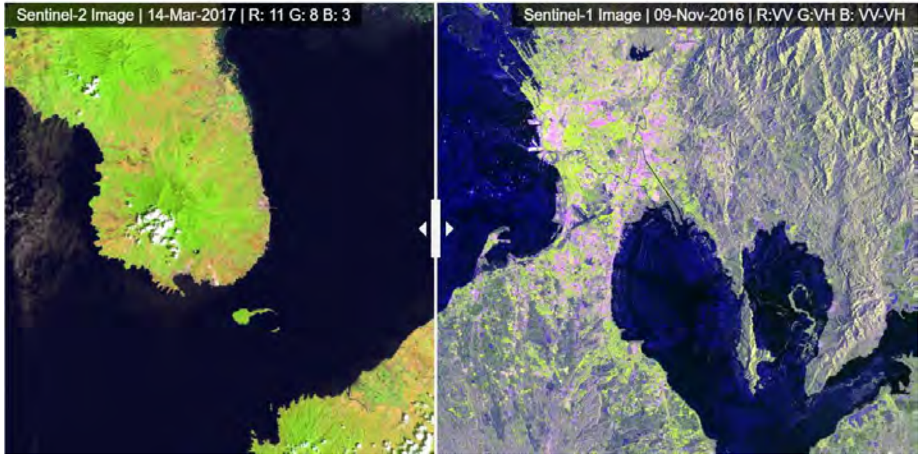
5273 registered

3170 started

ESA SAR MOOC “Echoes in Space”



Each module contains interactive content, and finishes with a series of quizzes. Participants can complete the modules in their own time.



On completion of the course, participants receive a certificate

Engaging the International Science Community

Massive Open On-line Courses 2018

Land Remote Sensing

Remote Sensing and Africa

Atmosphere Remote Sensing

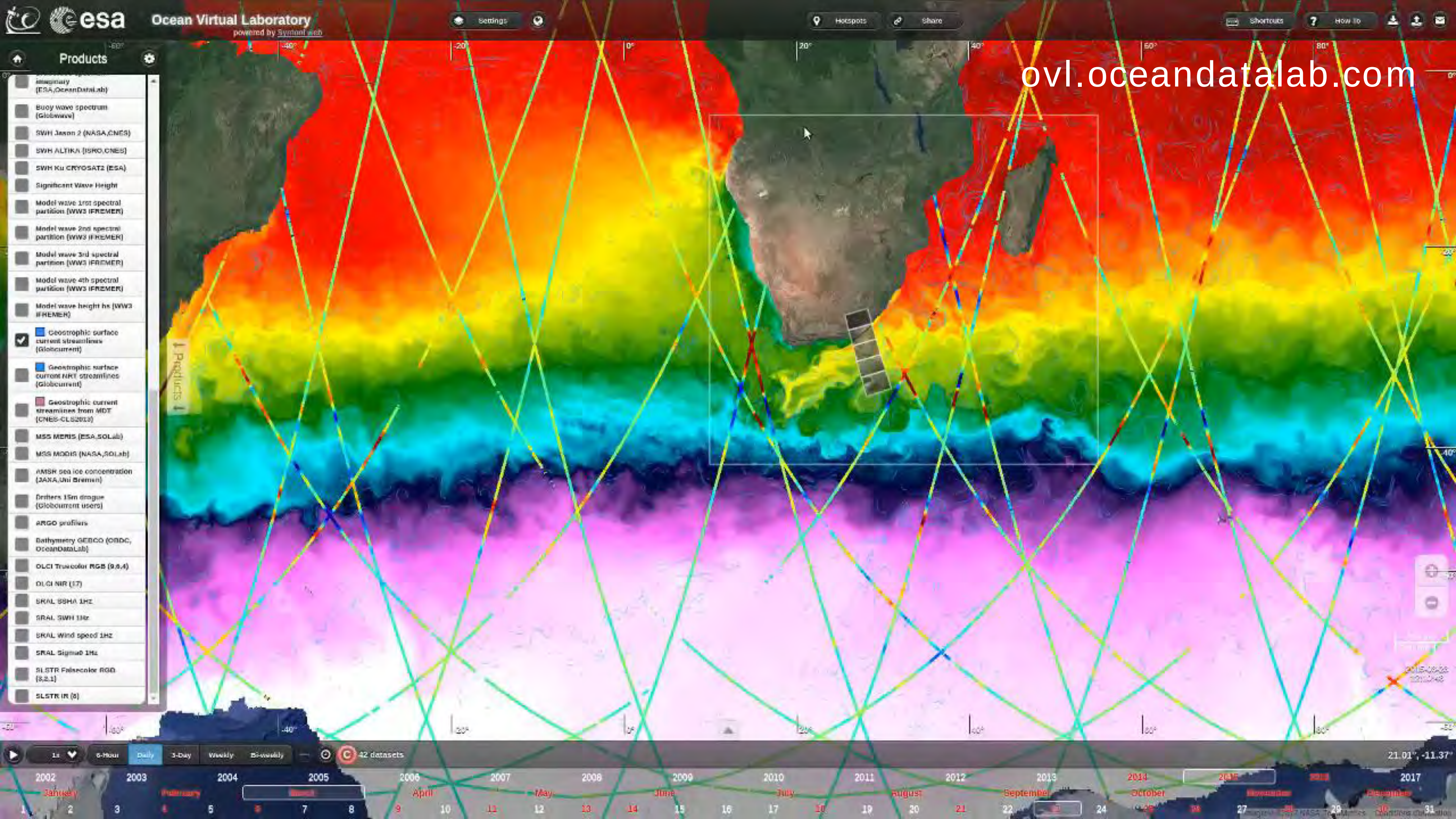
Cryosphere Remote Sensing

Marine Remote Sensing

The first MOOC on Radar Remote Sensing run on 9 October 2017.

3756 participants;

Re-**Run in preparation….**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SWH Jason 2 (NASA,CNES)
SWH ALTIKA (ISRO,CNES)
SWH Ku CRYOSAT2 (ESA)
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Model wave 3rd spectral partition (WW3 IFREMER)
Model wave 4th spectral partition (WW3 IFREMER)
Model wave height hs (WW3 IFREMER)
Geostrophic surface current streamlines (Globcurrent)
Geostrophic surface current NRT streamlines (Globcurrent)
Geostrophic current streamlines from MDT (CNES-CLS2013)
MSS MERIS (ESA,SOLab)
MSS MODIS (NASA,SOLab)
AMSR sea ice concentration (JAXA,Uni Bremen)
Drifters 15m drogue (Globcurrent users)
ARGO profilers
Bathymetry GEBCO (OBDC, OceanDataLab)
OLCI Truecolor RGB (9,6,4)
OLCI NIR (17)
SRAL SSHA 1Hz
SRAL SWH 1Hz
SRAL Wind speed 1Hz
SRAL Sigma0 1Hz
SLSTR Falsecolor RGB (3,2,1)
SLSTR IR (8)
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42 datasets
21.01°, -11.37°
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#EO Open Science 2017

Numbers at EO OpenScience 2017

- 103 organizations from 25 countries
- 150 Oral/Poster requests
- Webstreaming & Social networks RT
- Big Hall Afternoon Sessions:
  - ⚡Lightning Talks
  - 🖥Digital Posters
  - 🍹Networking
  - 💬Exhibitors

343 participants from 30 countries

Engaging the International Science Community

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60 MINUTES

EPISODES OVERTIME TOPICS THE TEAM SUBSCRIBE

RELATED VIDEO

The Leaning Tow of San Francisco

SAN FRANCISCO'S LEANING TOWER OF LAWSUITS

The Millennium Tower opened to great acclaim with high-priced, posh apartments. But those accolades and property values are sinking, along with the building's foundation

NOV 05 JON WERTHEIM

COMMENT 7 FACEBOOK TWITTER STUMBLE

It's a story as old as cities themselves: prosperity comes to town and triggers a building boom. In modern San Francisco, rows of skyscrapers have begun lining the downtown streets and recasting the skyline, monuments to the triumph of the tech sector. Leading this wave, the Millennium Tower. 58 stories of opulence, it opened in 2009 to great acclaim, then the tallest residential building west of the Mississippi. Though priced in the millions, the inventory of posh apartments moved quickly. Yet for all its curb appeal, the building has, quite literally, one fundamental problem: it's sinking into mud and tilting toward its neighbors. Engineering doesn't often make for rollicking mystery, but San Francisco is captivated by the tale of the leaning tower and the lawsuits it's spawned. It's a story positioned – albeit at an angle – somewhere between civic scandal and civic curiosity, an illustration of what can happen when zeal for development overtakes common sense.

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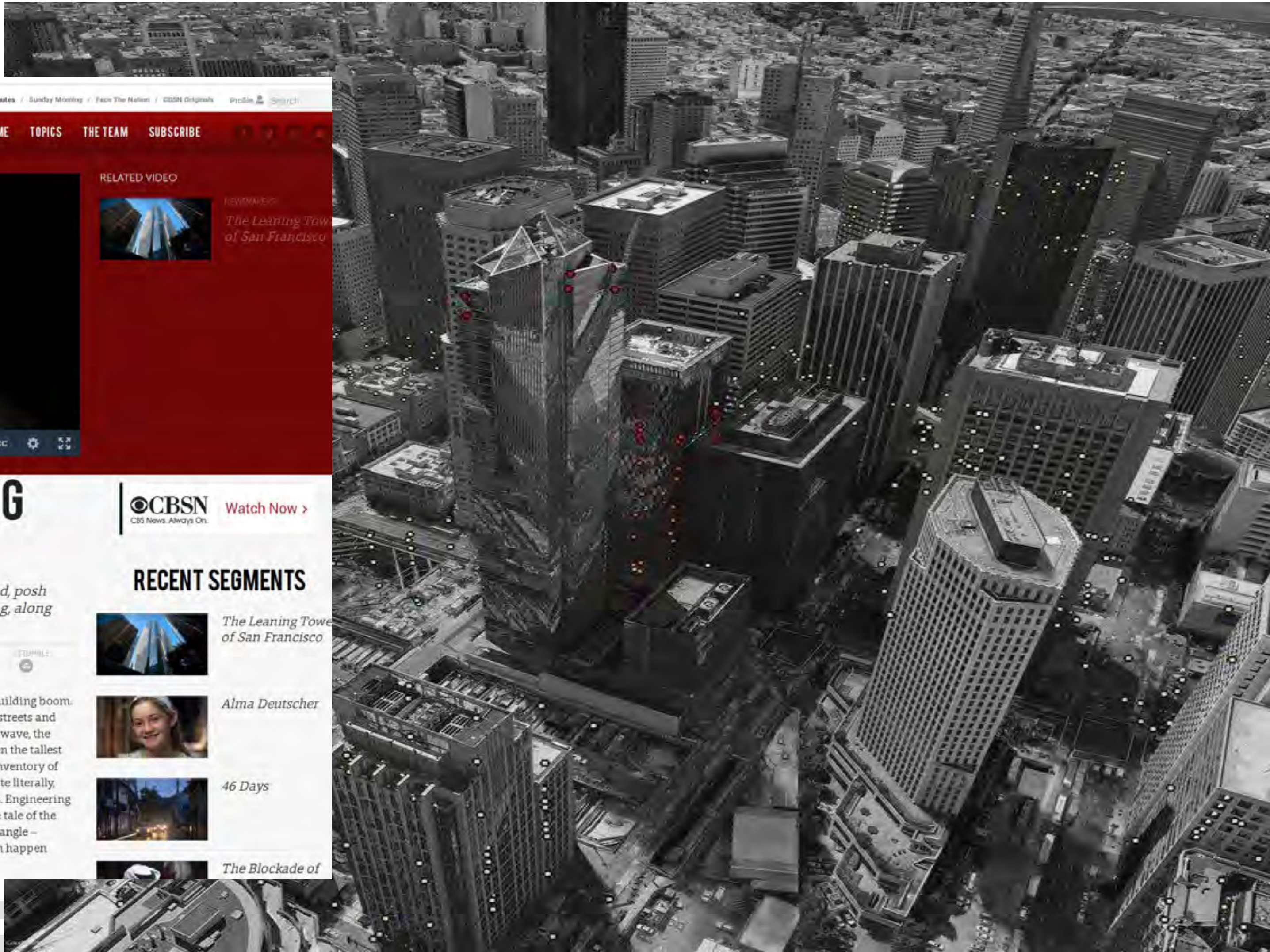
RECENT SEGMENTS

The Leaning Towe of San Francisco

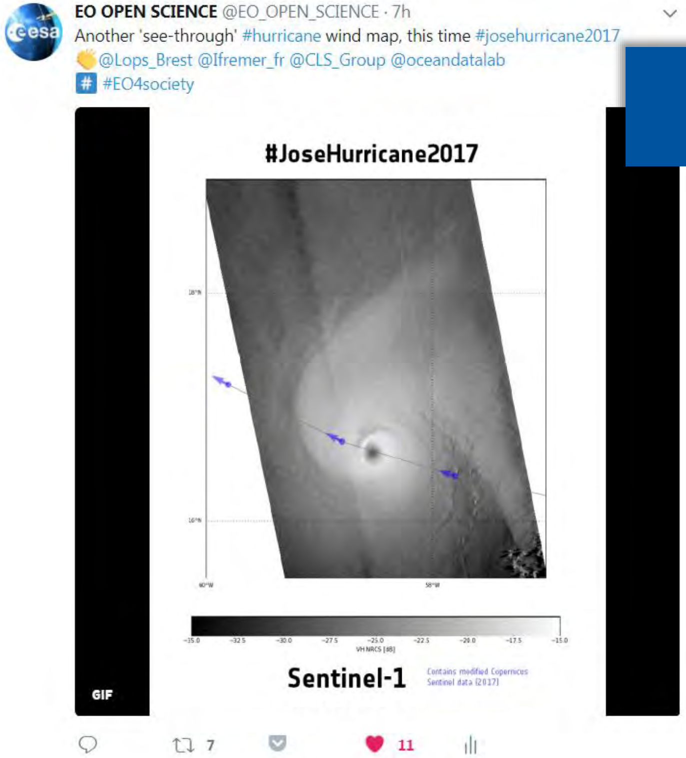
Alma Deutscher

46 Days

The Blockade of



First wind maps of recent hurricanes

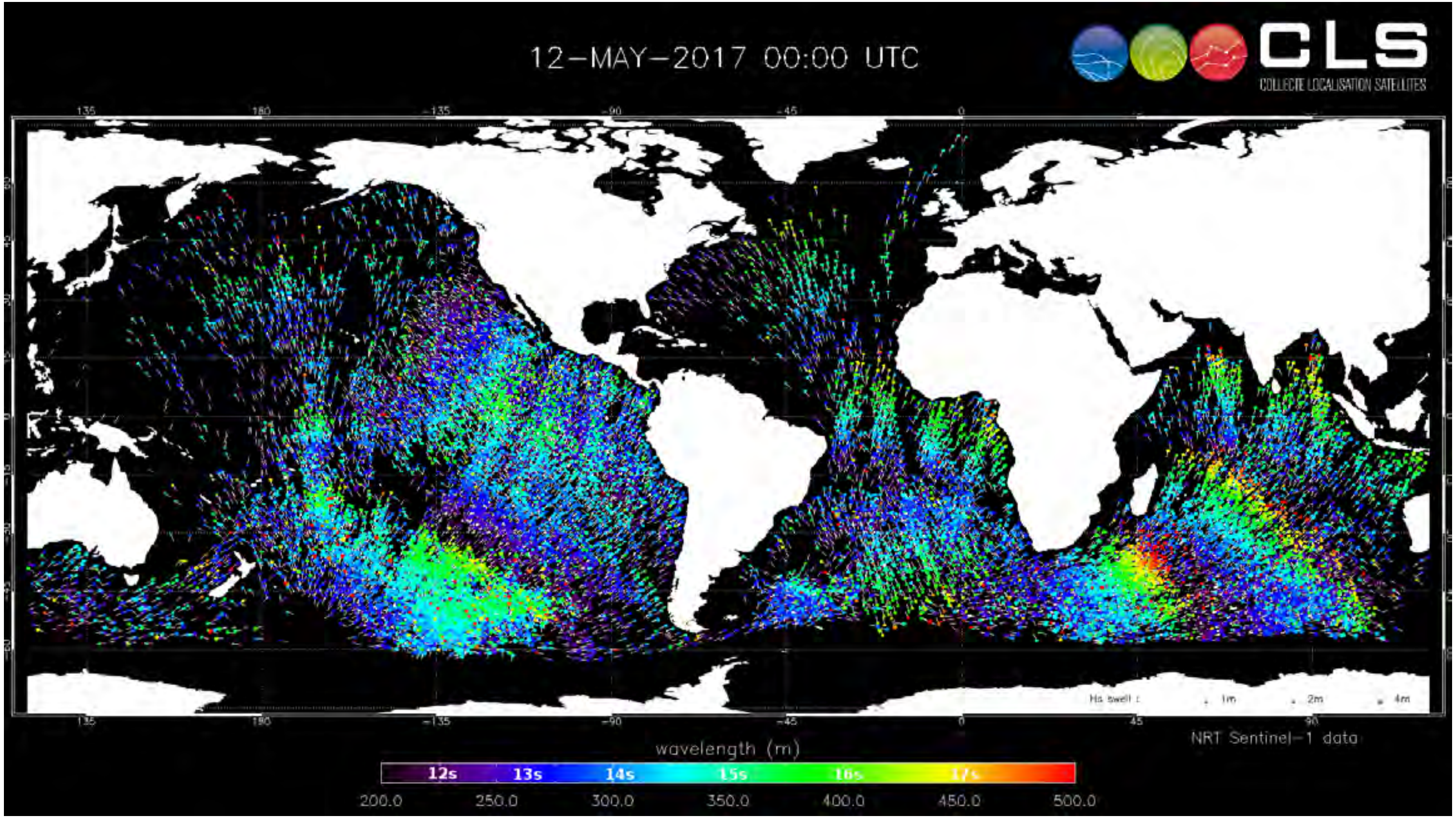


Scientific Exploitation

- Sentinel-1 A SAR (VH Channel)
- Wind speed seen through the hurricanes #Irma and #Jose, showing impact on sea surface
- Results from R&D activities (#EO4society)

@EO_OPEN_SCIENCE

S1A and S1B Global NRT Swell tracking (Wave Mode over 10 days)



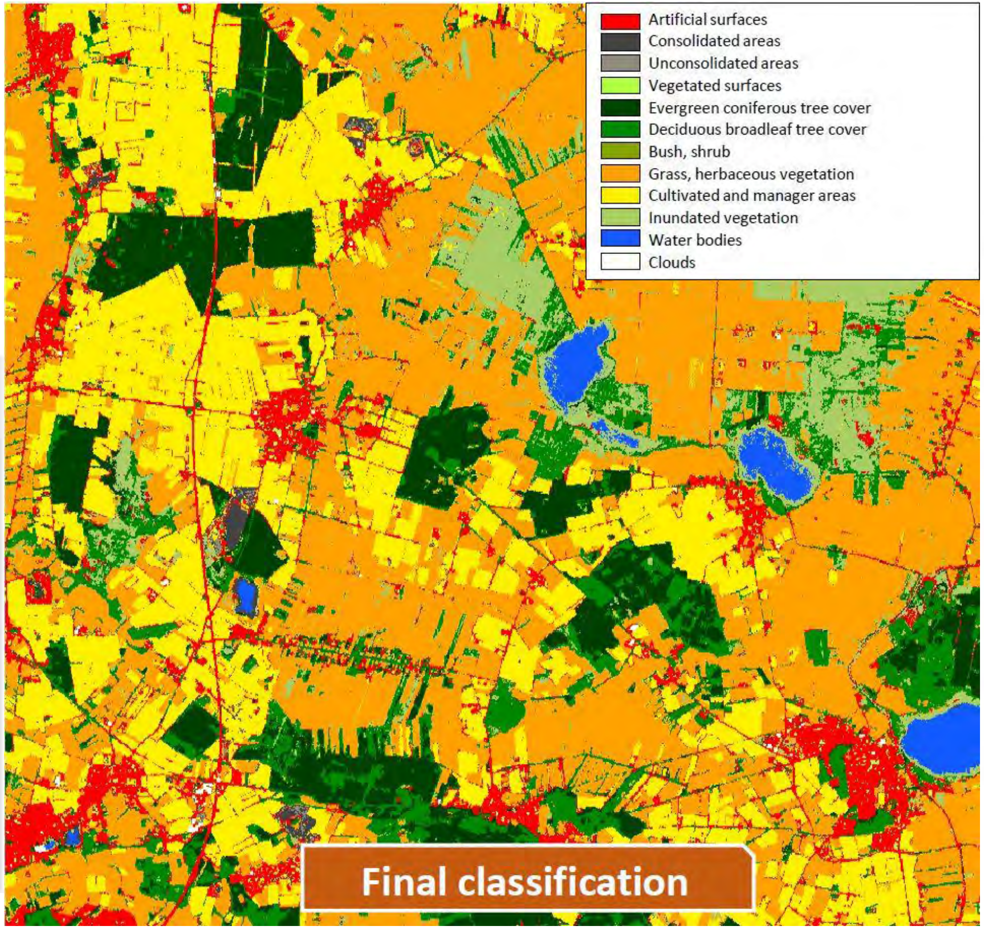
S2-GLC, CBK PAN (Poland)

Results

Test site Italy

Locations of test sites

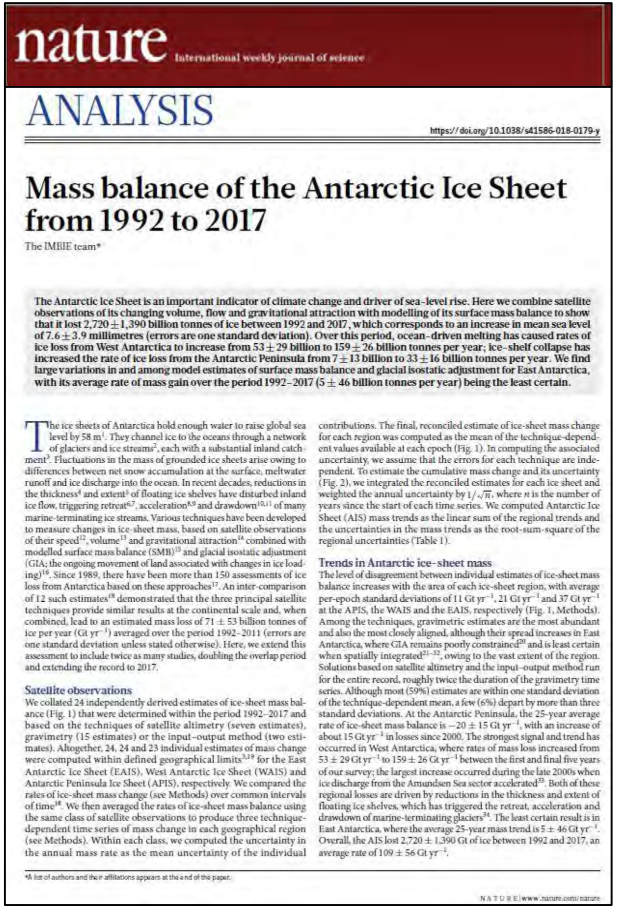
Test site Germany



EO Scientific Data Exploitation: Action Lines

Engaging international Science community	Continuous dialogue with the international scientific community with special focus on the young generations
Developing Open Science Practices-Tools	Developing Open Science 2.0 activities and practices using latest tools and techniques
Advancing EO methods and Techniques	R&D studies maximizing scientific exploitation of EO missions in terms of new methods and products;
Advancing Earth System Science	Addressing major open questions in Earth system science in close collaboration with major international science efforts.
Translating Exploitation Results into Novel Mission concepts	Reinforcing the role of exploitation results as a driver for future missions

ESA/NASA IMBIE-2 (1992-2017)



nature International weekly journal of science

ANALYSIS

https://doi.org/10.1038/s41586-018-0179-y

Mass balance of the Antarctic Ice Sheet from 1992 to 2017

The IMBIE team*

The Antarctic Ice Sheet is an important indicator of climate change and driver of sea-level rise. Here we combine satellite observations of its changing volume, flow and gravitational attraction with modelling of its surface mass balance to show that it lost 2,720 ± 1,390 billion tonnes of ice between 1992 and 2017, which corresponds to an increase in mean sea level of 7.6 ± 3.9 millimetres (errors are one standard deviation). Over this period, ocean-driven melting has caused rates of ice loss from West Antarctica to increase from 53 ± 29 billion to 159 ± 26 billion tonnes per year; ice-shelf collapse has increased the rate of ice loss from the Antarctic Peninsula from 7 ± 13 billion to 33 ± 16 billion tonnes per year. We find large variations in and among model estimates of surface mass balance and glacial isostatic adjustment for East Antarctica, with its average rate of mass gain over the period 1992–2017 (5 ± 46 billion tonnes per year) being the least certain.

The ice sheets of Antarctica hold enough water to raise global sea level by 58 m[1]. They channel ice to the oceans through a network of glaciers and ice streams[2], each with a substantial inland catchment[3]. Fluctuations in the mass of grounded ice sheets arise owing to differences between net snow accumulation at the surface, meltwater runoff and ice discharge into the ocean. In recent decades, reductions in the thickness[4] and extent[5] of floating ice shelves have disturbed inland ice flow, triggering retreat[6,7], acceleration[8,9] and drawdown[10,11] of many marine-terminating ice streams. Various techniques have been developed to measure changes in ice-sheet mass, based on satellite observations of their speed[12], volume[13] and gravitational attraction[14] combined with modelled surface mass balance (SMB)[15] and glacial isostatic adjustment (GIA; the ongoing movement of land associated with changes in ice loading)[16]. Since 1989, there have been more than 150 assessments of ice loss from Antarctica based on these approaches[17]. An inter-comparison of 12 such estimates[18] demonstrated that the three principal satellite techniques provide similar results at the continental scale and, when combined, lead to an estimated mass loss of 71 ± 53 billion tonnes of ice per year (Gt yr^{-1}) averaged over the period 1992–2011 (errors are one standard deviation unless stated otherwise). Here, we extend this assessment to include twice as many studies, doubling the overlap period and extending the record to 2017.

Satellite observations

We collated 24 independently derived estimates of ice-sheet mass balance (Fig. 1) that were determined within the period 1992–2017 and based on the techniques of satellite altimetry (seven estimates), gravimetry (15 estimates) or the input–output method (two estimates). Altogether, 24, 24 and 23 individual estimates of mass change were computed within defined geographical limits[3,19] for the East Antarctic Ice Sheet (EAIS), West Antarctic Ice Sheet (WAIS) and Antarctic Peninsula Ice Sheet (APIS), respectively. We compared the rates of ice-sheet mass change (see Methods) over common intervals of time[18]. We then averaged the rates of ice-sheet mass balance using the same class of satellite observations to produce three technique-dependent time series of mass change in each geographical region (see Methods). Within each class, we computed the uncertainty in the annual mass rate as the mean uncertainty of the individual contributions. The final, reconciled estimate of ice-sheet mass change for each region was computed as the mean of the technique-dependent values available at each epoch (Fig. 1). In computing the associated uncertainty, we assume that the errors for each technique are independent. To estimate the cumulative mass change and its uncertainty (Fig. 2), we integrated the reconciled estimates for each ice sheet and weighted the annual uncertainty by $1/\sqrt{n}$, where n is the number of years since the start of each time series. We computed Antarctic Ice Sheet (AIS) mass trends as the linear sum of the regional trends and the uncertainties in the mass trends as the root-sum-square of the regional uncertainties (Table 1).

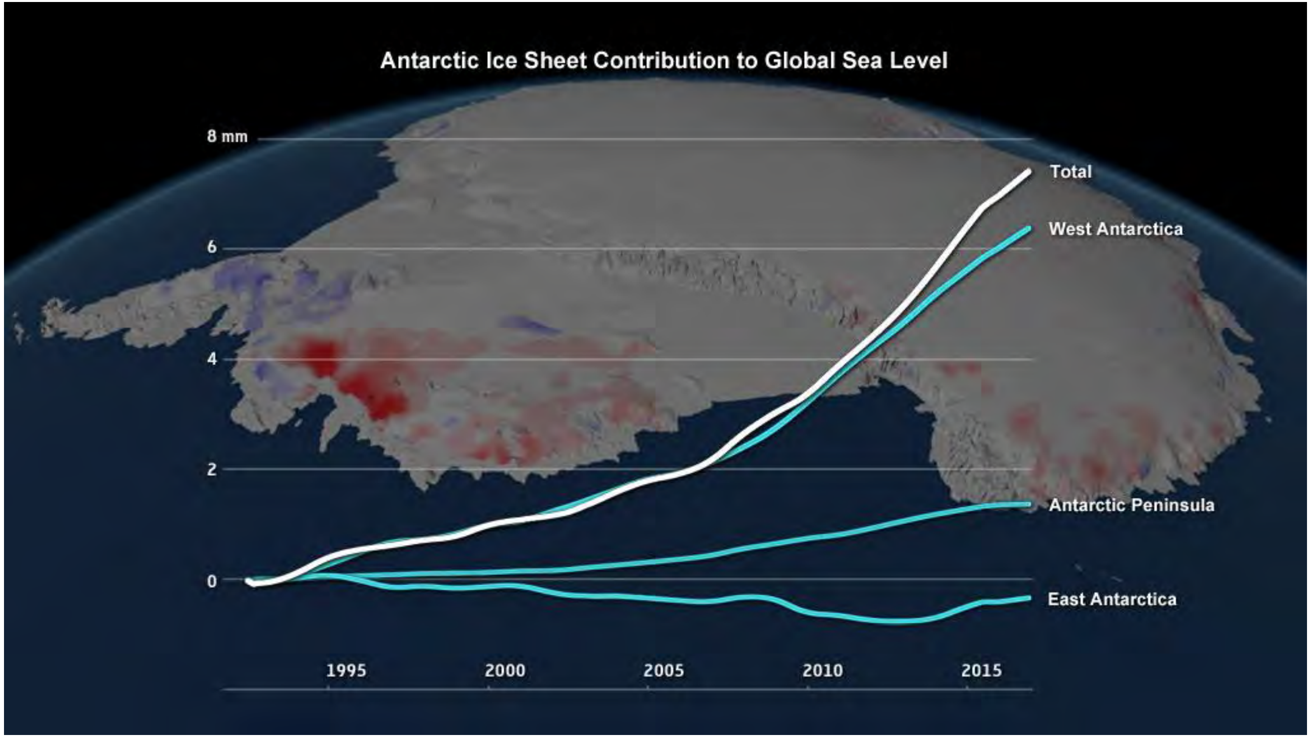
Trends in Antarctic ice-sheet mass

The level of disagreement between individual estimates of ice-sheet mass balance increases with the area of each ice-sheet region, with average per-epoch standard deviations of 11 Gt yr^{-1}, 21 Gt yr^{-1} and 37 Gt yr^{-1} at the APIS, the WAIS and the EAIS, respectively (Fig. 1, Methods). Among the techniques, gravimetric estimates are the most abundant and also the most closely aligned, although their spread increases in East Antarctica, where GIA remains poorly constrained[20] and is least certain when spatially integrated[21–32], owing to the vast extent of the region. Solutions based on satellite altimetry and the input–output method run for the entire record, roughly twice the duration of the gravimetry time series. Although most (59%) estimates are within one standard deviation of the technique-dependent mean, a few (6%) depart by more than three standard deviations. At the Antarctic Peninsula, the 25-year average rate of ice-sheet mass balance is −20 ± 15 Gt yr^{-1}, with an increase of about 15 Gt yr^{-1} in losses since 2000. The strongest signal and trend has occurred in West Antarctica, where rates of mass loss increased from 53 ± 29 Gt yr^{-1} to 159 ± 26 Gt yr^{-1} between the first and final five years of our survey; the largest increase occurred during the late 2000s when ice discharge from the Amundsen Sea sector accelerated[33]. Both of these regional losses are driven by reductions in the thickness and extent of floating ice shelves, which has triggered the retreat, acceleration and drawdown of marine-terminating glaciers[34]. The least certain result is in East Antarctica, where the average 25-year mass trend is 5 ± 46 Gt yr^{-1}. Overall, the AIS lost 2,720 ± 1,390 Gt of ice between 1992 and 2017, an average rate of 109 ± 56 Gt yr^{-1}.

*A list of authors and their affiliations appears at the end of the paper.

- A new assessment has been completed over Antarctica covering the period 1992-**2017…**
- 87 scientists has contributed to the exercise
- For the first time Cryosat-2 and Sentinel-1 data are included in the assessment;
- **The teams have been supported by ESA's** Climate Change Initiative and the Scientific Exploitation element of the EOEP
- Results has been published by Nature the 14th June.

IMBIE-2 (Nature, 14th June 2018)



Loss of 2720 ± 1390 Gt of ice between 1992 and 2017: 7.6 ± 3.9 mm contribution to mean sea level.

Ocean-driven melting has caused ice loss in West Antarctica to accelerate: from 53 ± 29 Gt/yr in the 1990s to 159 ± 26 Gt/yr in the 2010s.

Ice shelf collapse has driven Antarctic Peninsula ice loss up from 7 ± 13 Gt/yr in the 1990s to 33 ± 16 Gt/yr in the 2010s.

GOCE+ Antarctica (Science, 21st June 2018)

Science Home News Journals Topics Careers

RESEARCH

GEOPHYSICS

Observed rapid bedrock uplift in Amundsen Sea Embayment promotes ice-sheet stability

Valentina R. Barletta[1,2]*, Michael Bevis[2], Benjamin E. Smith[3], Terry Wilson[2], Abel Brown[2], Andrea Bordoni[4], Michael Willis[5], Shfaqat Abbas Khan[1], Marc Rovira-Navarro[1,6], Ian Dalziel[7], Robert Smalley Jr.[8], Eric Kendrick[2], Stephanie Konfal[2], Dana J. Caccamise II[2], Richard C. Aster[9], Andy Nyblade[10], Douglas A. Wiens[11]

The marine portion of the West Antarctic Ice Sheet (WAIS) in the Amundsen Sea Embayment (ASE) accounts for one-fourth of the cryospheric contribution to global sea-level rise and is vulnerable to catastrophic collapse. The bedrock response to ice mass loss, glacial isostatic adjustment (GIA), was thought to occur on a time scale of 10,000 years. We used new GPS measurements, which show a rapid (41 millimeters per year) uplift of the ASE, to estimate the viscosity of the mantle underneath. We found a much lower viscosity (4×10^{18} pascal-second) than global average, and this shortens the GIA response time scale to decades up to a century. Our finding requires an upward revision of ice mass loss from gravity data of 10% and increases the potential stability of the WAIS against catastrophic collapse.

The viscosity of Earth's upper mantle has a key role in Earth's response to surface mass variations, especially visible in glaciated areas, at both local and global spatial scales. Those glaciated areas, including Greenland and Antarctica, contributed over the period 2000 to 2010 to global mean sea-level rise at an estimated rate of +1.22 ± 0.17 mm/year (1). Over the same time interval, the ASE, with an area of less than 4% of the Antarctic Ice Sheet (AIS), contributed to global mean sea-level rise at a rate of +0.3 ± 0.02 mm/year (1, 2), a fourth of the entire cryosphere contribution. Ice flow rates in the ASE region are increasing (3, 4), and the grounding line, controlled by the marine ice-sheet instability (5, 6) and subglacial geology (7), is retreating rapidly (8). Bedrock deforms due to a combination of Earth's instantaneous elastic response to contemporary ice changes and the delayed viscoelastic response to past deglaciation (fig. S1). Regions underlain by high-viscosity mantle are mostly sensitive to the ancient ice history, whereas in the presence of low viscosity, only the recent ice history is relevant. The response time of ice-related Earth deformations is determined by the mantle viscosity: Viscosities ~10^{18} to 10^{19} Pa s correspond to decadal to centennial time scales (9–12), and viscosities ~10^{20} to 10^{21} Pa s to mil-

[1]DTU Space, National Space Institute, Geodynamics Department, Technical University of Denmark, Kgs. Lyngby, Denmark. [2]School of Earth Sciences, Ohio State University, Columbus, OH, USA. [3]University of Washington, Seattle, WA, USA. [4]DTU Compute, Technical University of Denmark, Kgs. Lyngby, Denmark. [5]University of Colorado Boulder, Boulder, CO, USA.

Barletta et al., Science 360, 1335–1339 (2018) 22 June 2018

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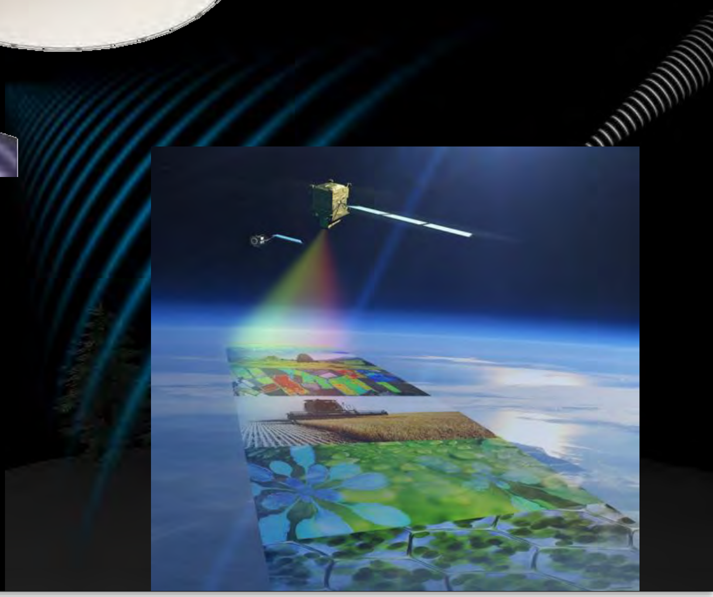
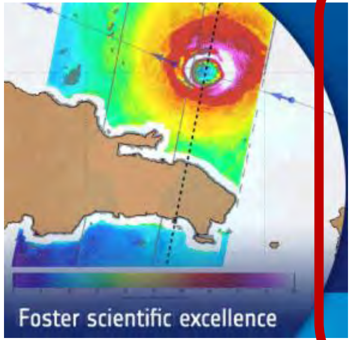
- 7th Earth Explorer: Biomass
  - Biomass estimates based on global interferometric and polarimetric P-Band Radar observations
  - Launch: 2021 (Vega)
- 8th Earth Explorer: FLEX
  - global maps of vegetation fluorescence, which can be converted into an indicator of photosynthetic activity
  - Launch: 2022 (Vega)



EO Science for Society #EO4society



Expanding Public Sector Benefits

Projects under this line will, in conjunction with committed end-user organizations, define, develop, demonstrate and validate new applications and precursor services at Global, Regional and National scales

GLOBAL

Development of global EO-based Applications to support major international initiatives.

- Intl. Env. agreements
- GEO Initiatives
- Global Environment Programs

REGIONAL

Enhance and integrate EO within existing regional monitoring and assessment systems in cooperation with regional/ national authorities.

- In Europe and neighbor countries.
- Over Atlantic, Baltic, Black Sea, Mediterranean, Alps.

NATIONAL

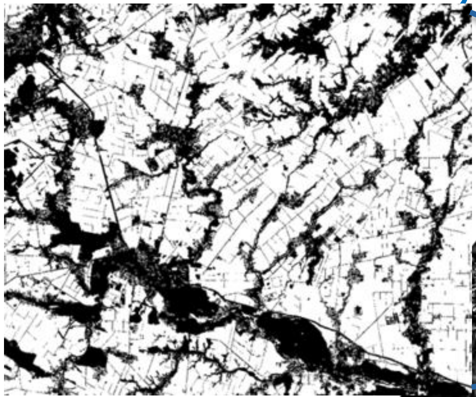
Foster new EO capacities and demonstrate EO applications that have public impact and visibility to decision makers and ministries:

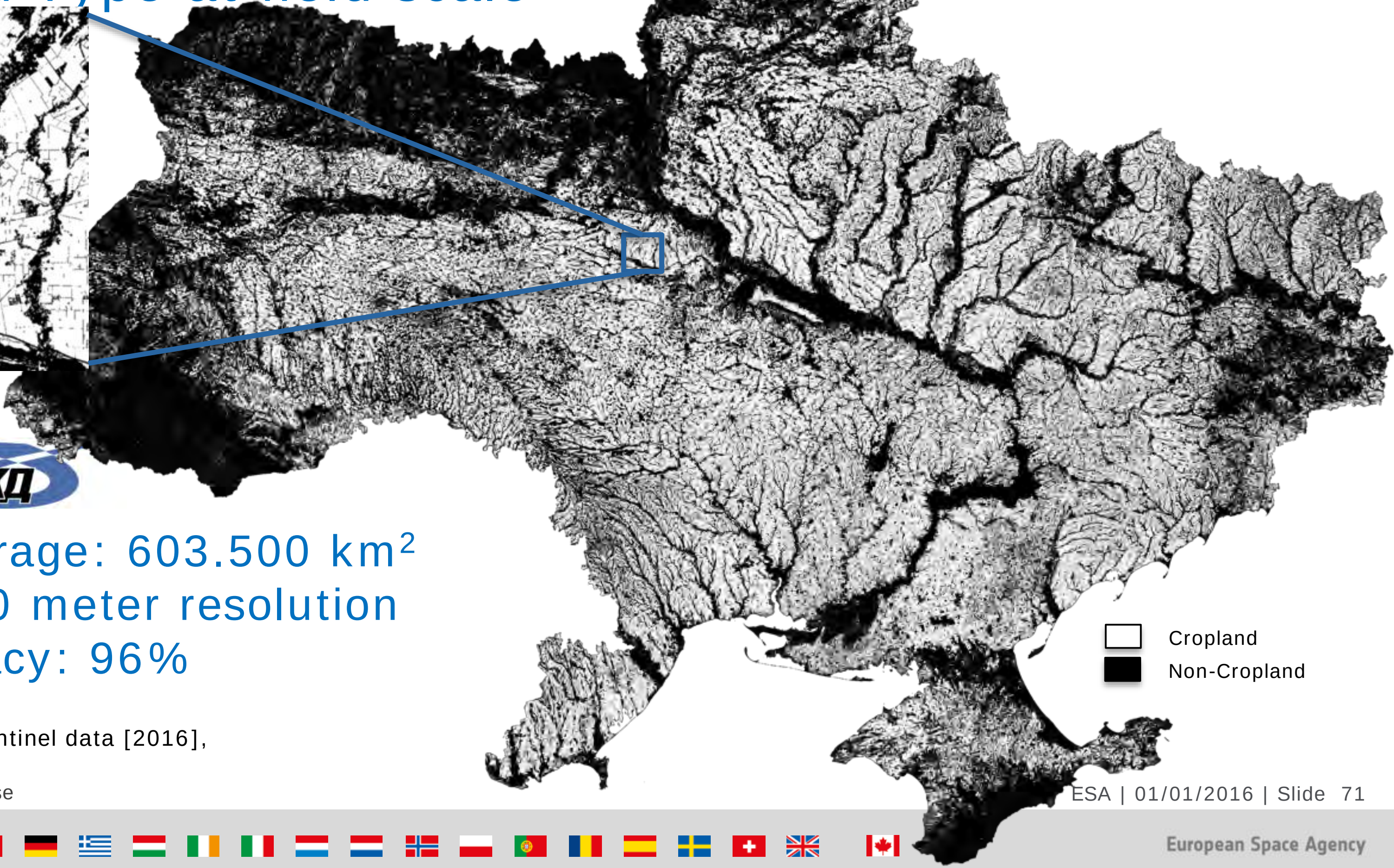
- In countries without EO national programs.
- In new and small ESA Member States

Activities will build on user dialogue and engagement methods that were successful in DUE projects.

Users: international organisations, inter-governmental bodies, national governments and agencies, civil society, NGOs

Ukraine – 2016 National Crop Mask and Type at field scale

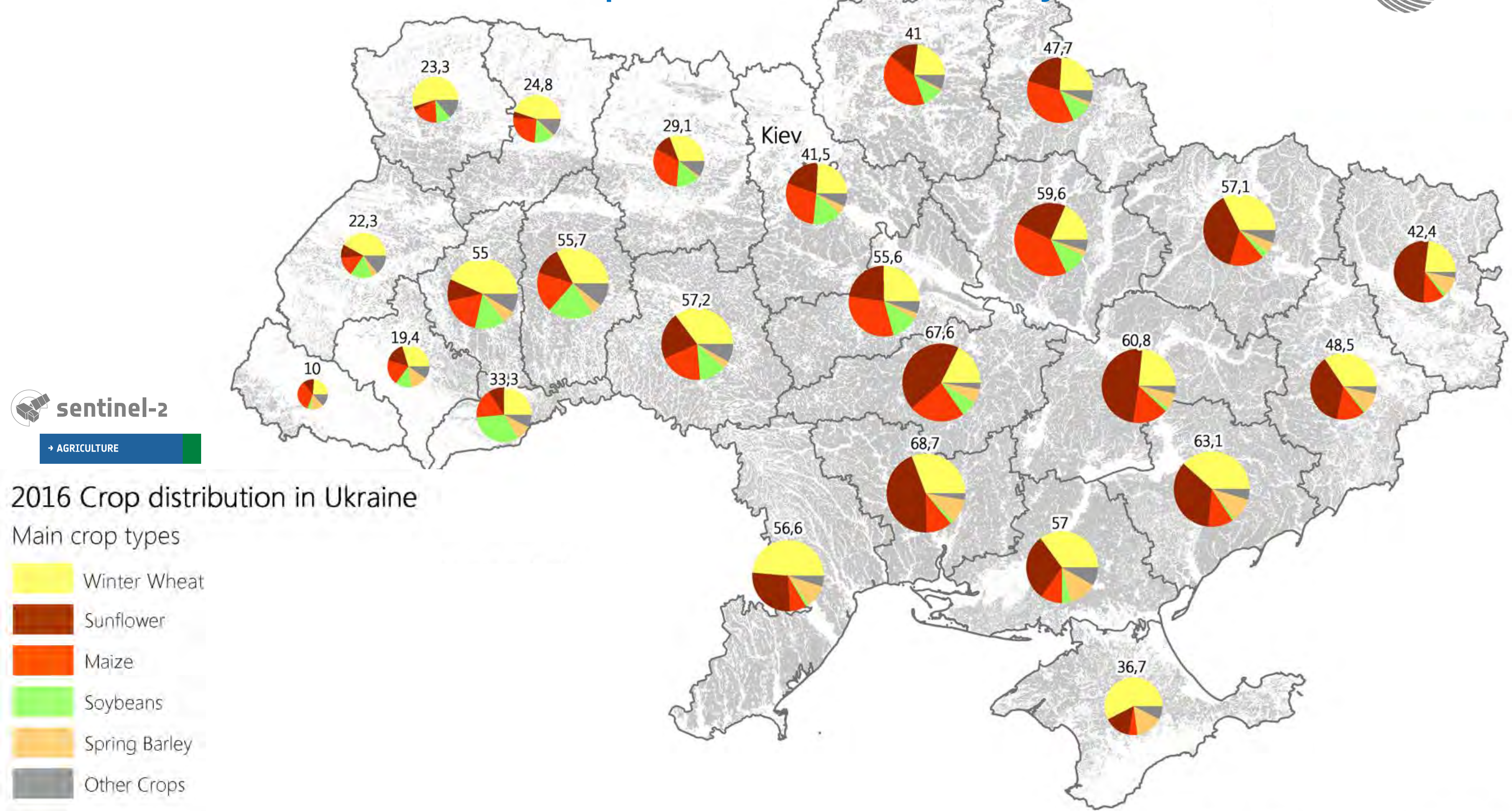




- National Coverage: 603.500 km^2
- Field Scale: 10 meter resolution
- Overall Accuracy: 96%

Contains modified Copernicus Sentinel data [2016], credit Sen2-Agri project

National statistics: Crop area indicator by Oblast



Endorsement of Copernicus for Use within the CAP

Commissioner P. Hogan: "...already Paying Agencies using data of the Sentinels ... ESA has launched a tender Sen4CAP which will provide us useful knowledge and further possibilities on how we use Sentinel data in the context of the CAP "

User Driven Thematic Conferences

2018/2019

2nd Mapping Water Bodies from Space Conference

27-28 March 2018 [ESA-ESRIN]

Background

In the frame of the EO Science for Society Programme Element, the European Space Agency is organising the 2nd Mapping Water Bodies from Space Conference.

The purpose of this conference is to provide scientists and data users with the opportunity to present first-hand and up-to-date results from their on-going research and application development activities by using data from past and current Satellites.

Participation

- ✓ ESA Principal Investigators
- ✓ Co-investigators
- ✓ Sentinel-1, Sentinel-2 and Sentinel-3 users
- ✓ Scientists
- ✓ Students
- ✓ Representatives from national, European and international space agencies, research labs and value adding industries

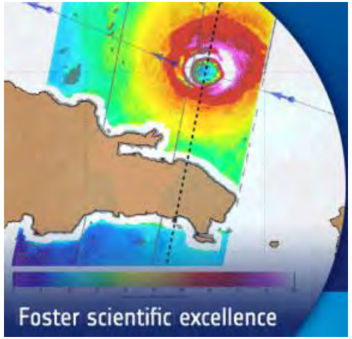
2nd Mapping Urban Areas from Space Conference

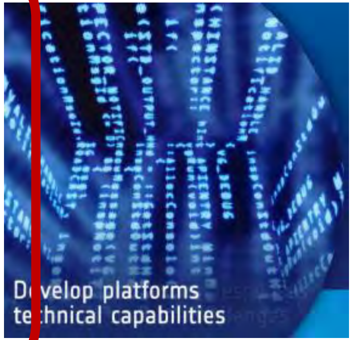
30-31 October 2018 [ESA-ESRIN]

WorldCover 2019 Conference

February 2019 [ESA-ESRIN]

EO Science for Society #EO4society





Enabling Industry Growth

Projects under this line will foster growth in commercial EO information industry through the development of new user-demand and the generation of marketable EO-based products and services that respond to this demand.

Expand Demand

User sectors that offer significant potential to grow the use of EO enabled by step-increase in operational demonstrations (eg. Large-scale, NRT, massive computing, Data Analytics).

New Opportunities & Actors

Stimulate entrepreneurship/innovation by exploring many small-scale disruptive ideas, Develop a network of Earth Lab Accelerators (ELA), Develop outreach / MOOC portfolio.

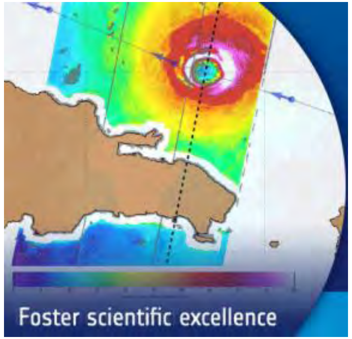
Best-Practices

User sectors initial use of EO has been made, but comprehensive understanding of the EO potential needs to be established through trade associations/organizations.

Making use of European National Missions

Primary Users: Industrial Private-Sector

EO Science for Society #EO4society



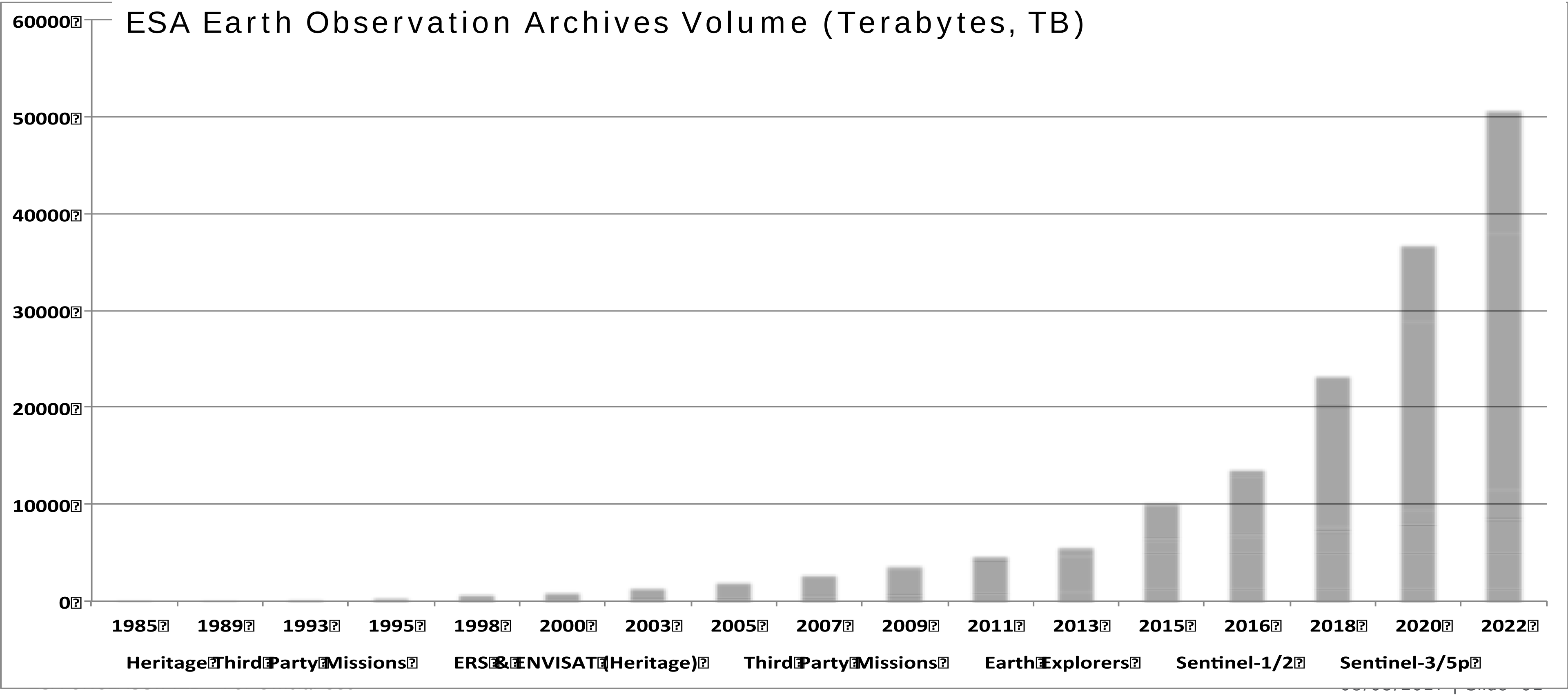
New IT Boundary Conditions

- Easy Data Access
- 7B cell phones world wide
- Wide availability of mobile broadband subscriptions
- Social media and networks
- Crowd Sourcing/Mapping
- “Big Data”
- Cloud Computing
- Exploitation Platforms
- New companies becoming involved in space

Election Pope Benedict XVI

Election Pope Francis

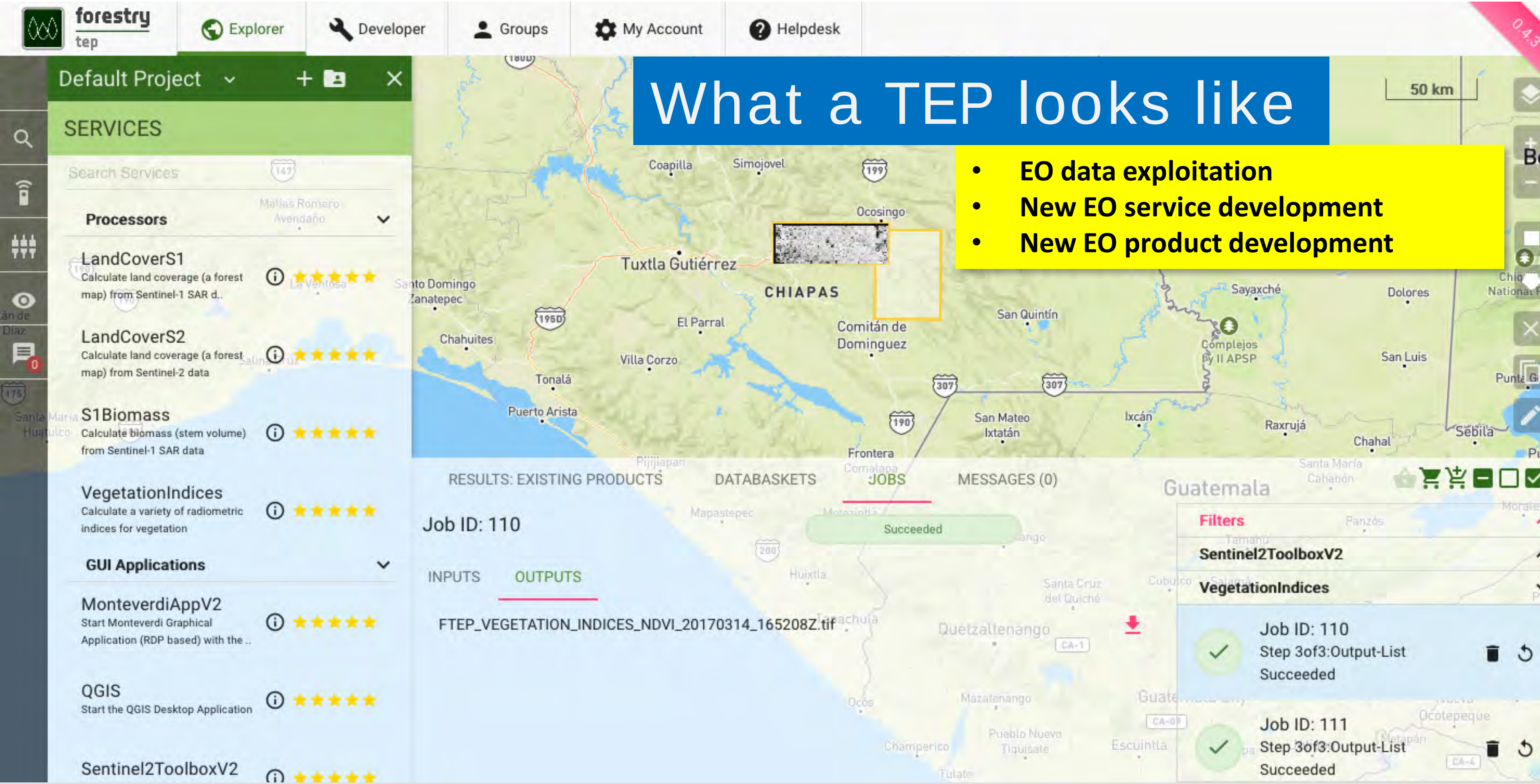
ESA Earth Observation – Big Data Era Starts

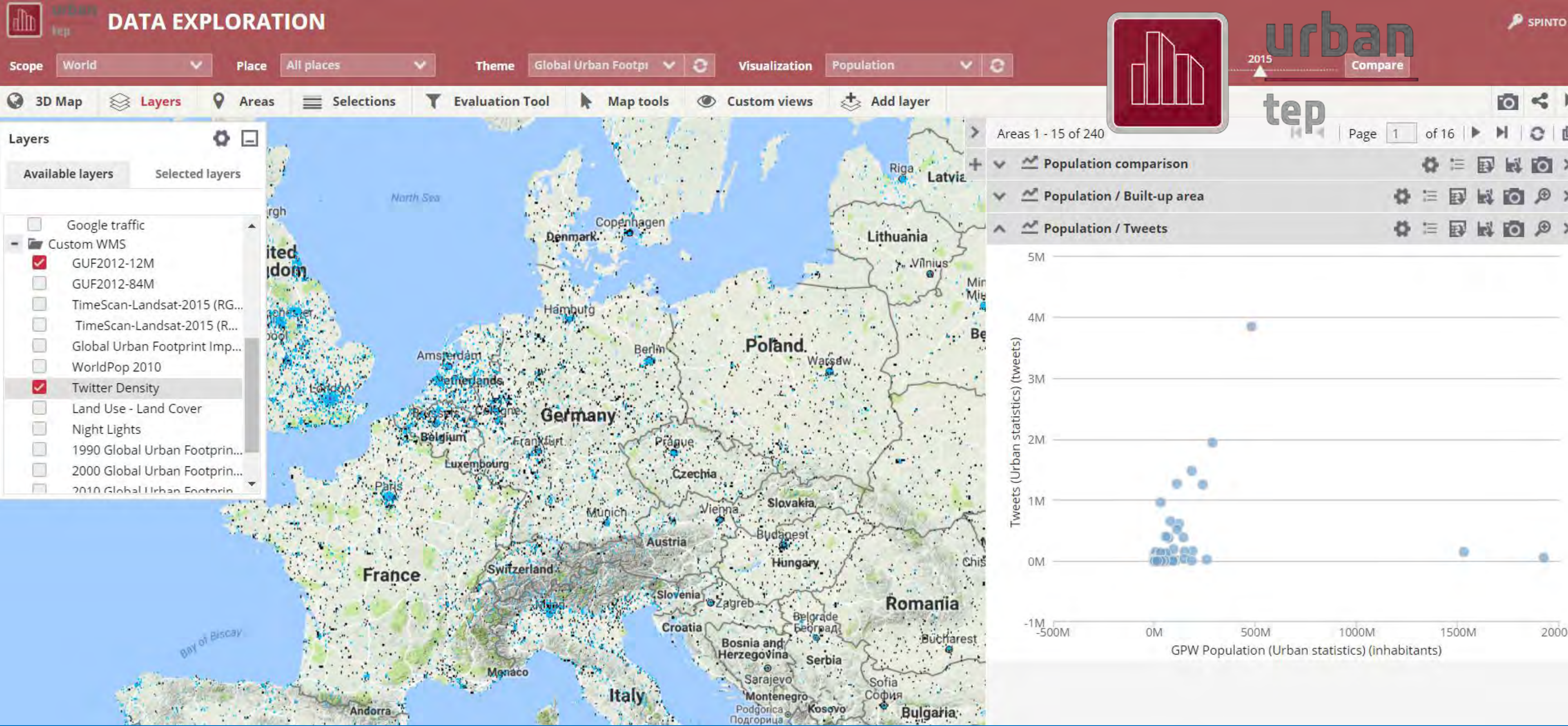


Thematic Exploitation Platforms

What a TEP looks like

- **EO data exploitation**
- **New EO service development**
- **New EO product development**

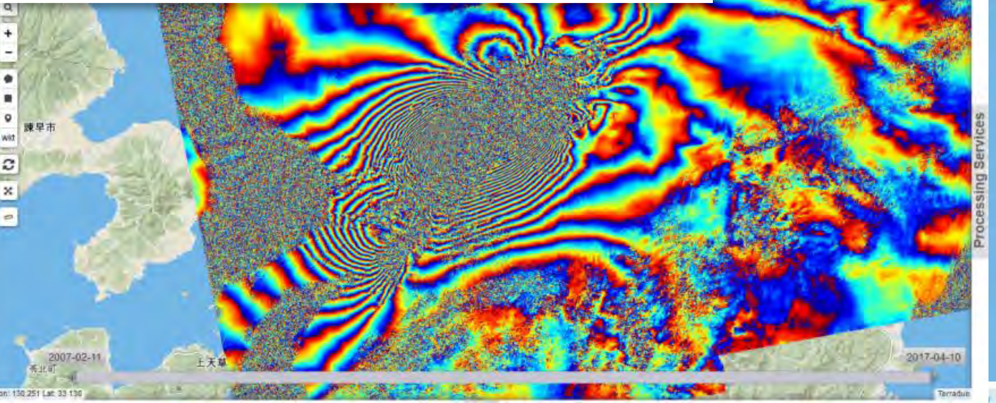




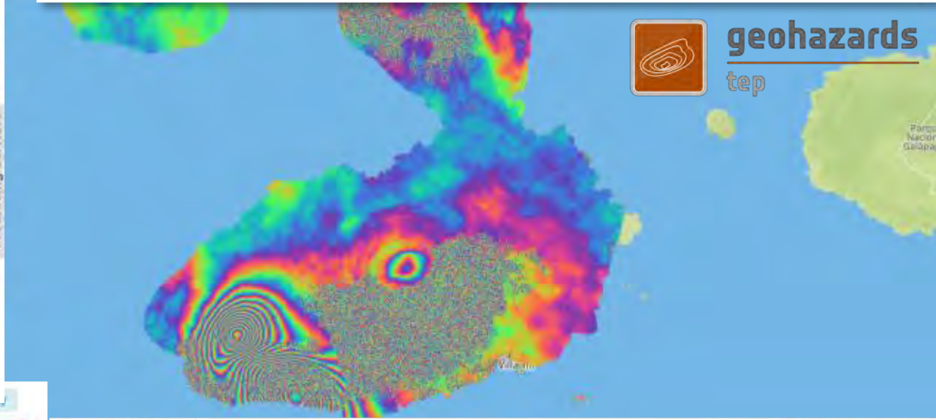
A TEP service: Compare Population, Urban footprint (Sentinel-1 & TerraSAR-X) and Twitter data

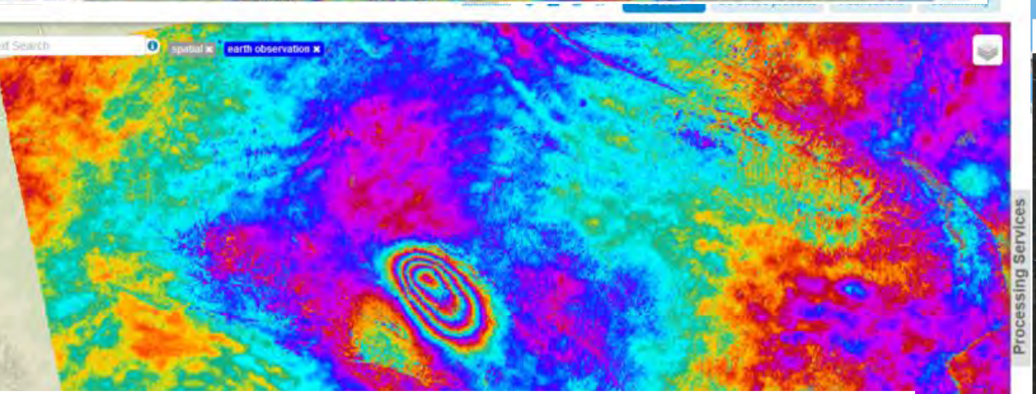
A TEP service: Earthquake and Volcano eruptions

Mid April 2016 Kumamoto Earthquake: Sentilel-1 wrapped interferogram

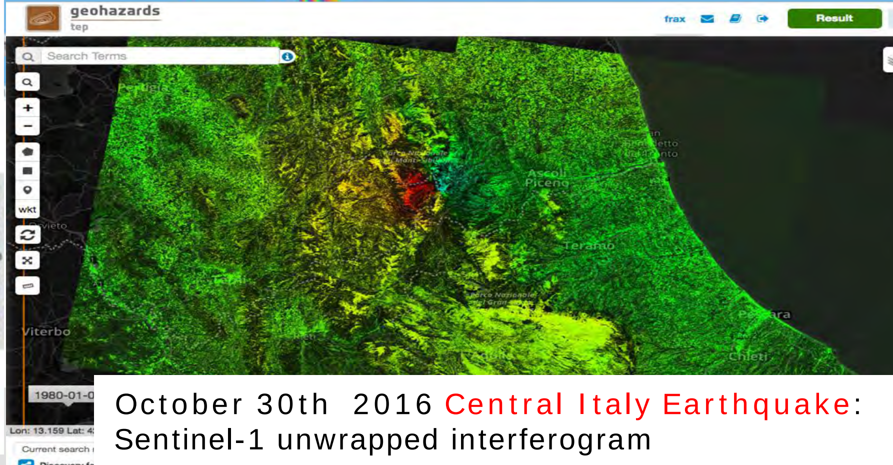


March 2017 deformation of the Volcano Cerro Azul: Sentinel-1 wrapped interferogram

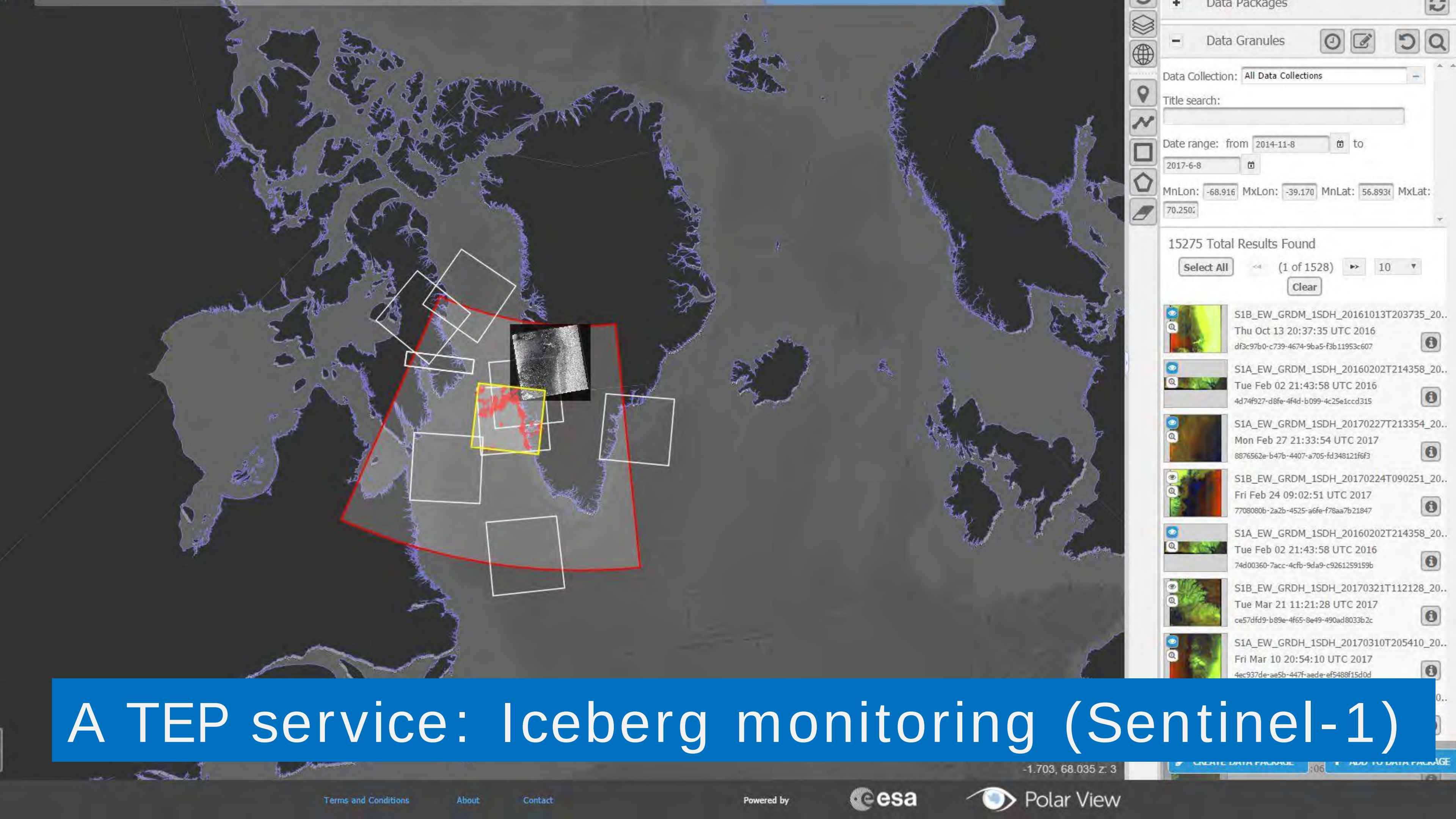




April 5th 2017 Iran Earthquake: Sentinel-1 wrapped interferogram

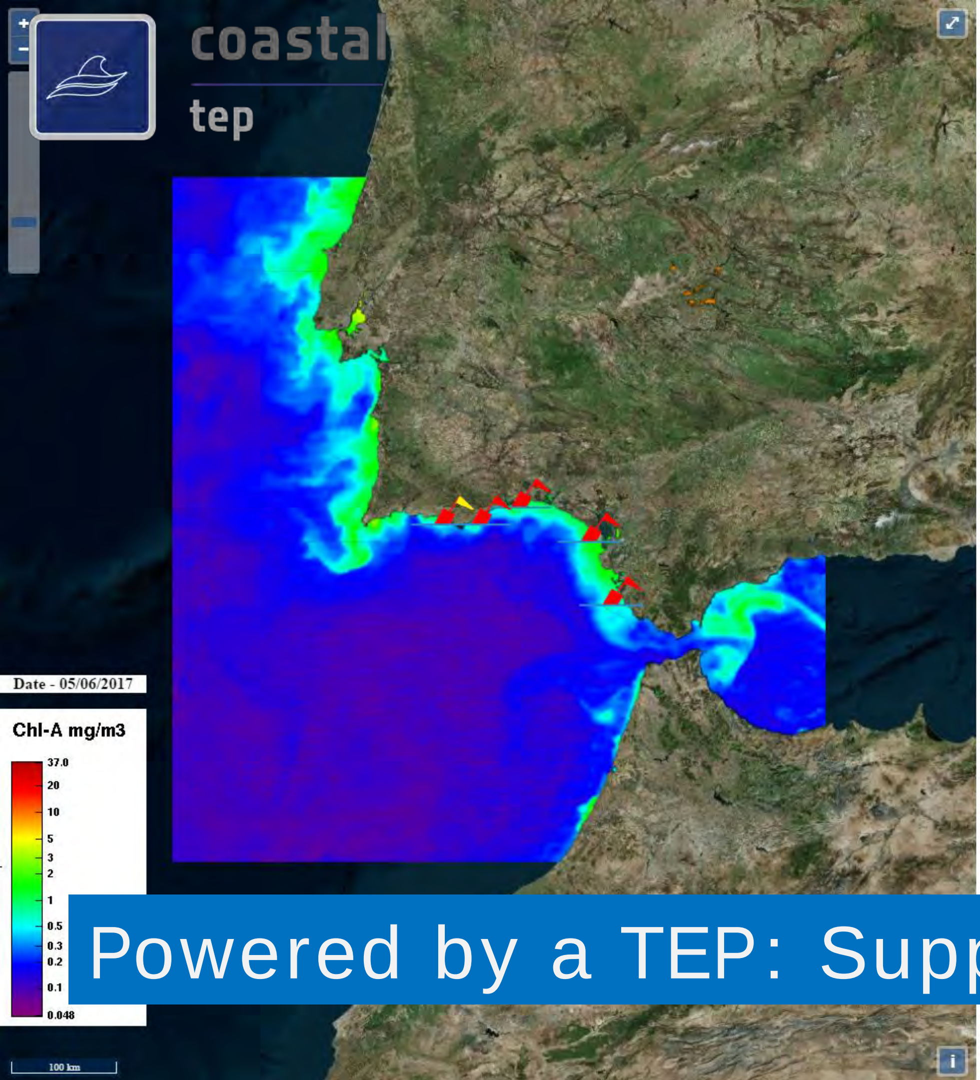


October 30th 2016 Central Italy Earthquake: Sentinel-1 unwrapped interferogram



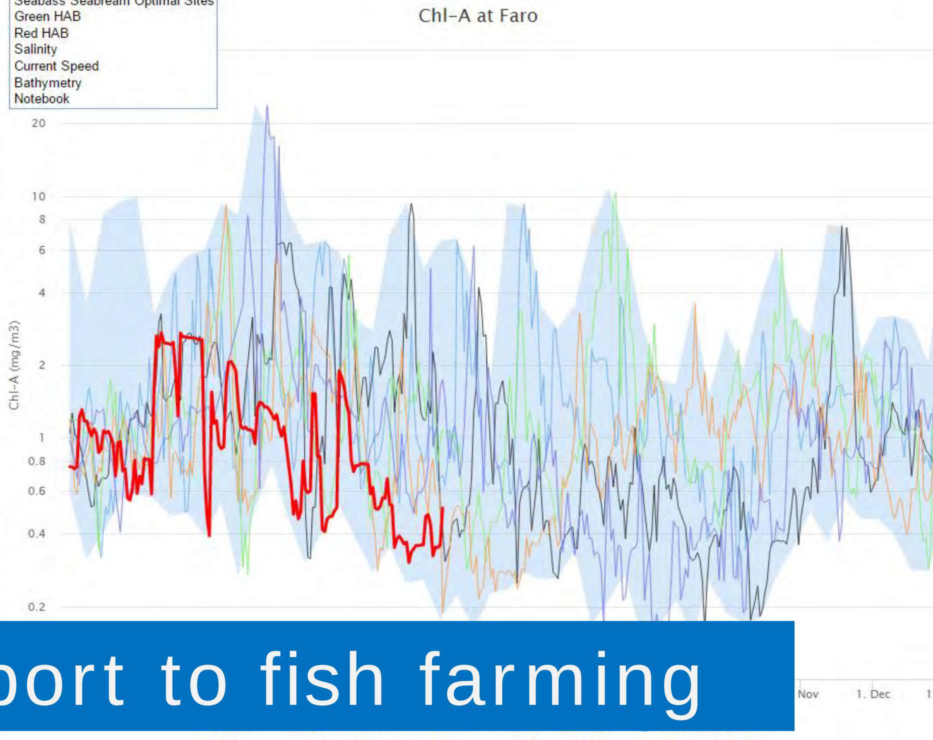
A TEP service: Iceberg monitoring (Sentinel-1)

Powered by a TEP: Support to fish farming



Get user manual

Chl-A
Temperature
Transparency
Turbidity
Wave
Sentinel-2 Composite RGB
Gradients of SST
Relative mussels weight
Sardine Recruitment
Tuna Migration
Mussel Optimal Sites
Seabass Seabream Optimal Sites
Green HAB
Red HAB
Salinity
Current Speed
Bathymetry
Notebook



You can show and hide timeseries by clicking on their name above

SAFI is a FP7 project funded by the European Commission. The views and opinions expressed in this publication are the sole responsibility of the authors and do not necessarily reflect the views of the European Commission.

Towards efficient data exploitation

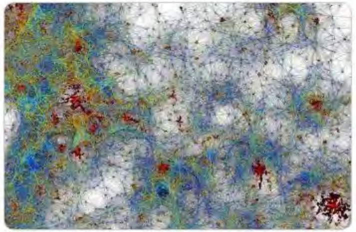
WEBBROWSER

Urban TEP – Pre-operations portfolio: demo products/services

Global thematic datasets

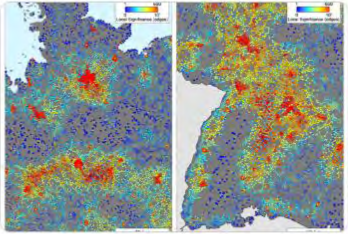
Global Urban Footprint 2012 (GUF)

Global Built-up Density 2012 (GUF-DenS 2012)

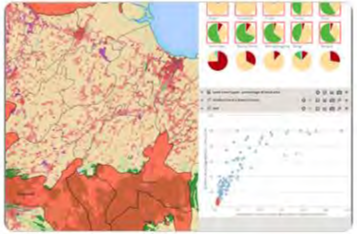


Global Settlements Network 2012 (GUF-NetS 2012)

Indicators and metrics

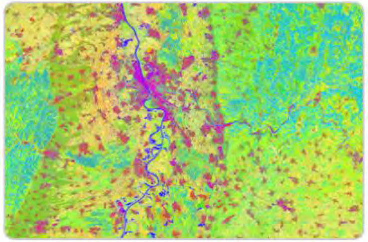


Functional Urban Area



User-defined metrics and indicators

Value-added basic EO data



TimeScan Landsat 2015

Innovative Demo Applications and Products

Tourists routes based on Flickr and Picasa time stamps

NRT mobility data

Monitoring urban development

Shanghai
1985-2015

Monitoring urban development

Shanghai
1985

Monitoring urban development

Shanghai

1990

Monitoring urban development

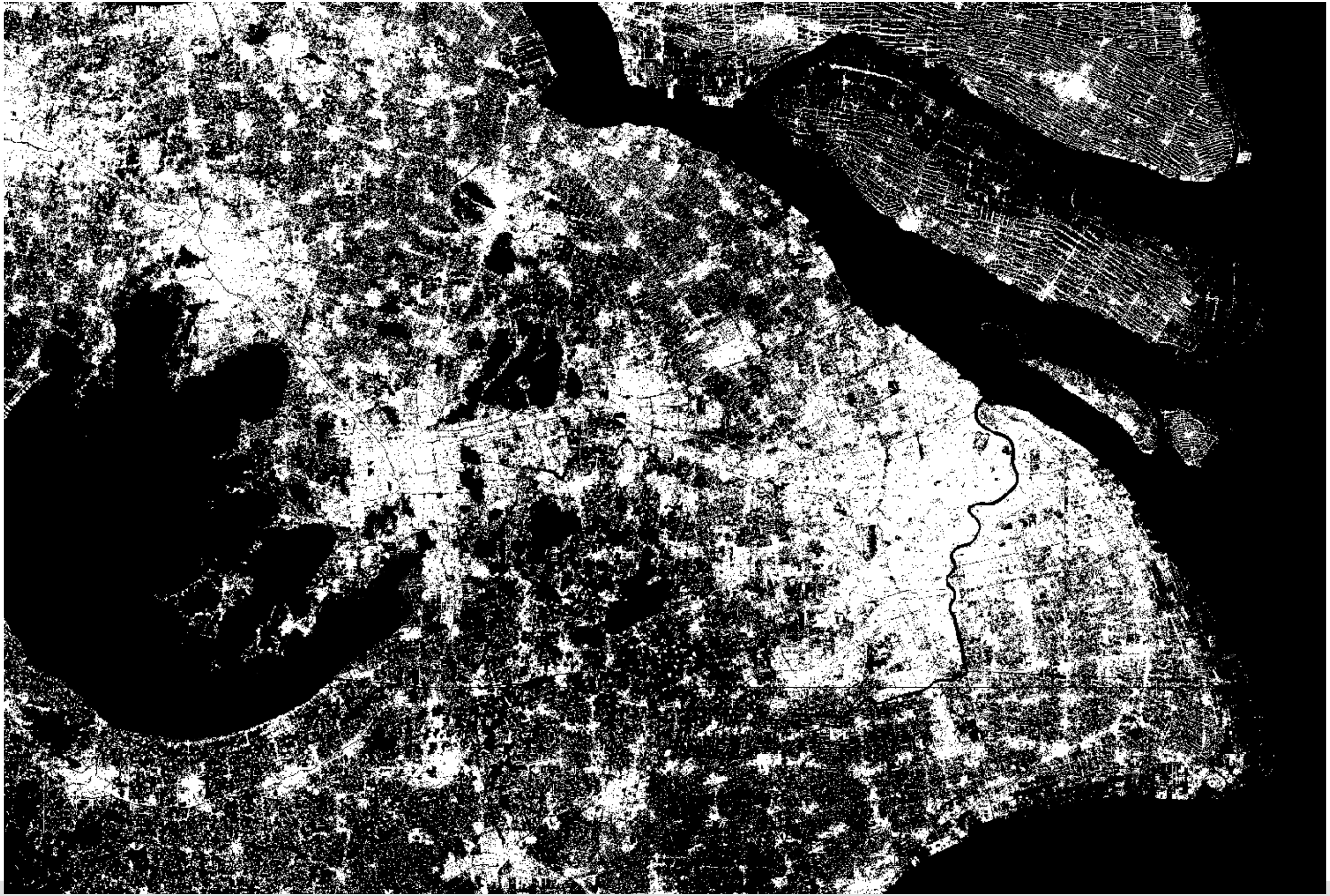
Shanghai
1995

Monitoring urban development

Shanghai
2000

Monitoring urban development

Shanghai
2005

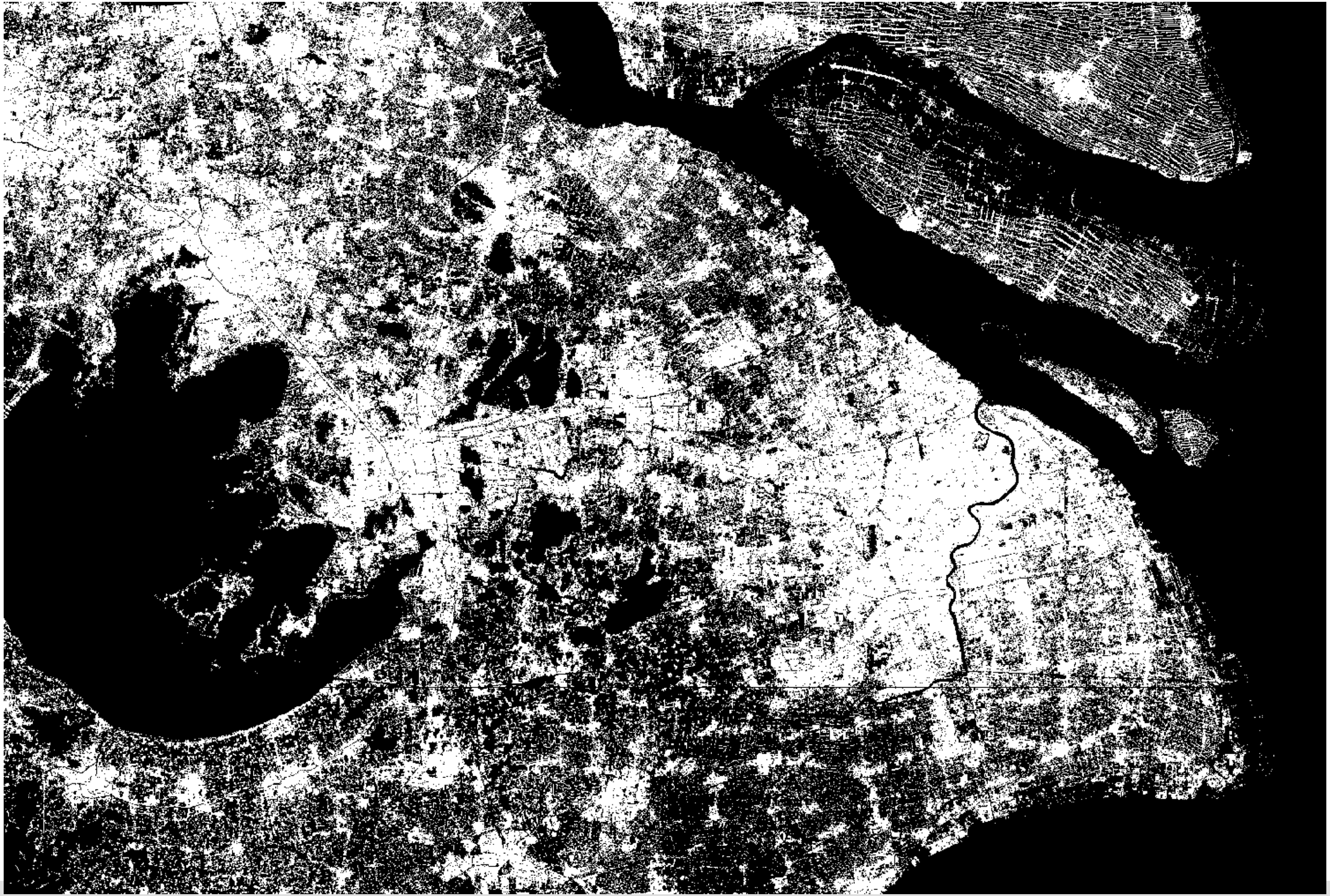


esa

Monitoring urban development

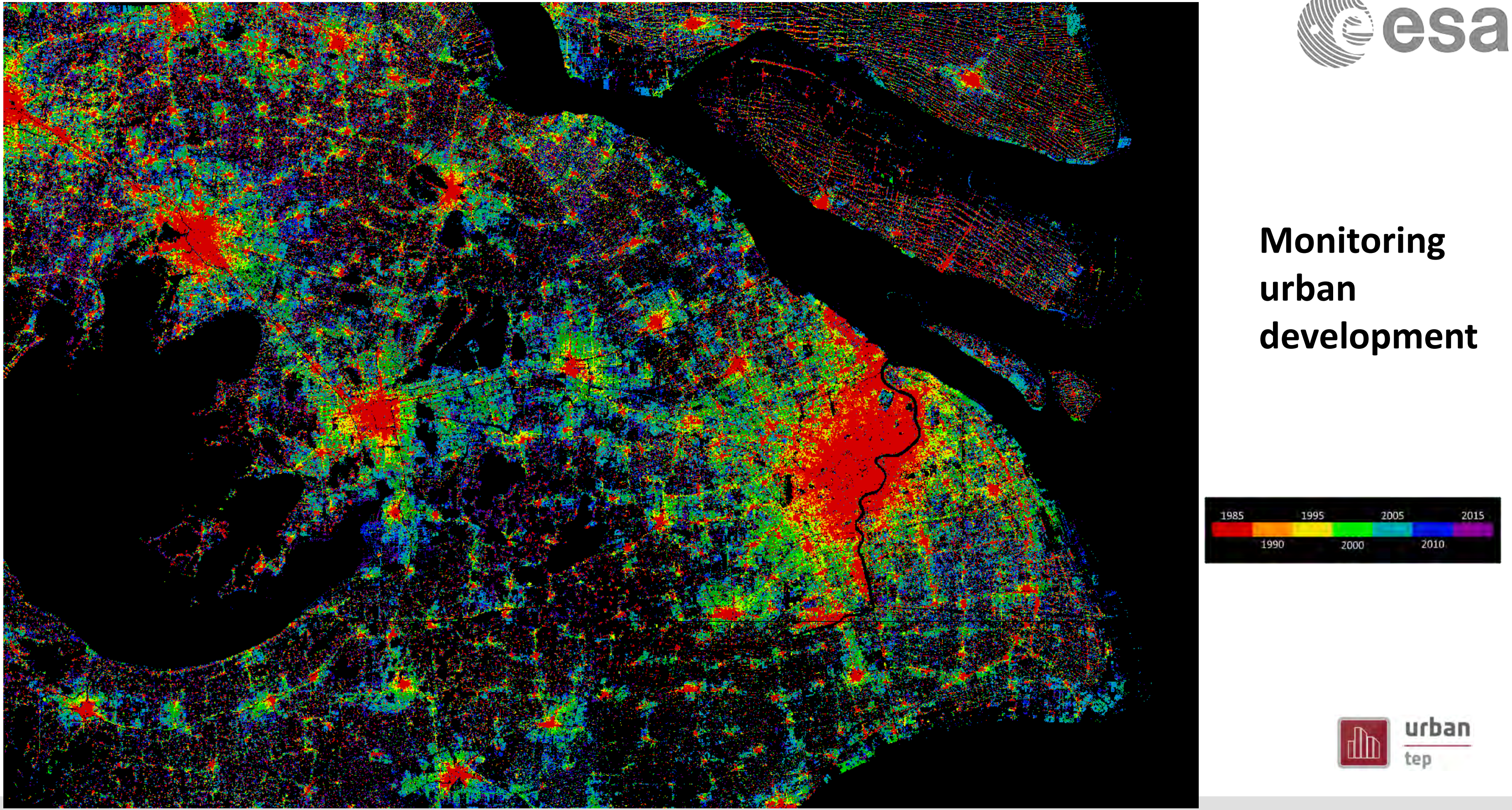
Shanghai
2010

urban tep



Monitoring urban development

Shanghai
2015



Monitoring urban development

urban tep

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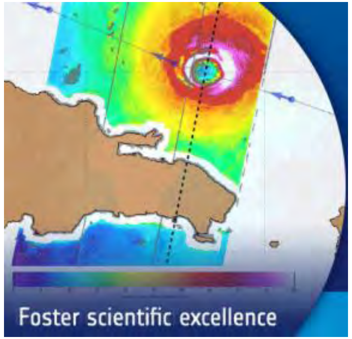
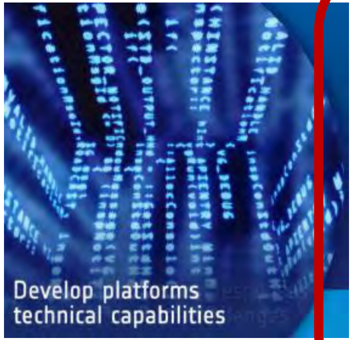
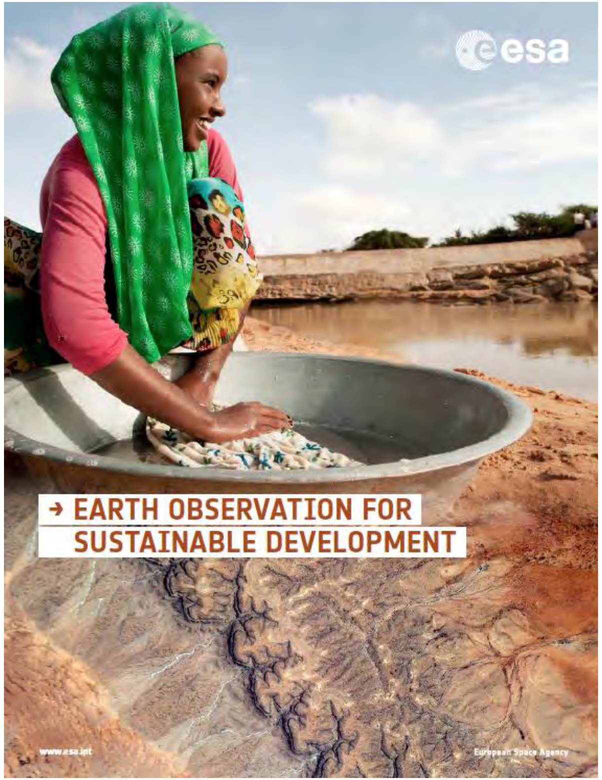




EO FOR SUSTAINABLE DEVELOPMENT

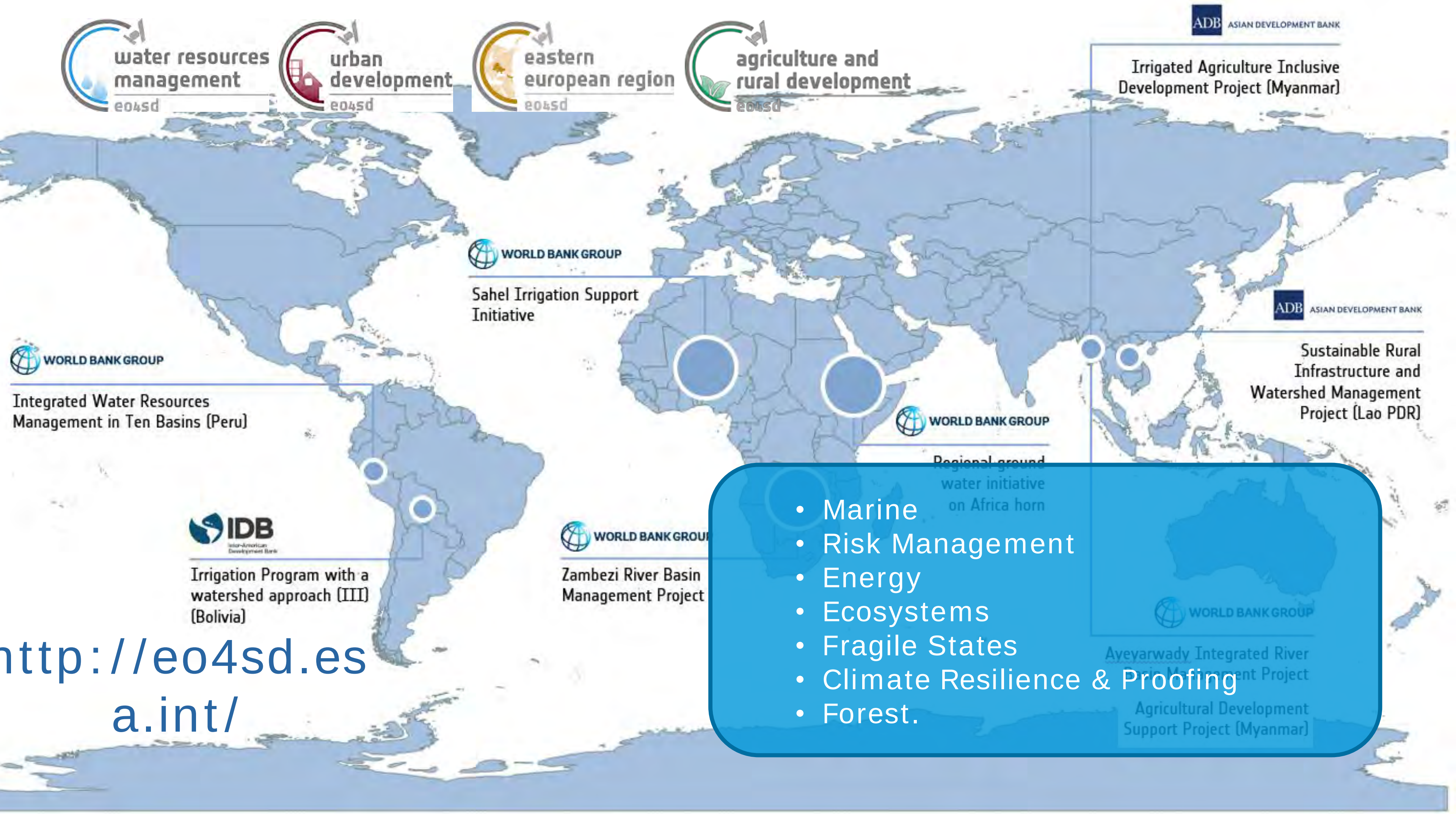


- Phase 1 (3 years, EOEP-5): Consolidate Requirements, engage stakeholders (IFIs & Client States) via regional demonstrations of EO.

- Phase 2 (5 years, EW TBD, C-MIN19): Mainstream & Transfer EO into operational working processes & financing of ODA as 'best-practice' source of environmental information in Environmental Safeguards Systems and Monitoring & Evaluation methodologies, SDGs of highly relevant.

- Priority thematic areas :

  Urban, Marine & Coastal, Agriculture, Risk Management, Energy & Extractives, Water Resources, Forest, Ecosystems Services, Fragile & Conflict States, Climate Resilience & Proofing.



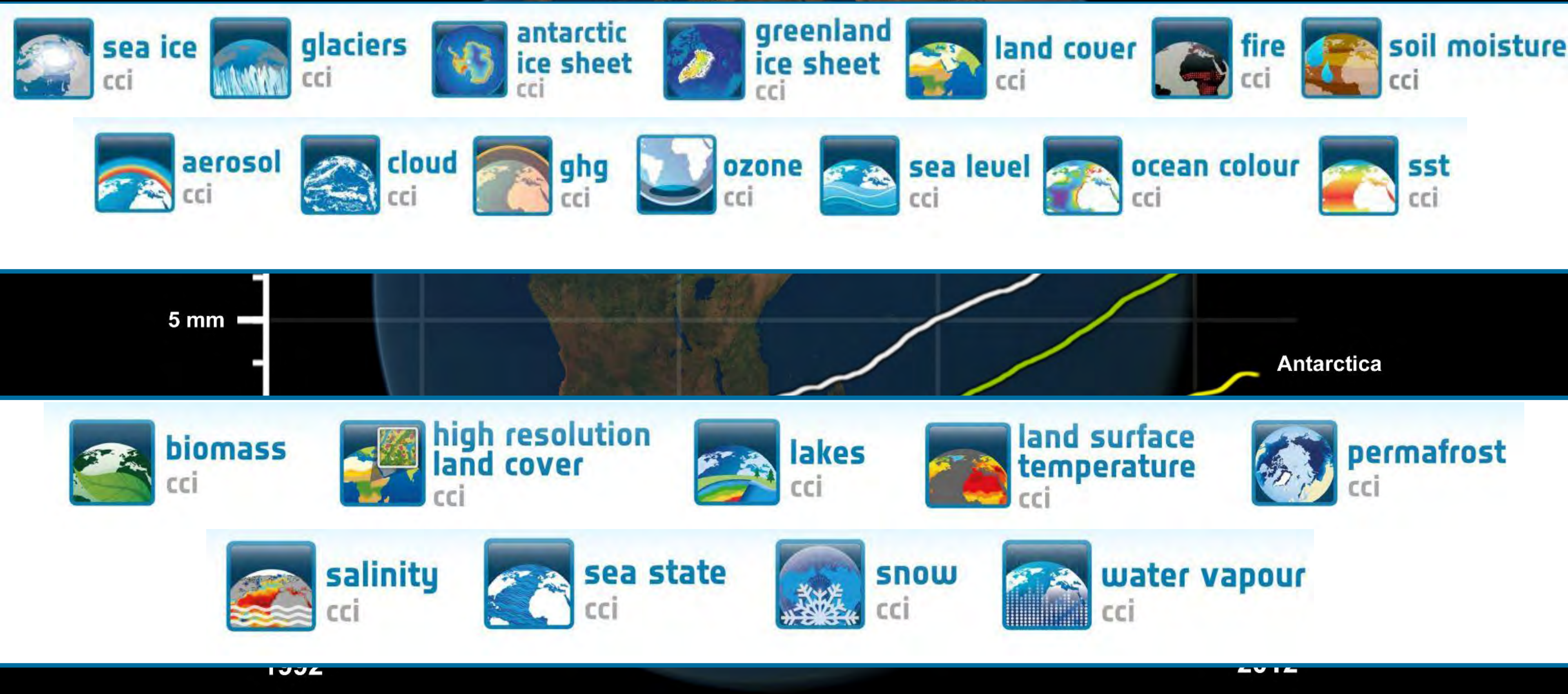
- Marine
- Risk Management
- Energy
- Ecosystems
- Fragile States
- Climate Resilience & Proofing
- Forest.

http://eo4sd.esa.int/

Regional Initiatives

- ESA has started a set of Regional initiatives
- Including science, applications and data infrastructure components (exploitation platforms);
- Focus on regional priorities with high interest for ESA Member States;
- Target regions: Baltic, Black-sea/Danube, Alpine, Atlantic and Mediterranean.

Total Ice Sheet Contribution to Global Sea Level




European Space Agency
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