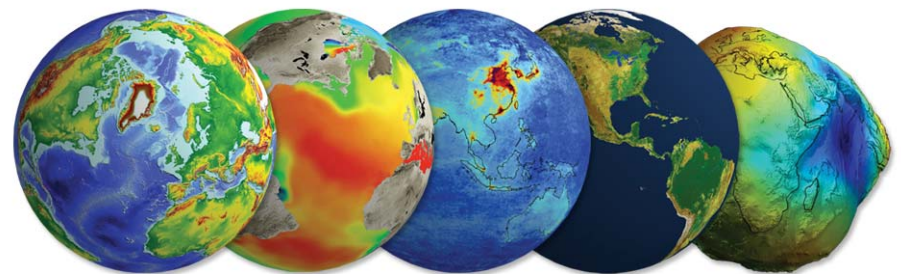


EOEP REVIEW SEMINAR

Mission Exploitation

15-16 June 2011



- ***Scientific excellence and innovation***
- ***Engagement & benefits for end-users***
- ***Engagement and benefits for value-adding industry***
- ***Coordination with other programmes***
- ***Achievement of programme objectives***
- ***Looking forward...***



Which elements are involved ?

EOEP Data Exploitation



- ***Continuity of Missions:*** provides support to PIs, with multi-mission toolboxes, thematic workshops, advanced training courses, targeted R&D (ERS and ENVISAT to date)
- ***Data User Element:*** transfers new EO research results into user-driven applications and engages end-user organizations
- ***Value-adding Element:*** supports development of marketable EO-based products and services by the European value-adding industry
- ***Support to Science Element*** (*new in EOEP3*) fosters scientific innovation and targeted research to stimulate exploitation of earth explorers

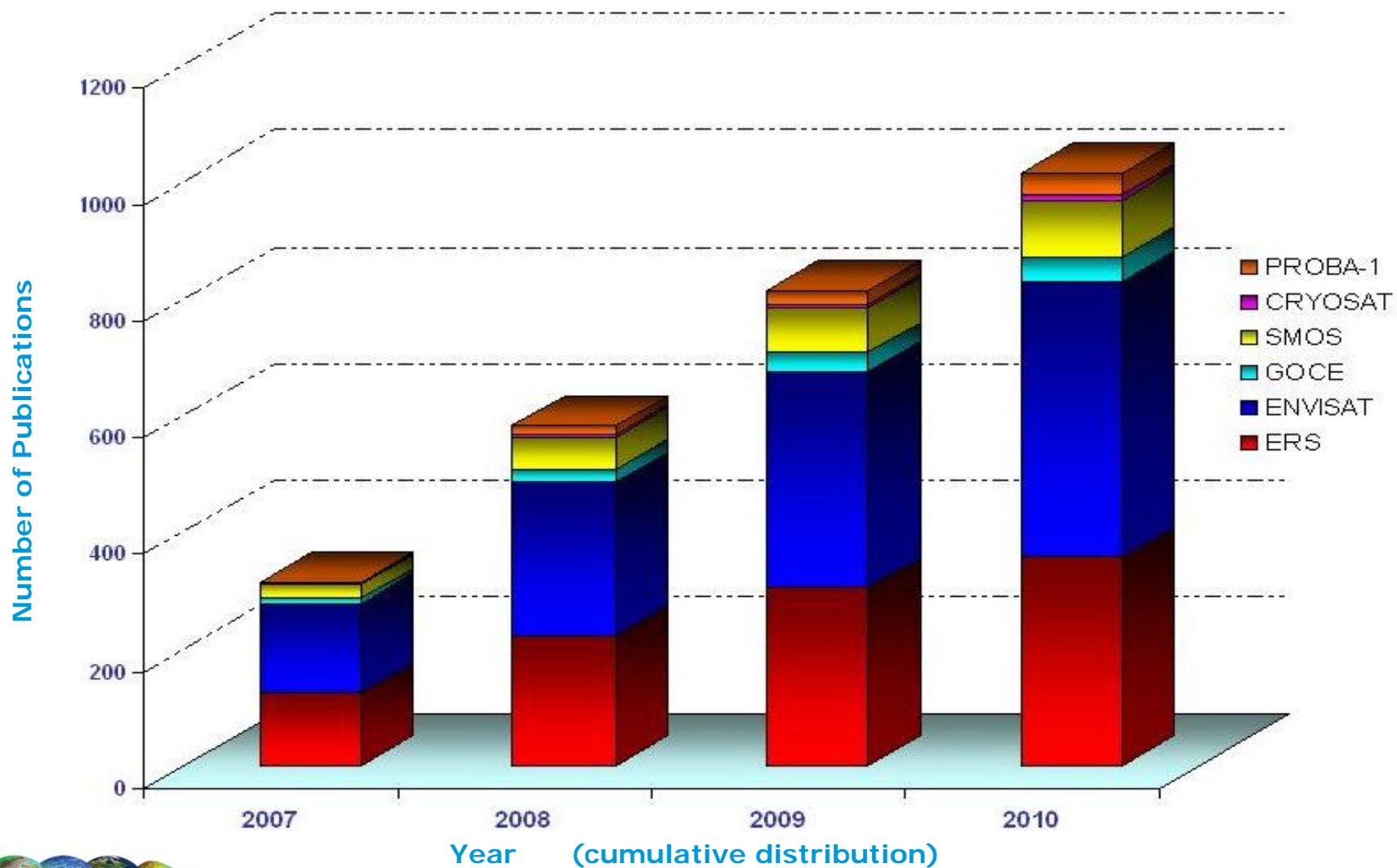


Scientific Excellence and Innovation...

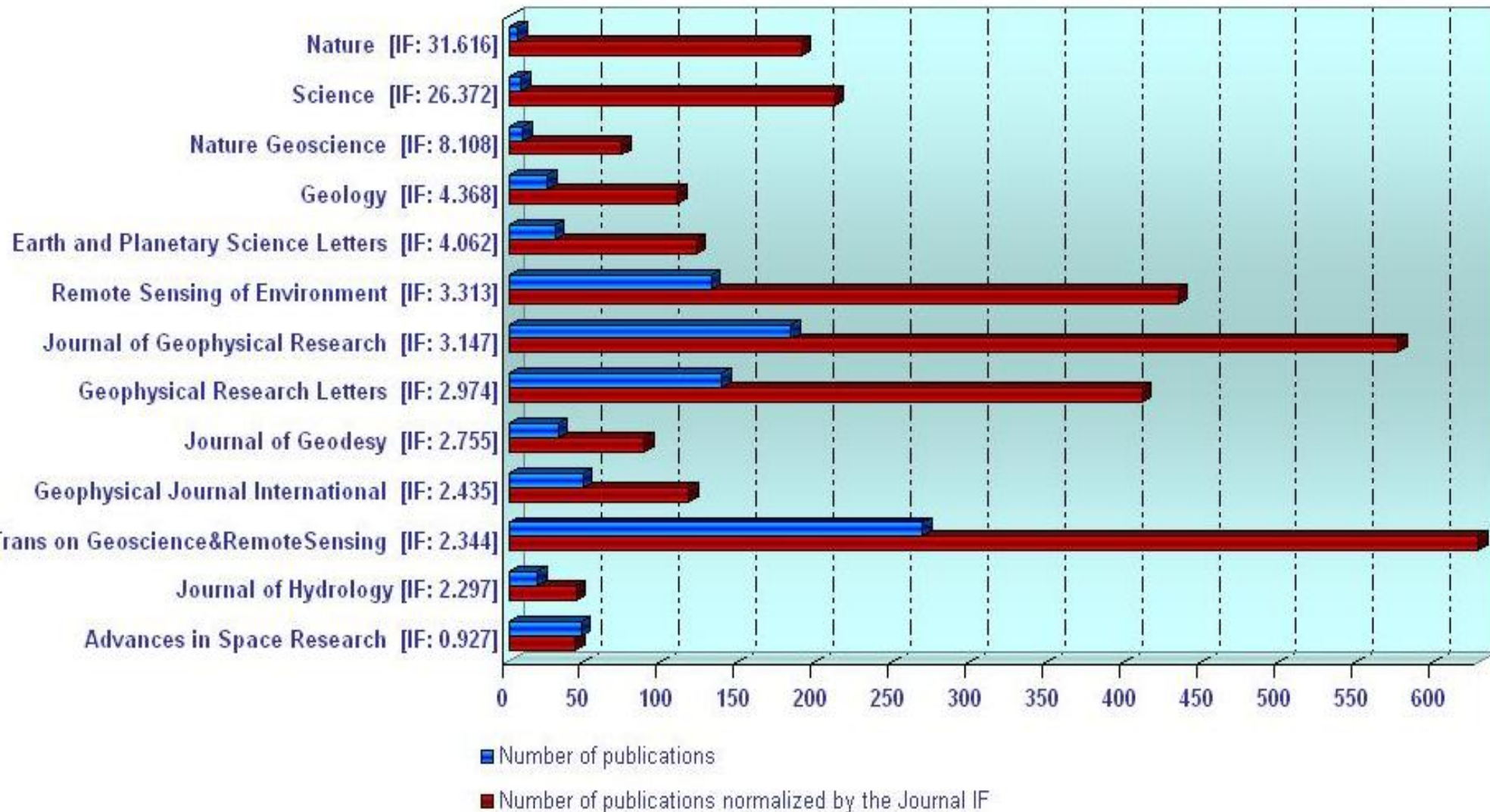


Scientific impact

Peer reviewed publications



Main peer reviewed Publications (2007 – 2010)

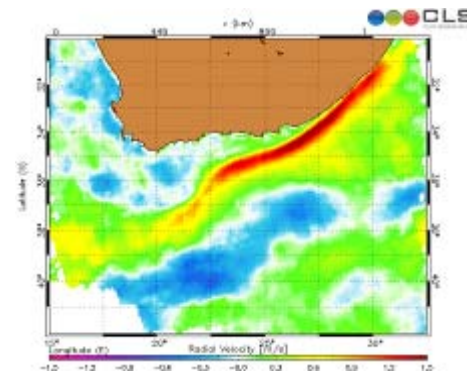


New scientific results made possible

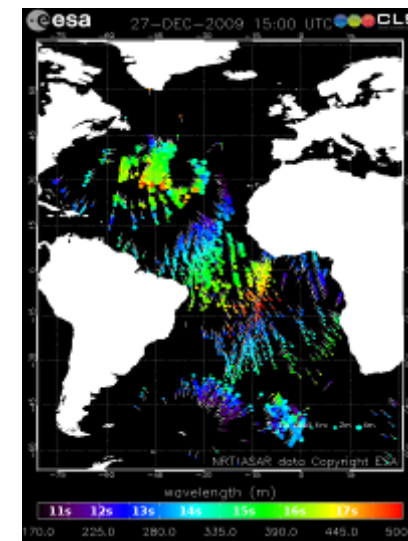
ERS and ENVISAT



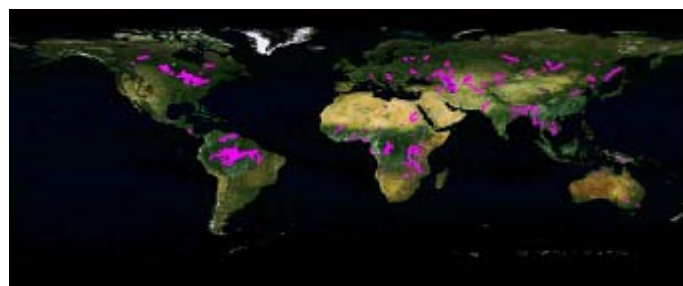
1. Radial Surface currents retrieval from SAR Doppler anomaly



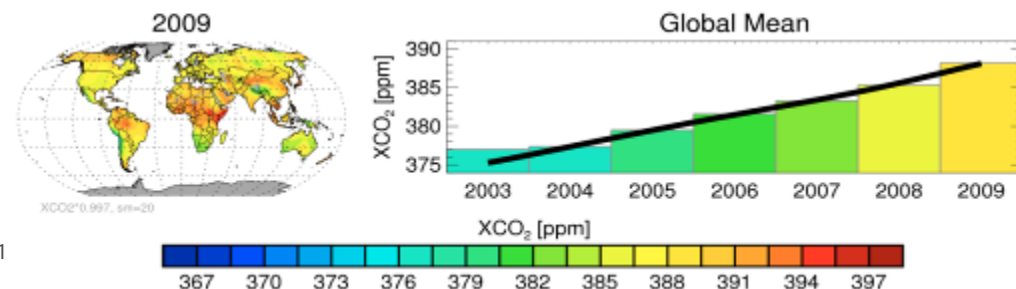
2. Global Swell tracking from SAR wave mode



3. Global River and Lakes measurements from space







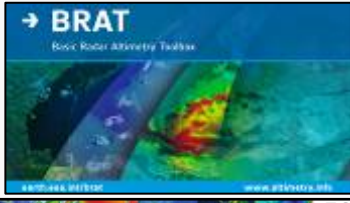
4. Greenhouse gases monitoring



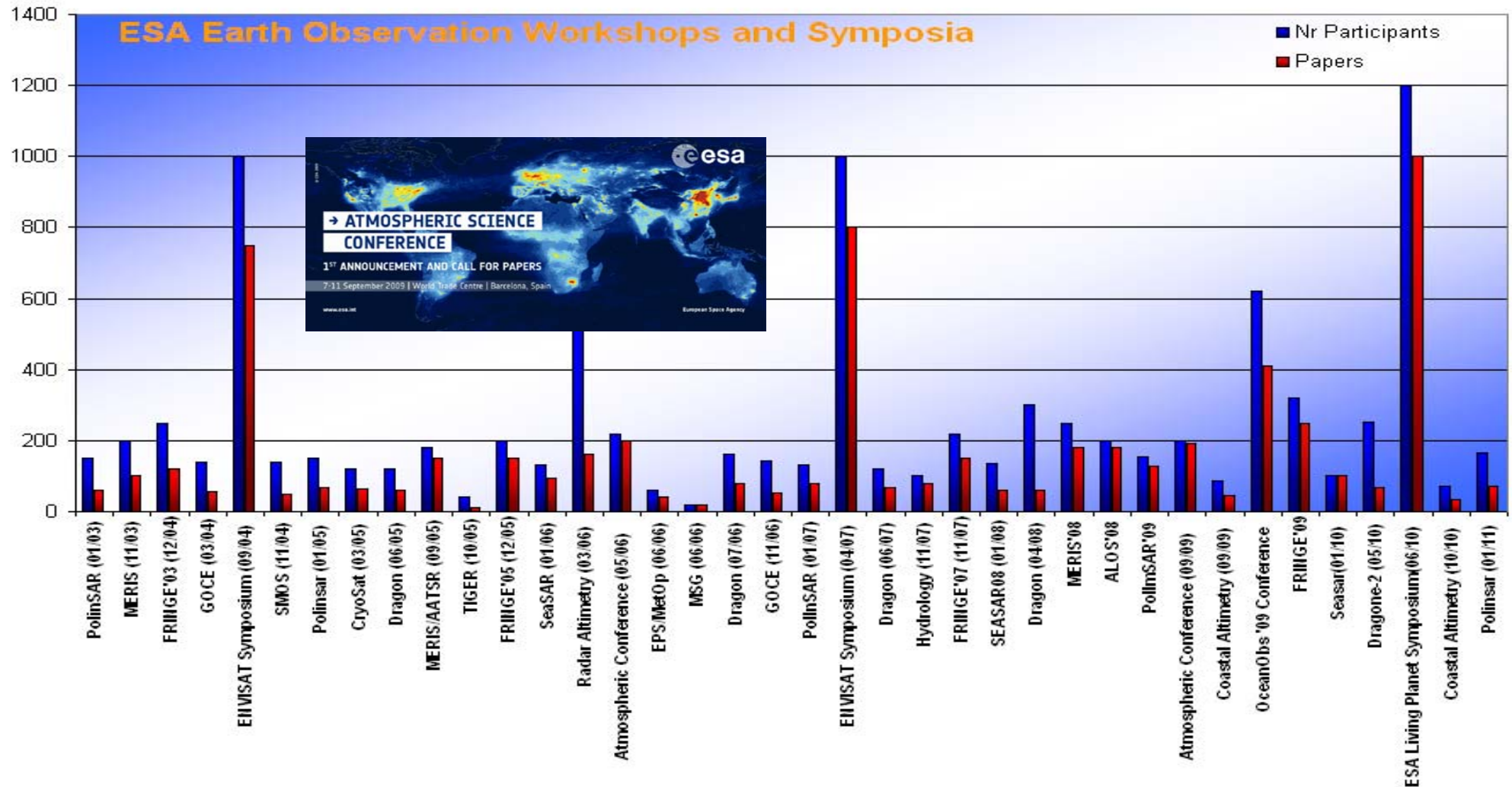
Innovative methods

Open Source Multi-mission Toolboxes

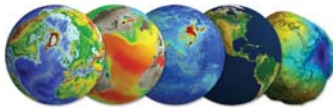
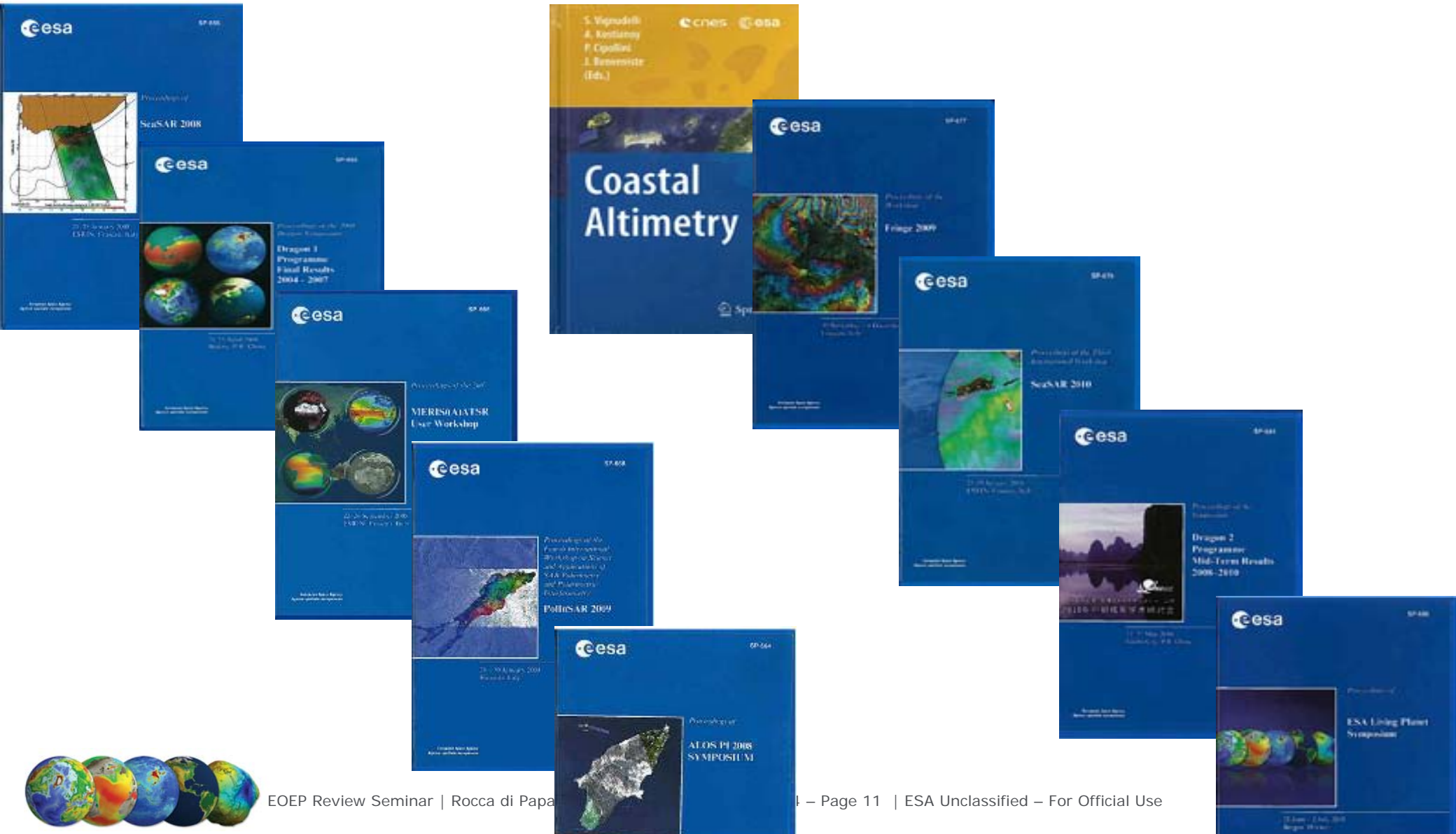


	Example of innovative features	Mission	Users
 <p>→ BEAM v. 4.6 Earth Observation Toolbox and Development Platform</p>	<ul style="list-style-type: none"> – Level 3 Binning and Mosaicing <ol style="list-style-type: none"> 1. Atmospheric corrections 2. Cloud Probability computation 3. SMOS and CHRIS-Proba data handling 	Envisat MERIS/AATSR, ERS ATSR, Proba CHRIS, Alos PRISM/AVNIR-2, Terra&Aqua MODIS, NOAA-KLM AVHRR/3, Landsat5 TM, SPOT Vegetation	2000
 <p>→ POLSARPRO v. 4.0 The Polarimetric SAR Data Processing and Exploitation Tool</p>	<ul style="list-style-type: none"> – Polarimetric Coherence Tomography – Stack data processing – Fully coherent Forest simulator – Pol-InSAR capability – Surface parameter data inversion – Tutorial on Radar Polarimetry Principles and Applications 	Envisat ASAR, RADARSAT-2, ALOS PALSAR, TerraSAR-X, SIR-C, AIRSAR, TOPSAR, EMISAR, E-SAR Pi-SAR, SAR580-Convair, RAMSES, UAVSAR	1200
 <p>→ NEST v. 2B beta Next ESA SAR Toolbox</p>	<ul style="list-style-type: none"> – GTC product – Multitemporal/Multisensor data processing – Full InSAR capability with DORIS – Ocean exploitation Tools 	Envisat ASAR, ERS-1&2, ALOS PALSAR, Radarsat-1&2, TerraSAR-X, Cosmo-SkyMed, JERS SAR	3100
 <p>→ BEAT Next SWINAT Atmospheric Toolbox</p>	<ul style="list-style-type: none"> – Atmospheric multi-mission data handling (<i>Co-funded by EUMETSAT</i>) <ol style="list-style-type: none"> 1. Visualisation Tool (VISAN) 2. GEOFIT/Multi Target Retrieval (up to 24 species) 3. MIPAS processor 4. Handling validation data and spectral data base 	ERS-2 GOME, Envisat GOMOS/ MIPAS/ SCIAMACHY, MetOp GOME2/IASI, Aura, ACE, ODIN	200* *institutions
 <p>→ BRAT Basic Radar Altimetry Toolbox</p>	<ul style="list-style-type: none"> – Application use cases (Hydrology, Oceano, cryosphere) – Full tutorial on Radar Altimetry Principles and applications – Data exchange with GOCE user Toolbox <p><i>*Toolbox Co-funded by CNES</i></p>	ERS-1, Topex-Poseidon, ERS-2, Jason-1, Envisat, Jason-2, GFO, Cryosat,	1400

A high pace of ESA EO Thematic Workshops



A matching pace of ESA EO proceedings and publications



Building alliances with international science programmes

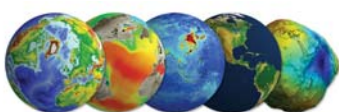
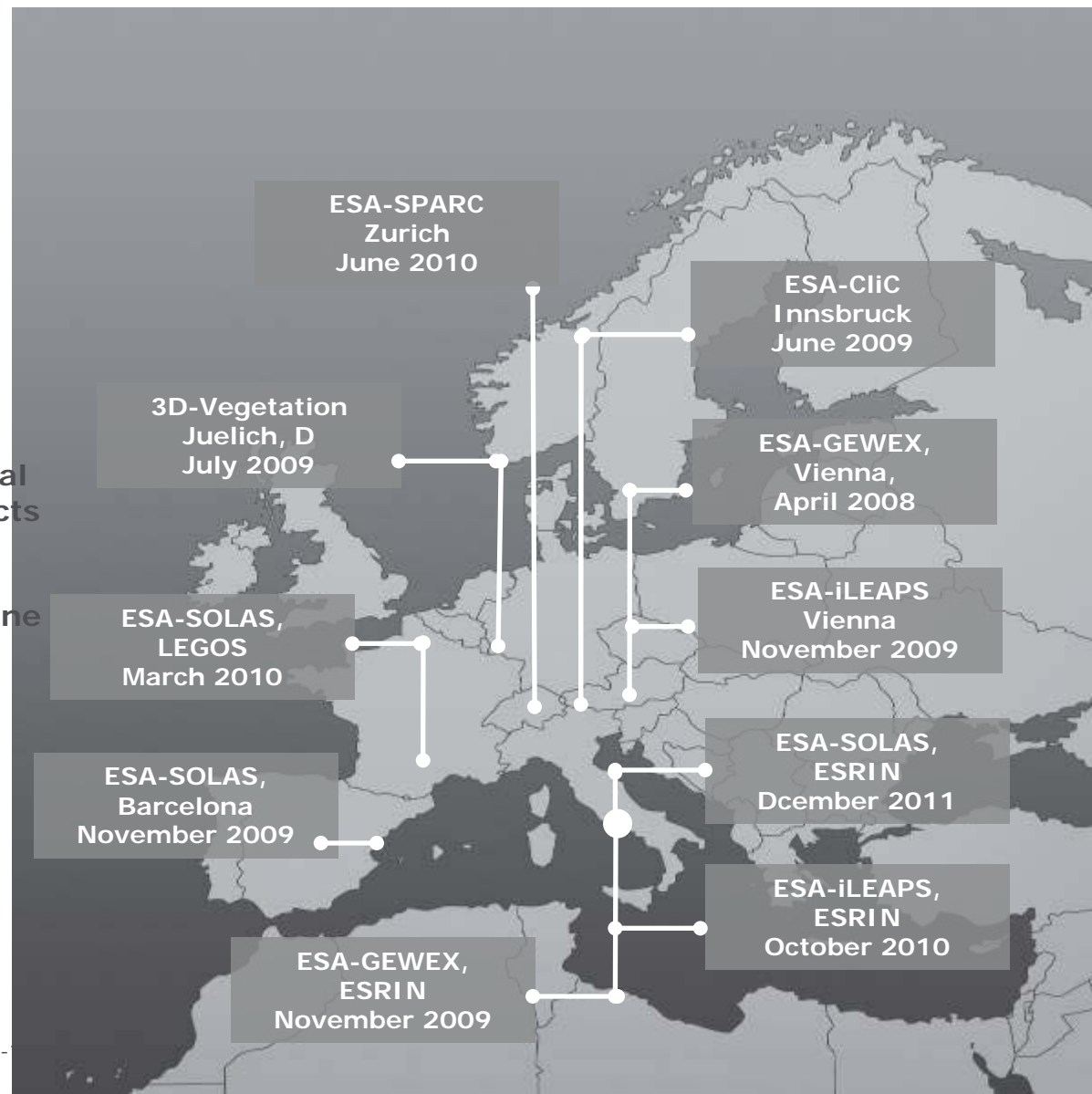
- *ESA data contribution to major international scientific efforts*
- *Promote ESA missions to wider Earth science communities*
- *Coordination of STSE activity with international scientific priorities*



Consultations with international science programmes

10 international workshops & conferences since 2008

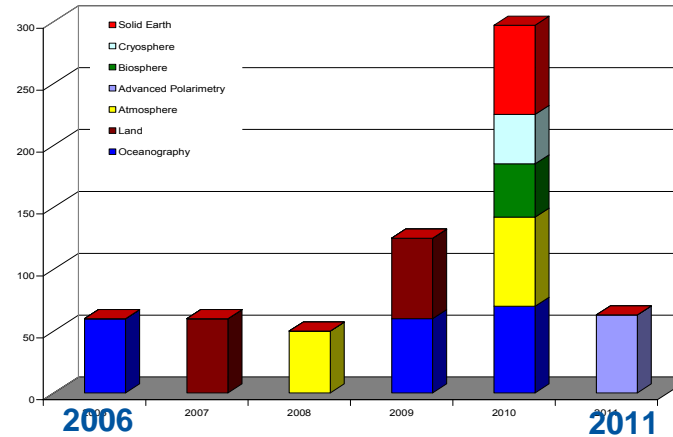
- Scientific consultation workshops to identify scientific needs
- Major conferences where international scientific community assesses projects results
- Workshop to present results and define future roadmaps;



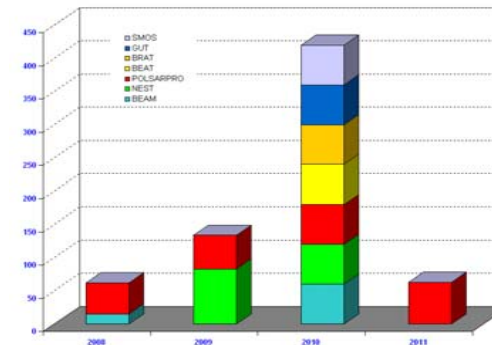
Advanced training opportunities for young scientists



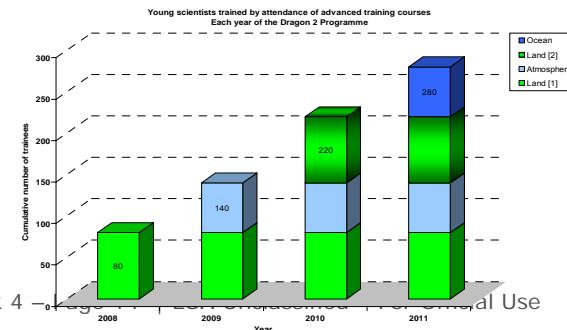
ESA Advanced EO training courses and tutorials



Toolbox-based training at ESA thematic workshops



DRAGON 2
Advanced training



ESA EO Summer School

Earth system monitoring & modeling



2010



2008



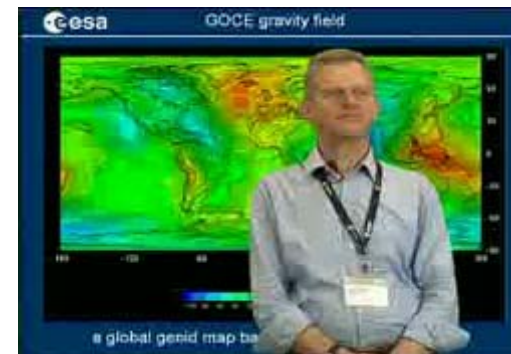
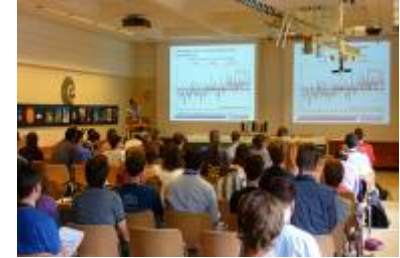
2006



About **70+ young researchers** (e.g. Ph.D. Student, Young PostDoc) selected from more than **240 applications** joined **20+ leading scientists** in Earth Observation, Modelling and Data Assimilation in ESRIN for *keynote lectures, hands-on computing practical and poster sessions.*

School held in 2010, 2008, 2006, 2004, and 2003

Interview R. Rummel



The Changing Earth Science Network:

aims at supporting young scientists in member states to undertake innovative research activities addressing the challenges of the Living Planet Program by maximizing the use of ESA EO data;

The main objectives of the initiative are:

- Supporting the next generation of ESA PIs;
- Promoting fast scientific results demonstrating the value of ESA data;
- Foster concrete research actions towards the achievement of the challenges of LLP.
- Promote better interactions and links between ESA and the next generation of scientists in member states via stages in ESA centres;

- **20 Activities have been launched between 2009 and 2010;**
- **First Science Network Workshop, ESRIN, 12-13 November 2009;**
- **Special session (Mid-term review) at the Living Planet Symposium, Bergen, Norway 2010.**
- **Results will be collected in a series of books (first in preparation for 2011);**



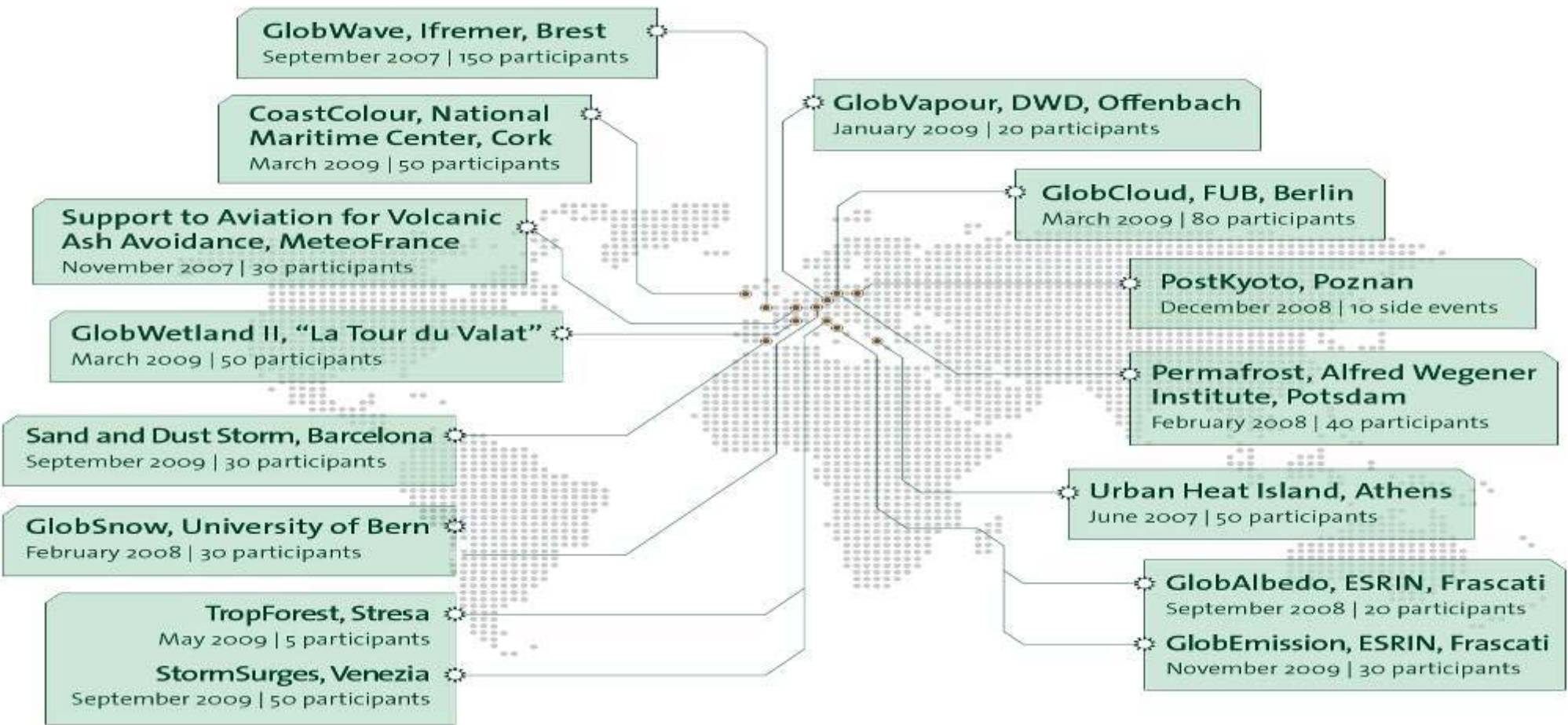
Engagement and Benefits for End-Users



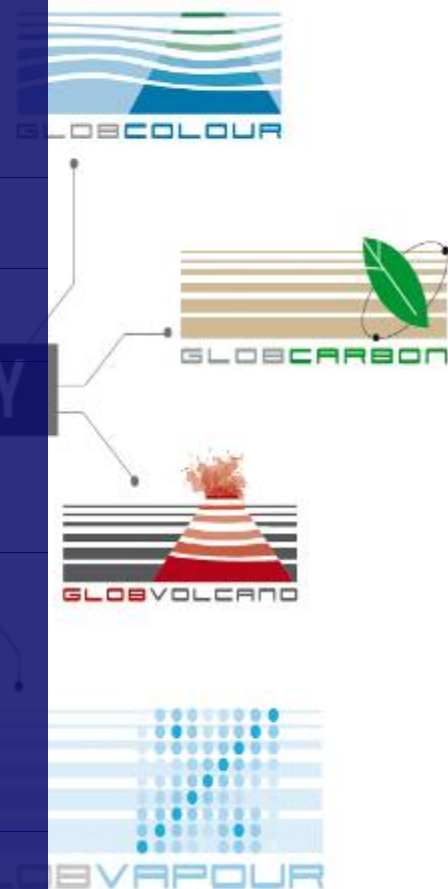
- *Are end-users adequately involved in defining priorities for programme and its projects?*
- *Is EOEP exploitation significantly expanding the use and user base of EO?*
- *Do the exploitation projects have critical mass necessary to have real impact for users ?*
- *How well are user requirements being met ?*



Engaging end-user organizations



New products for Global Change Research GlobSeries

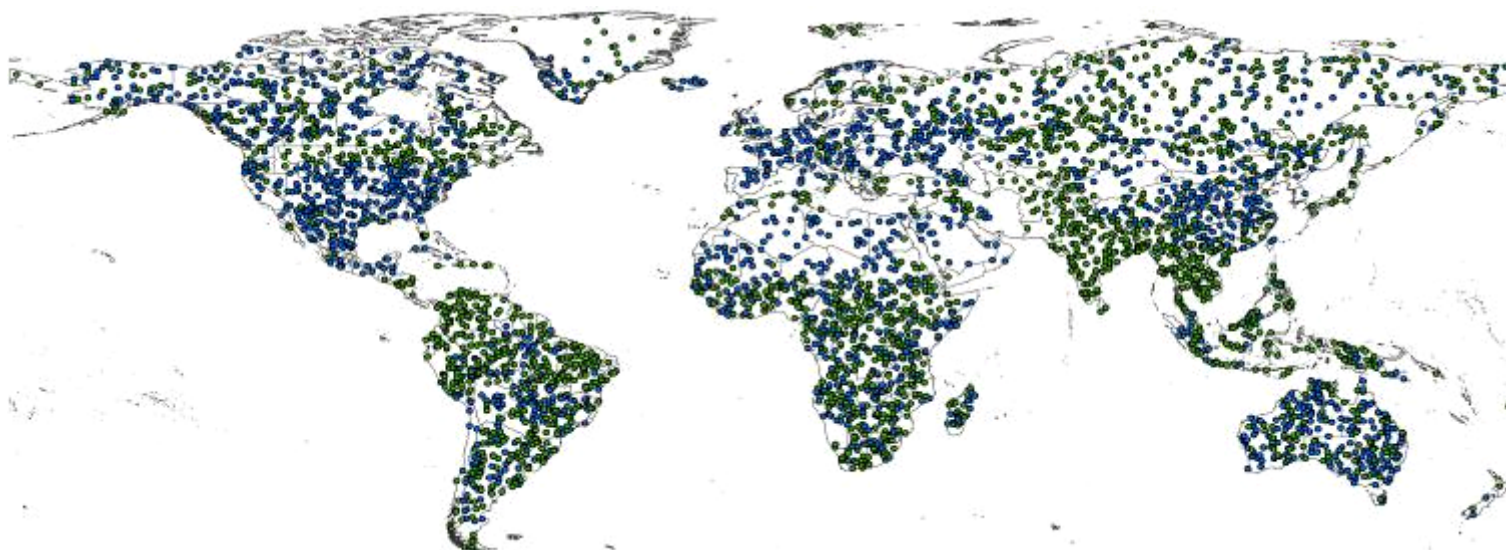


	<i>citations</i>
GlobCover	254
GlobCarbon	84
GlobWetland	58
GlobColour	51
Medspiration	44
GlobAerosol	34
GlobGlacier	28
DesertWatch*	25
GlobSnow*	17
GlobVolcano	17
GlobModel	11

Extensive independent validation

Globcover example

- Assessed by a global network of **14 land cover experts**
- Dedicated interpretation and validation tool
- **3134 sample points** were interpreted by the experts
- Overall weighted-by-class accuracy **67,5%**

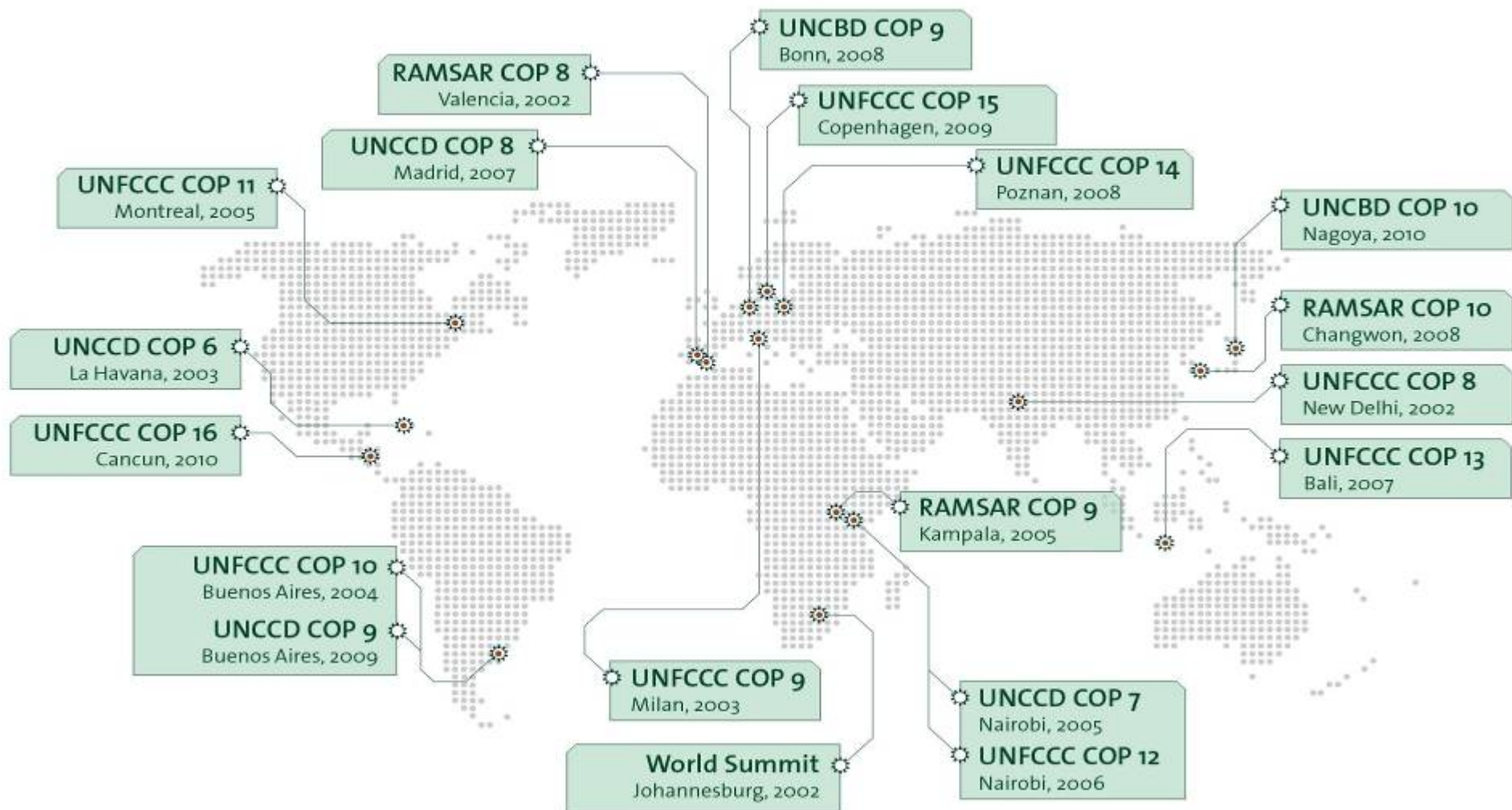


Blue points: GlobCover 2005 heritage samples

Green points: New additional samples

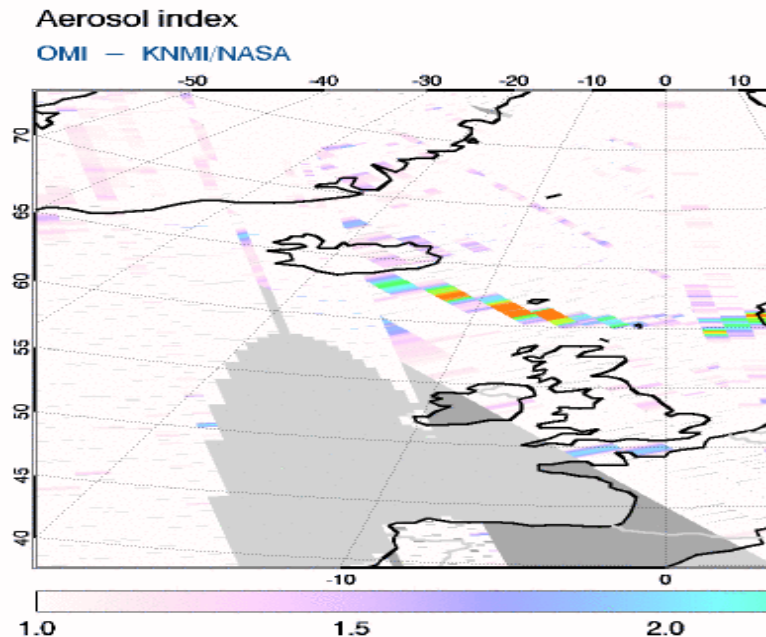


Supporting International Environmental Conventions



web-based global volcanic ash alert ser

- *UV/VIS and IR data sources*
- *Combining European and US services*
- *<http://sacs.aeronomie.be>*



→ MONITORING VOLCANIC ASH FROM SPACE

ESA-EUMETSAT workshop
on the 14 April to 23 May 2010 eruption
at the Eyjafjöll volcano, South Iceland

Publication	ESA STM-280 July 2010
Editing/Layout	Editing and Layout Julie Oakley Serco, and EO Graphics Bureau
ISBN	978-92-9221-901-7
ISSN	0379-4067
DOI	doi:10.5270/atmch-10-01
Copyright	© 2010 European Space Agency

How to cite this document: 'C. Zehner, Ed. (2010). Monitoring Volcanic Ash from Space. Proceedings of the ESA-EUMETSAT workshop on the 14 April to 23 May 2010 eruption at the Eyjafjöll volcano, South Iceland. Frascati, Italy, 26-27 May 2010. ESA-Publication STM-280. doi:10.5270/atmch-10-01'



Engagement and Benefits for Value-adding Industry

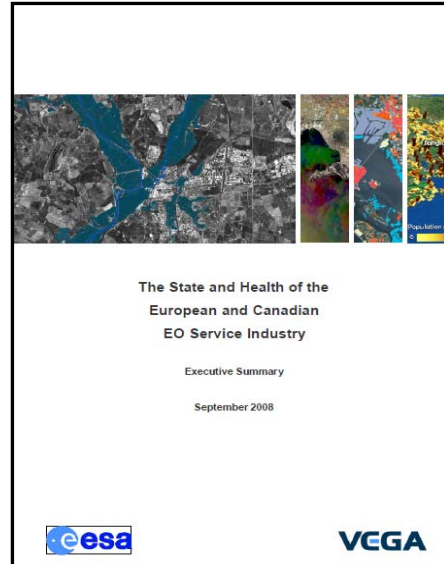
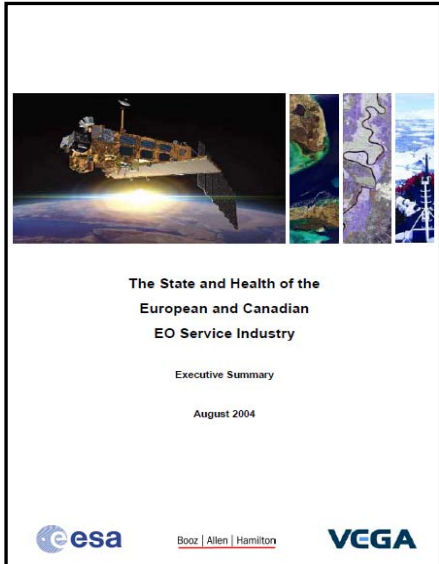


- *Does EOEP offer attractive, unique opportunities for EO exploitation ?*
- *Is value-adding industry involved in setting priorities?*
- *Are the applications developed truly innovative?*
- *How is the competitive position of European industry strengthened?*



EO service industry surveys

chart progress...

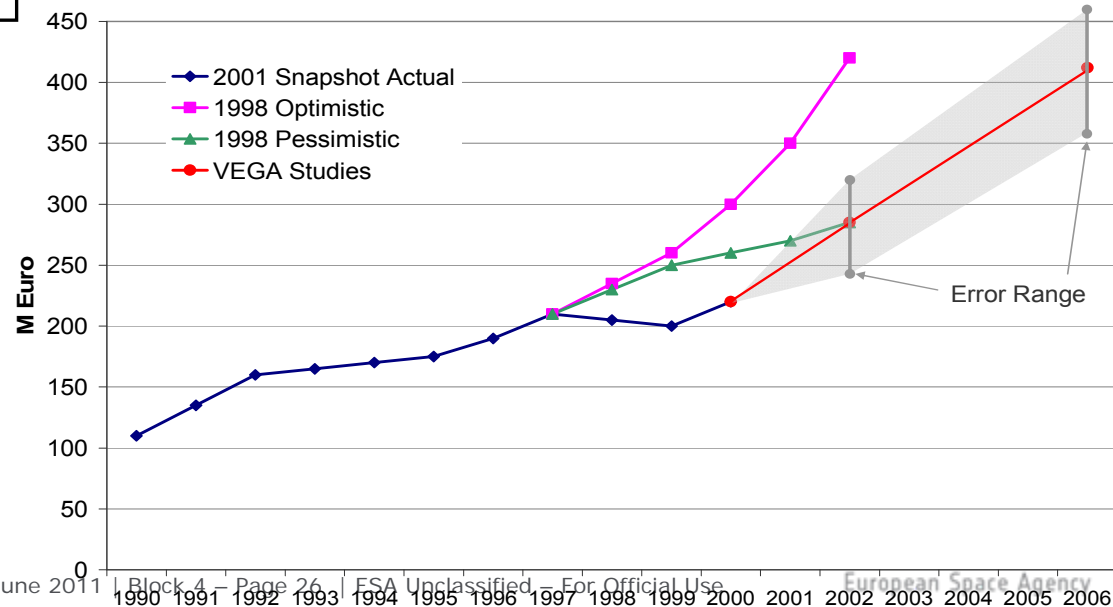


- Unique, in-depth survey of European EO Services industry capabilities, constraints, issues
- Baseline 2003, Updated 2006, Update for 2010 in progress
- Cited by Euro-Consult, OECD

- 2006 Revenues estimate :
412 M€ (services + data)
306 M€ (services only)
Growing at 8% CAGR

- ~ 3000 employees

- 2010 rough figure ~ 600 M€
(EARSC : includes S/W, GIS, Data)

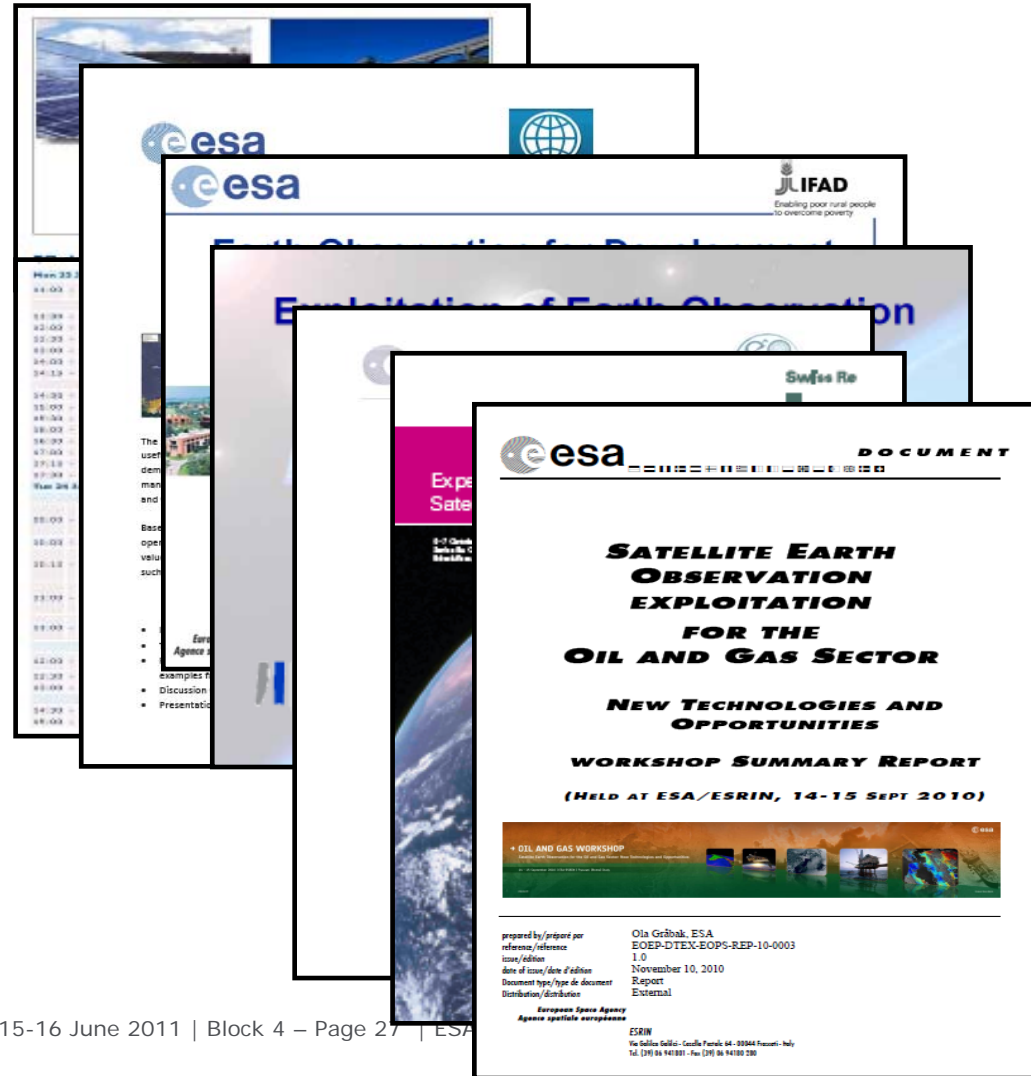


Industry Consultations *identify evolving market needs...*



Corporate Industry & Multi-Lateral Development Banks

- Jun 2003 : **Renewable Energy Industry**
(33 companies)
- May 2008 : **World Bank Group**
- Dec 2008 : **UN International Fund for Agricultural Development**
- Dec 2008 : **European Investment Bank**
- Sep 2009 : **Insurance Industry**
(15 companies)
- Oct 2009 : **SwissRe (Flood Risk)**
- Sep 2010 : **Oil & Gas Industry**
(40 companies)
 - **Information requirements**
(technical specs for EO services)



Value-adding industry sets priorities...



Oct 2001

April 2002

Jan 2004

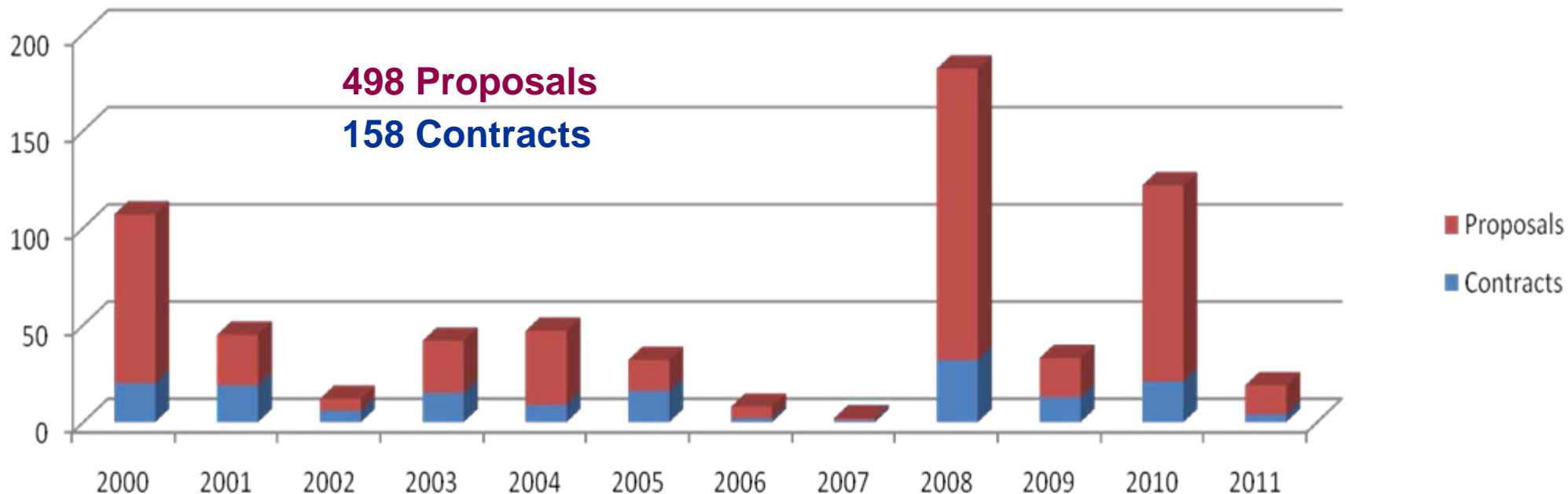
Nov 2007

- **Regular Briefings/Workshops with European EO Services industry**
 - 100 + companies at each event.
 - Priorities for scales, types and implementation of support needed

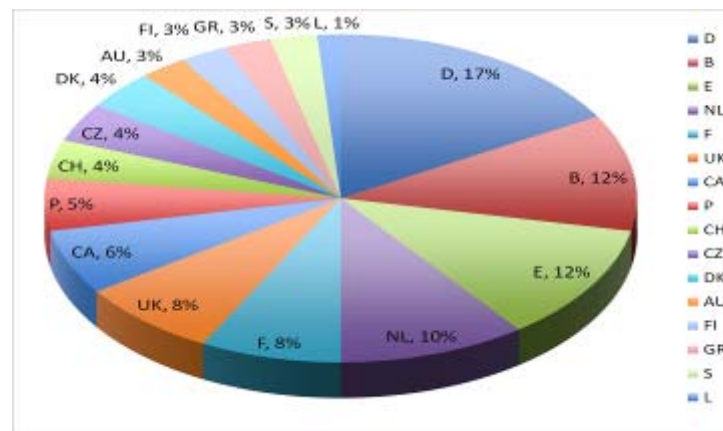


EOEP Open Competitive ITTs

offer opportunities for Value Adding Industry



- *Frequent opportunities* ✓
- *Small activities* ✓
- *High Industry response* ✓
- *Highly competitive* ✓
- *Engagement in all MS* ✓

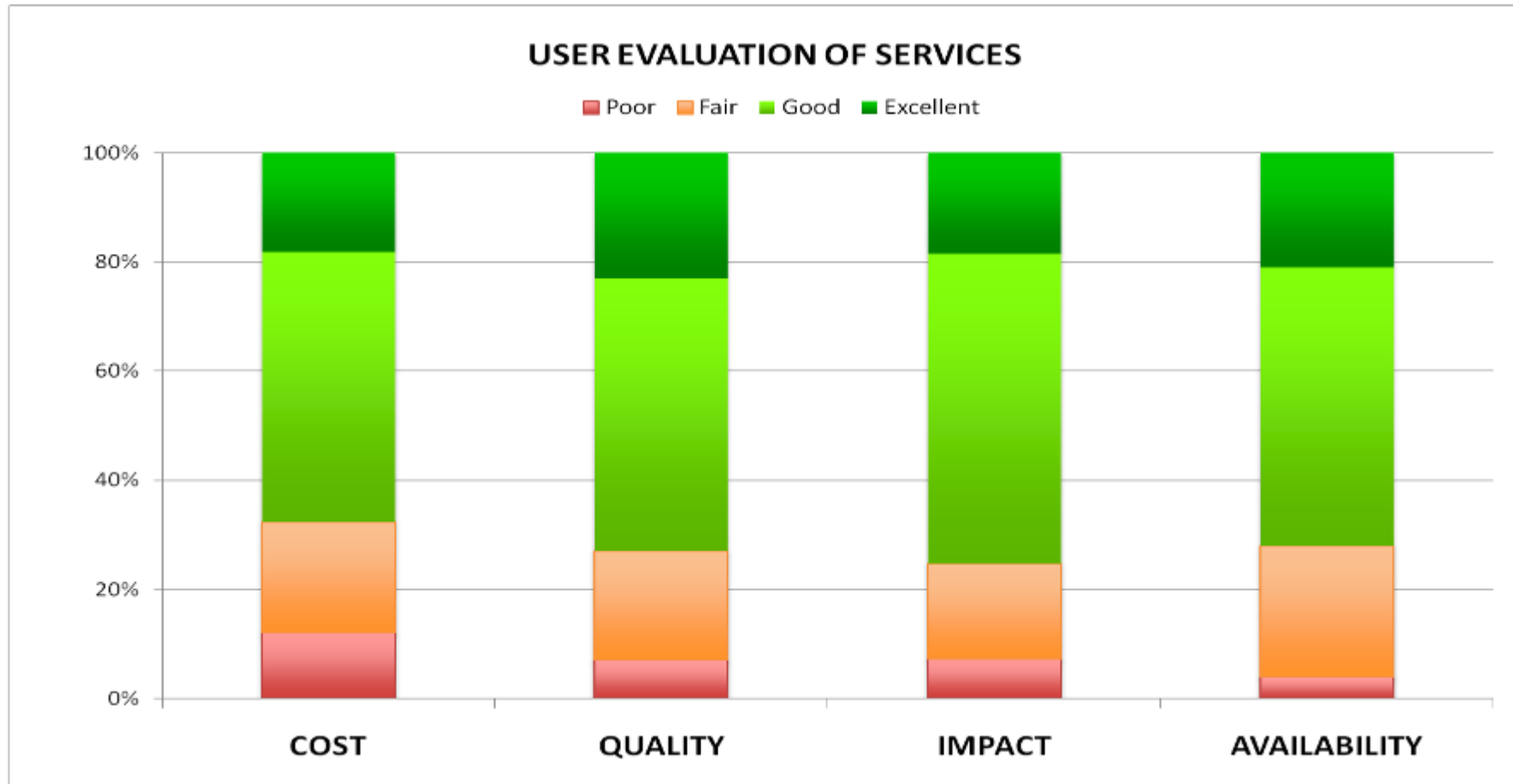


WB Projects
- 78 proposals
- 16 MS



Industrial users *evaluate new products and services*

100+ service trials 35+ industry sectors



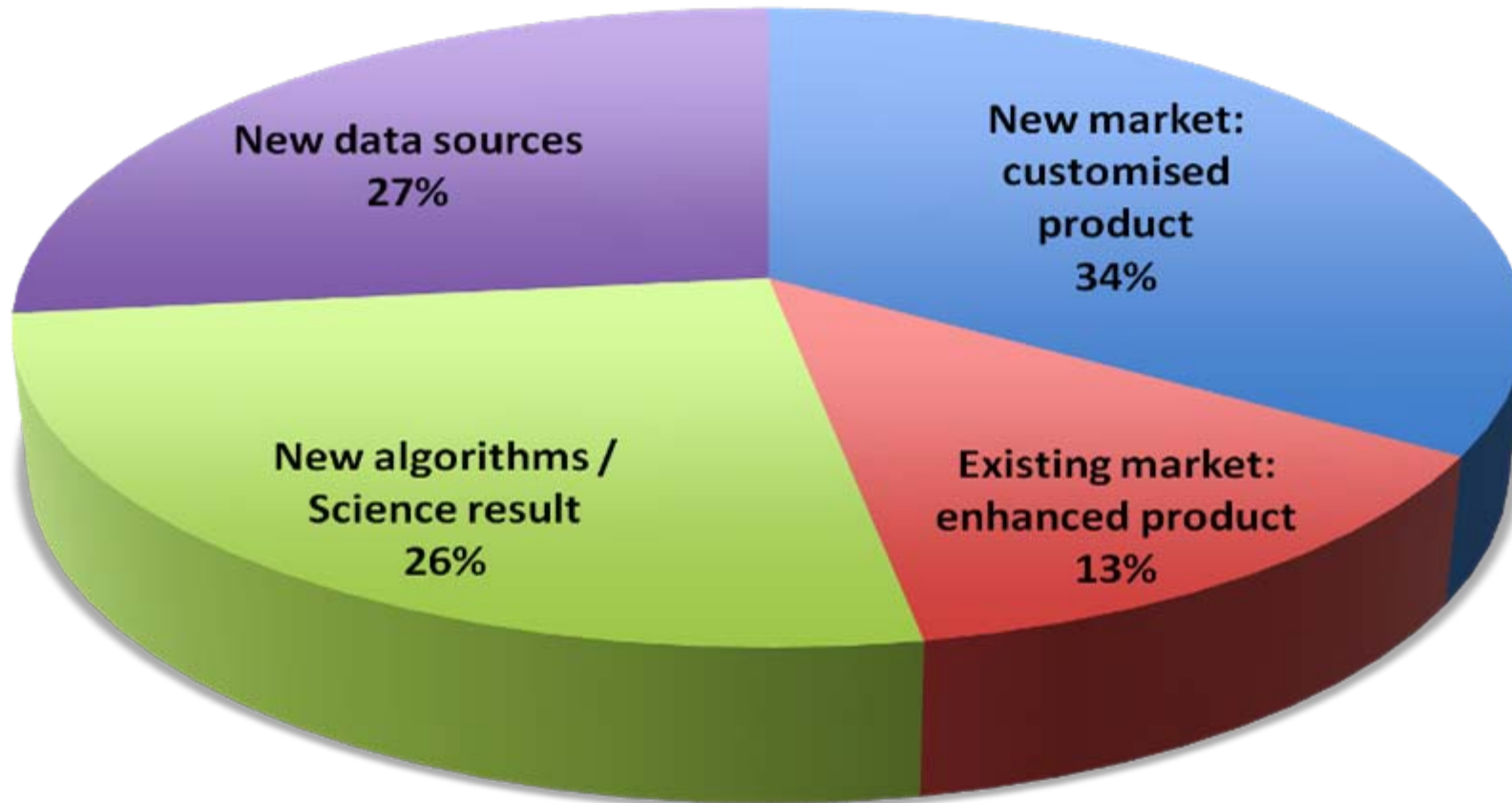
Good prospects

- Solar irradiance
- HR off-shore winds for Renewable Energy

Poor prospects

- Land motion for oil & gas pipeline monitoring





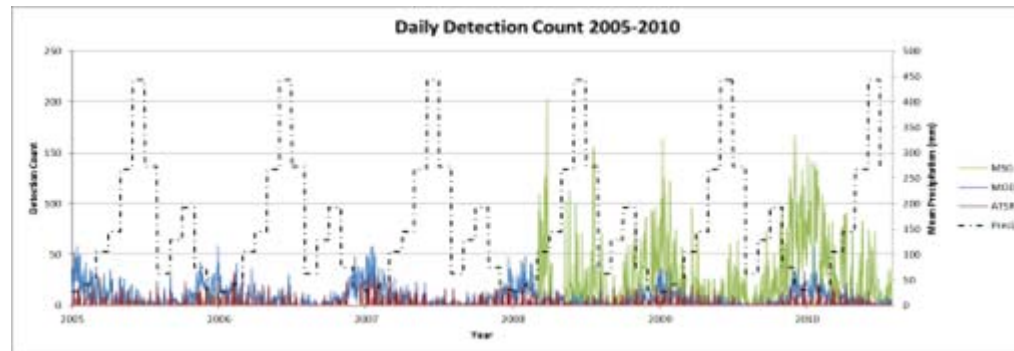
- Innovation in EO services addressed equally along several fronts,
- Analysis of 68 activities (since 2007).



- **35 + activities integrating New Developments (new techniques, new EO data) to produce enhanced EO Services (based on existing capabilities)**

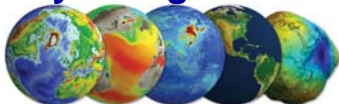
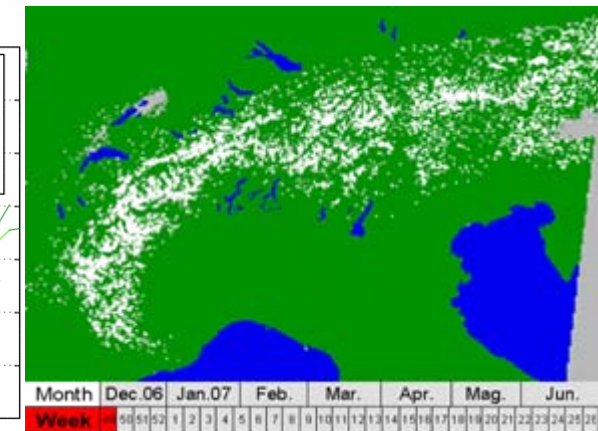
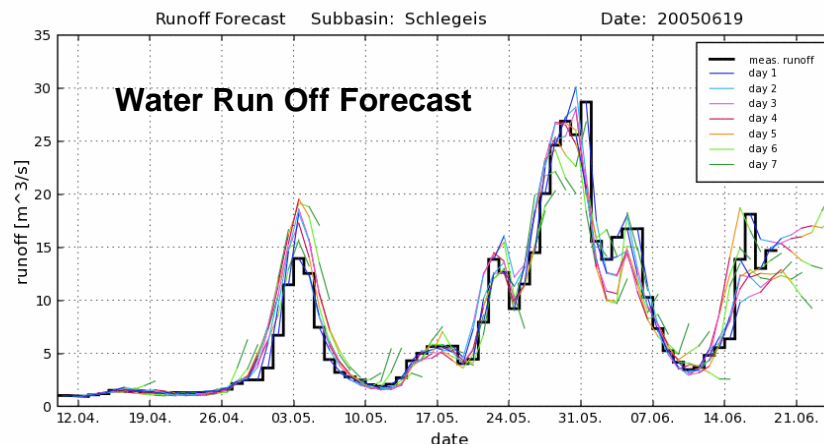
• Gas Flares

- MODIS +ATSR + MSG improved algorithms,
- Monitor at 1km res, 4xday,
- Optimisation for cold (Siberia) and warm (desert) environments,
- Fire Radiative Power (FRP) estimation.



• HydroPower

- Weather Conditions (MSG) + Snow Cover + DEM + Land Cover (ENVISAT/MERIS)
- Water run-off Forecasting via Hydrological model.



Coordination with other Programmes



- *Effective coordination with related National and European programmes ?*
- *Lessons from exploiting current EO missions fed into future missions ?*
- *Correct balance between exploiting ESA missions and non-ESA missions data ?*
- *Have EOEP exploitation elements evolved to take account of the changing European EO landscape ?*



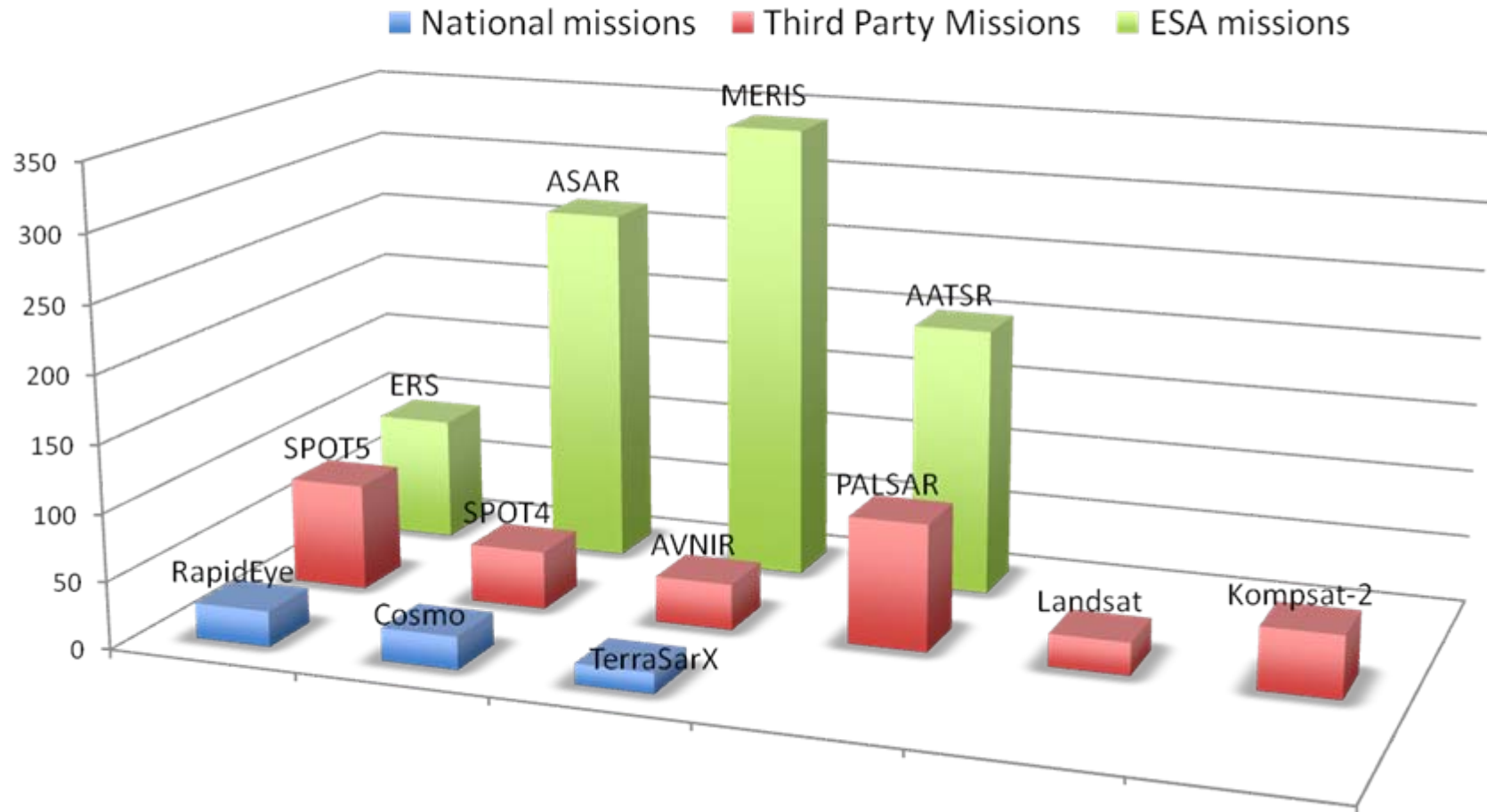
- *ESA staff are frequently invited to participate in **evaluation boards for of Member States EO science and applications development programmes***
- *ESA Exploitation programmes are presented at **major national EO symposia and workshops in member states***
- ***Regular coordination meetings** are held with managers of Member States EO applications programmes (annual and occasional)*
- *Ad-hoc meetings are convened with ESA PBEO delegations to ensure **coherent interfaces to national end-user organizations***



- *ESA Exploitation programmes presented regularly at **EC FP7 briefing events***
- ***Close working coordination** with European End-User Organizations
 - EEA, EMSA, FRONTEX
 - source of user requirements*
- ***Formal cooperation agreements** with JRC, EMSA*
- ***ESA staff seconded** to EC (DG-Rech and DG-Ent)*
- ***JRC staff seconded** to ESA (ESRIN)*
- *EOEP project teams have accessed EC funds for related activities e.g.:
 - **Cal/Val projects**
 - **Dragon***



Promoting exploitation of data from ESA National and Third Party Missions



e.g.: Extensive use of European EO Missions (ESA + National) in EO services to support World Bank Projects.



Achievement of Programme Objectives

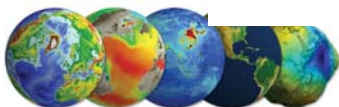
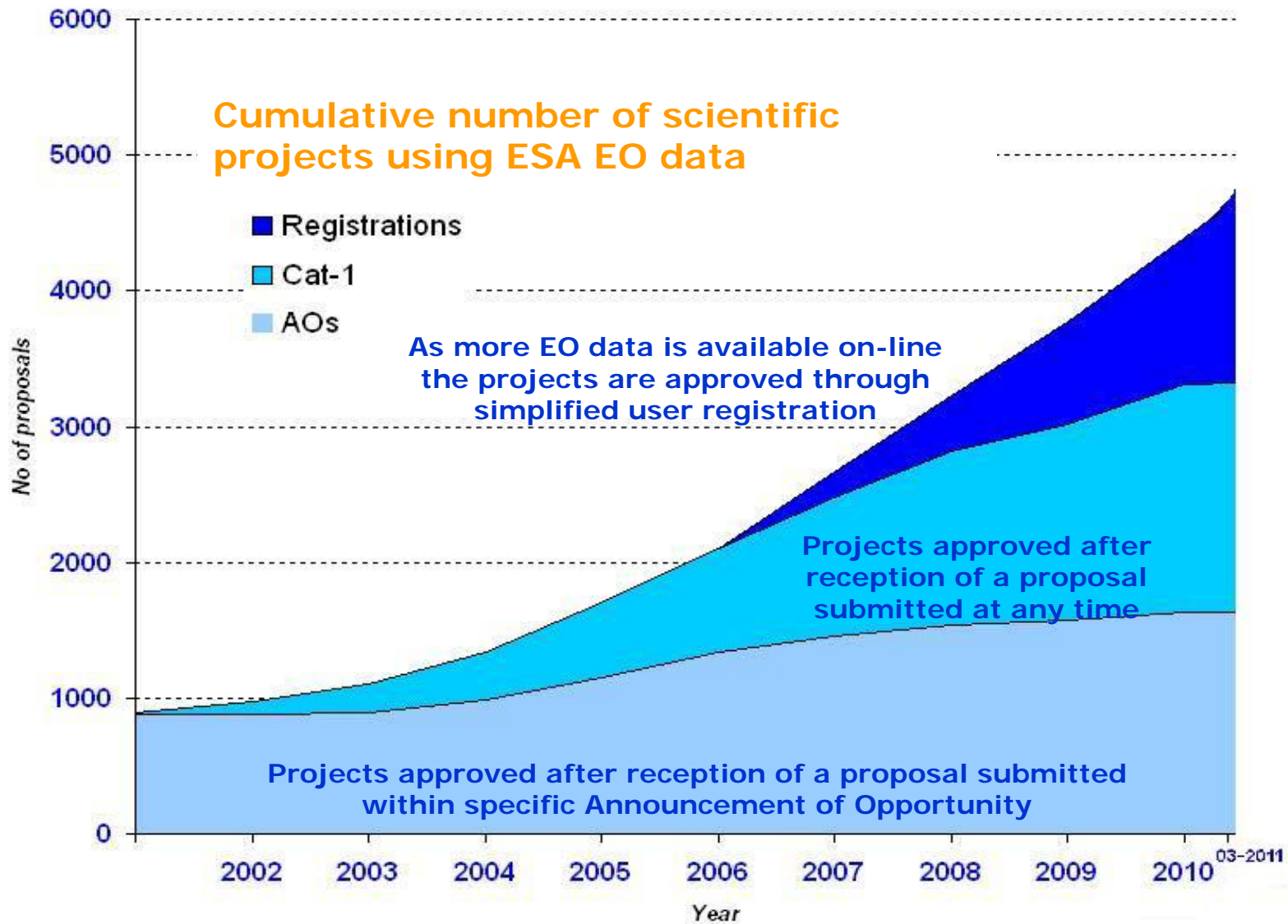


- *How successful is EOEP in transferring from research to an operational framework?*
- *Do the exploitation projects have critical mass necessary to have real impact?*
- *What happens after the applications development projects finish? (sustainability)*
- *Has EOEP exploitation fostered international cooperation?*
- *Has EOEP exploitation laid the basis for major new European EO initiatives ?*
- *Has EOEP exploitation significantly increased public awareness of the benefits of EO?*



Scientific Impact

Increasing number of EO research projects



Fostering international scientific collaboration

Major conferences and symposia



ESA Co-Organised Symposia:

- 15 Years of Progress in Radar Altimetry '06
- Two Decades of Progress in Radar Altimetry '12
- OCEANOBS'09
- COSPAR Scientific Assembly '08, '10, '12
- IGARSS '12

ESA Sponsored Symposia:

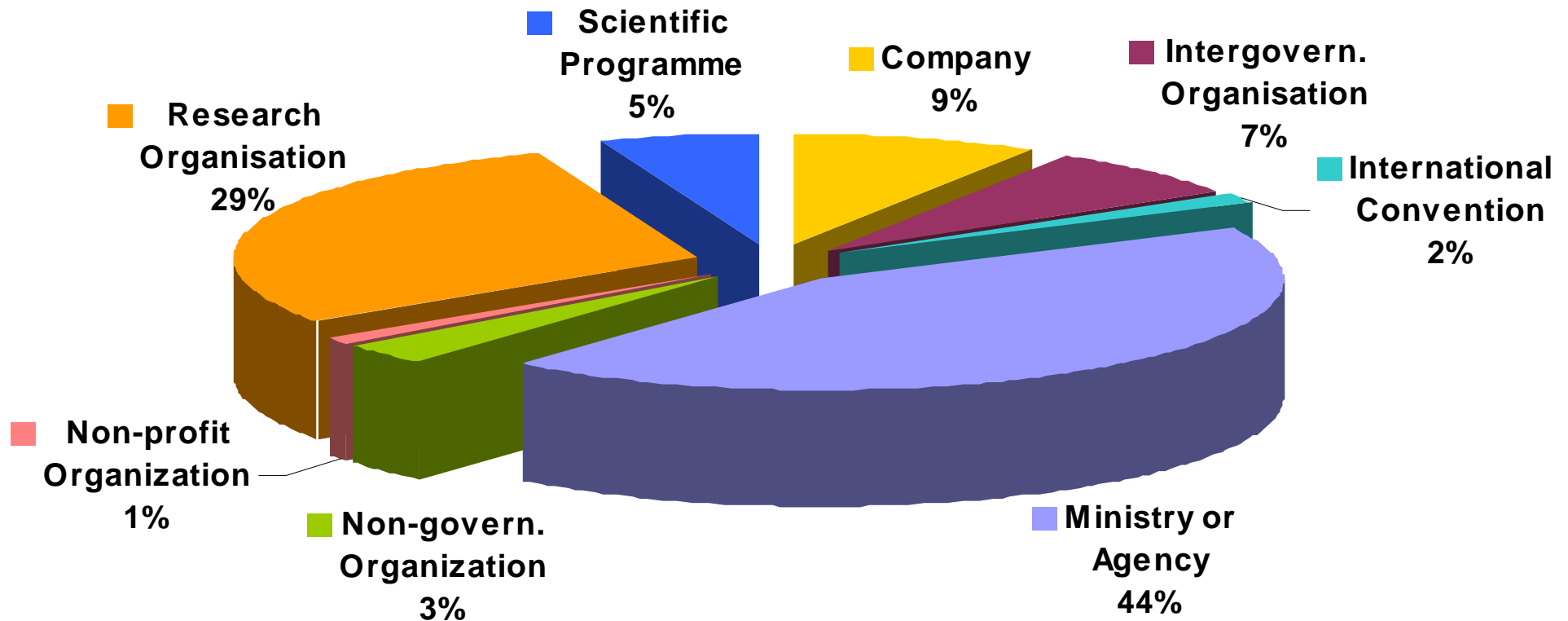
- EARSeL, etc.

ESA Yearly Presence at:

- EGU, AGU, IUGG, IAG, etc.



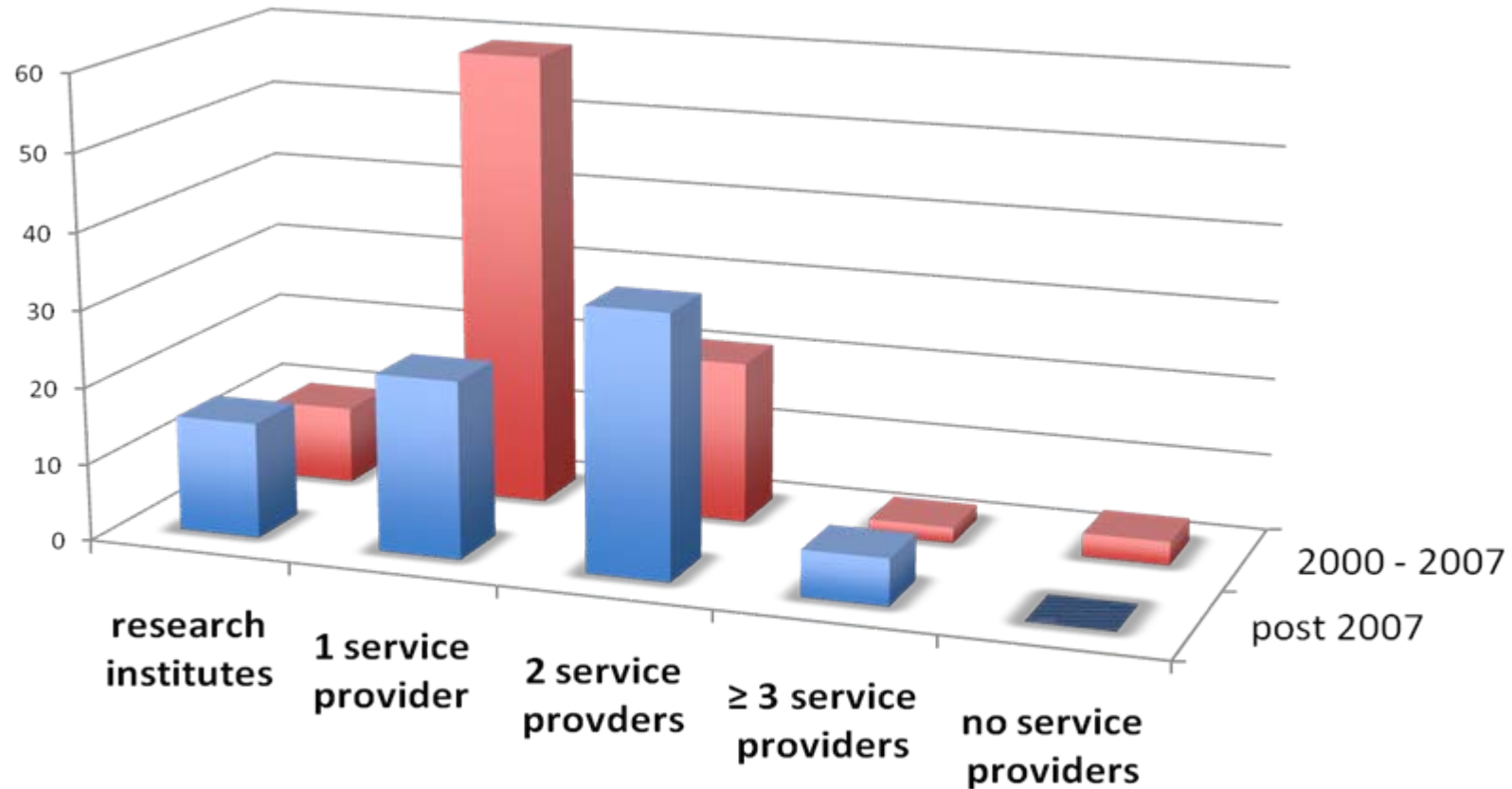
Engaging end-users



388 new user organisations for EO



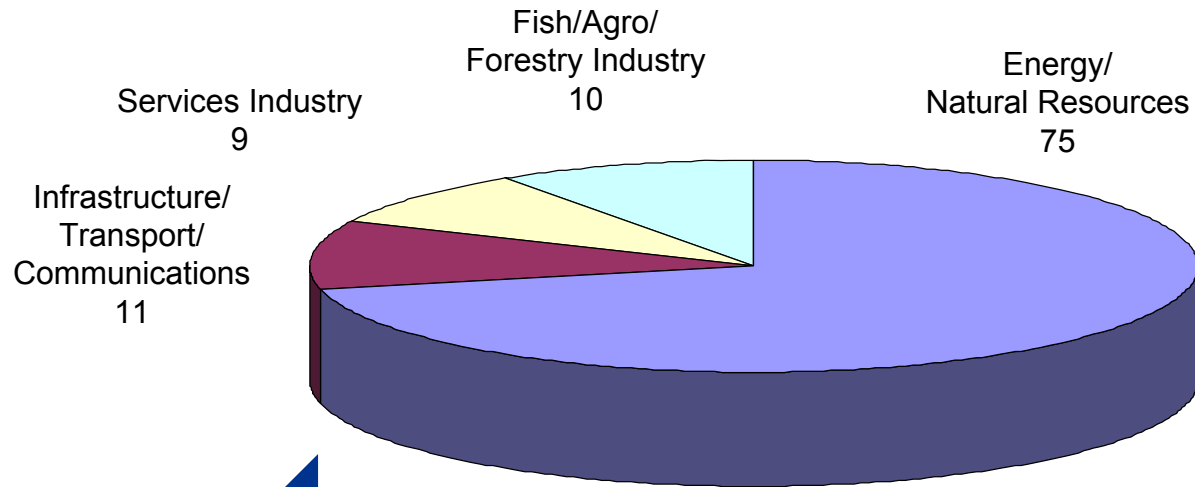
Fostering Research and Value-Adding partnerships



- Stronger (pan-European) partnerships between EO service companies,
- Increasing role of research / science in EO service teams.



Enlarging the Industrial User Base



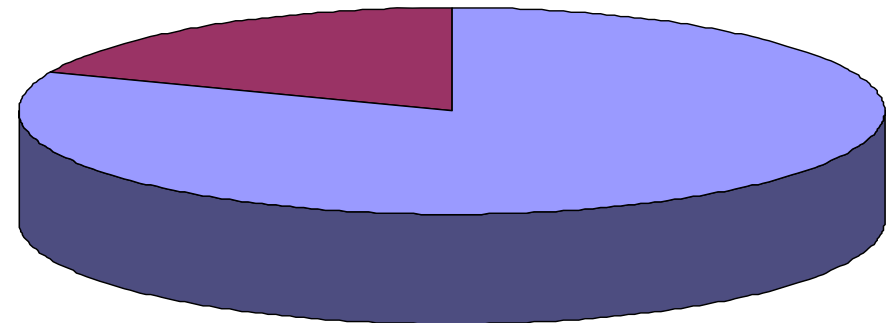
• **105 Users**
Private Sector

Up **44%** wrt 2004



• **53 Users** Public
Sector

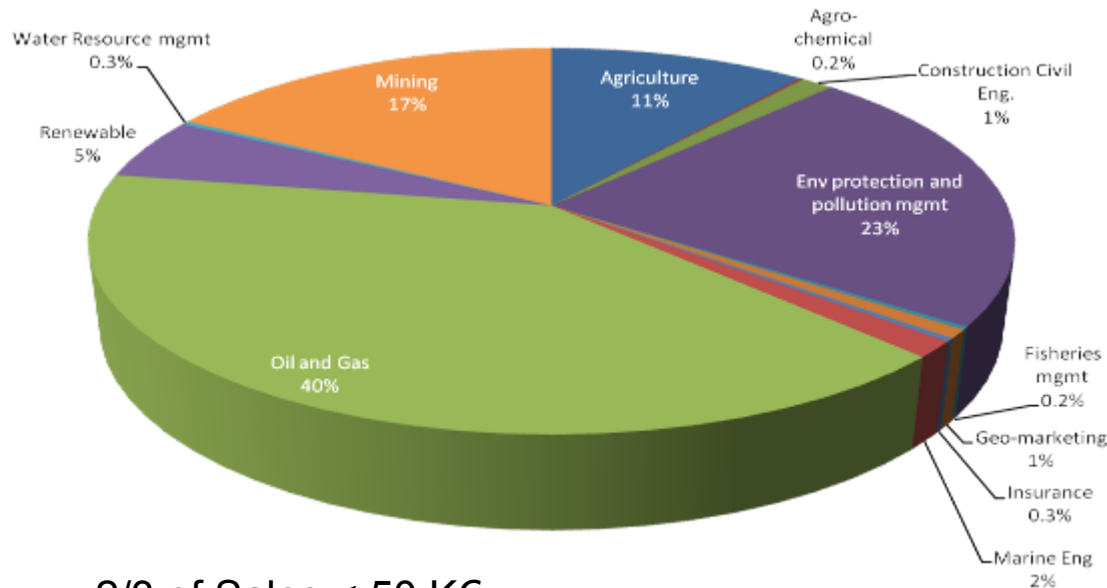
International/
Intergovernmental Organisations
10



National Public/
Governmental bodies
43



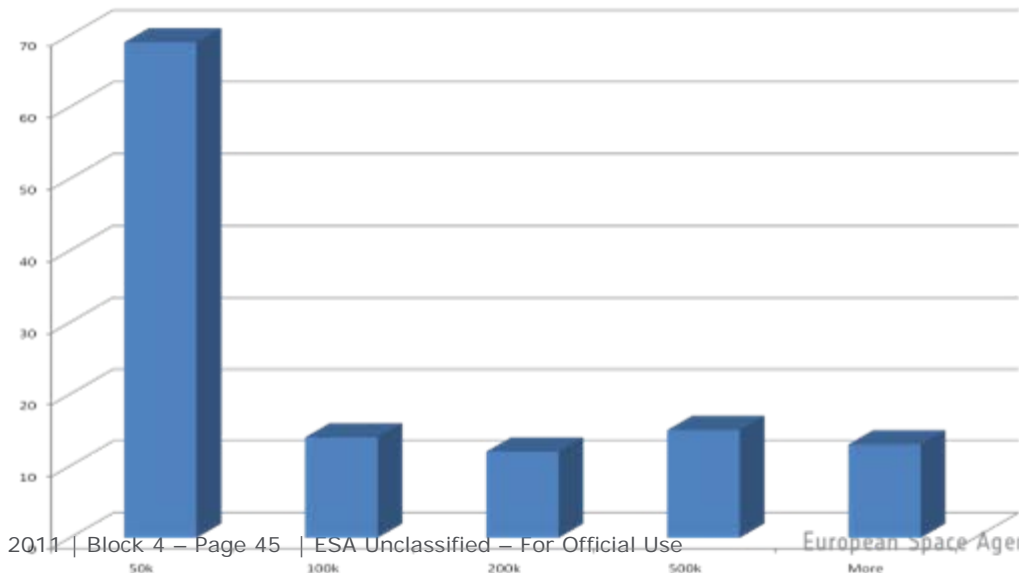
Improving the competitive position of European EO value-adding industry



• **48.2 M€** Total Service Sales
(to date...)

- Follow on from ESA contracts
- 1€ spent => 2€ generated

- 2/3 of Sales < 50 K€,
- Largest single sales (both out of EU)
 - Oil & Gas market (> 10M€, 5 years)
 - Agriculture market (> 4 M€, 3 years)
- Marine & Coastal Surveillance largest commercial service sector
(ice, oil spill, vessels, bathymetry)
- Sales can take > 5 years to realise after initial demonstrations.



1. Dragon 2 – Exploiting ESA and Chinese EO data

- *Scientific excellence, joint publications (e.g. Nature Geoscience & Science in China)*
- *Sessions at International Symposia, e.g. ISRSE, APSAR*
- *Training of 280 post graduate scientists*
- *bilateral agreements with EU/China universities*
- *1st joint exploitation of Chinese & ESA EO missions' data*

2. Dragon 3 programme – in preparation

- *Starting in 2012, 4 years*
- *exploitation of new European and Chinese EO missions*

3. Opportunity for extended collaboration

- *Beyond Dragon Programme*



Guilin Symposium participants (252)



2010 Land training, CAREERI, Lanzhou



Front cover of Nature Geoscience

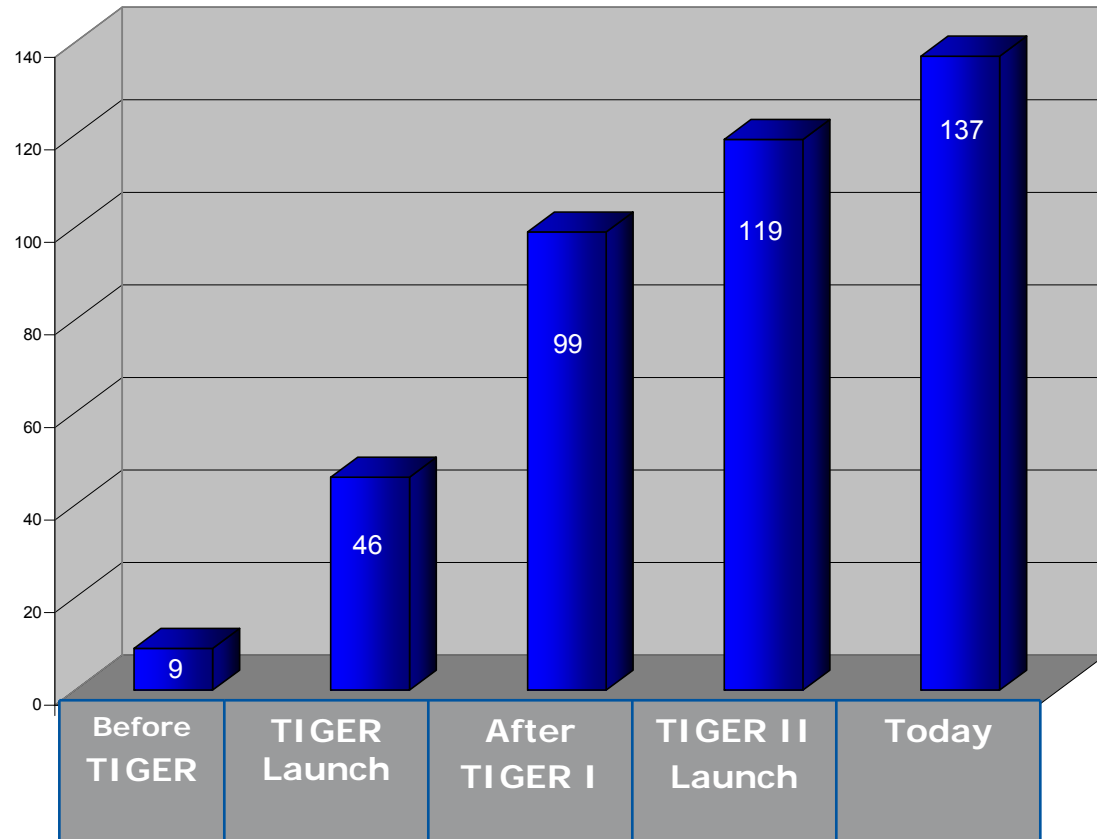


Advancing International cooperation

Africa - Tiger



- Developed **critical mass of African scientists** and technical centres using ESA EO data.
- 9 African PIs before TIGER
- 137 African PIs now.
- **20+ training sessions** in Africa
- **150+ African scientists** to research and advance courses in European labs



Contributing to GEO



GEO GROUP ON EARTH OBSERVATIONS SCIENCE AND TECHNOLOGY COMMITTEE

esa

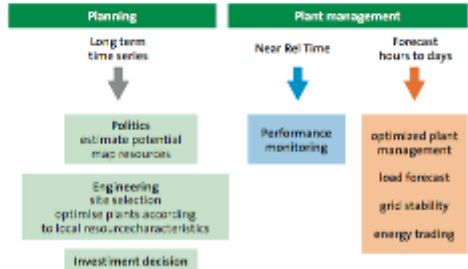
→ GEO AND SCIENCE

A report prepared by the European Space Agency in the framework of the GEO Science and Technology Committee in support of the GEO Task ST-09-01 "Catalyzing Research and Development (R&D) Resources for GEOSS"

Edited by Jean-Louis Fellous and Jérôme Béquignon

3.3.3 Quantifying solar radiation to optimize operations of solar energy plants

Meteorological satellites can provide global maps of irradiance up to a 1 km resolution several times per hour. By combining these irradiance maps with other EO products, such as Digital Elevation Model and cloud cover maps, it is possible to estimate the optimal solar energy yield expected from a solar energy power plant. The ability to go back in time in the archive of Meteosat data – spanning several decades – provides the long-term time series and statistics of direct/diffuse solar irradiance together with cloud conditions necessary to quantify solar resources. EO further allows the quantification of atmospheric turbidity based on aerosols and water vapour, which reduces surface solar irradiance.



Participation in

- GEO Energy Expert Group
- GEO Energy CoP
- GEO & Science Book

GEO GROUP ON EARTH OBSERVATIONS

Energy Community of Practice

Biomass Coal Gas/Oil Geothermal Hydro-power Nuclear Ocean Solar Wind

Sections

- Biomass
- Coal
- Gas/Oil
- Geothermal
- Hydro-power
- Nuclear
- Ocean
- Solar
- Wind

Breaking News

- 10th User Interface Committee Meeting

Latest Published

Welcome to the Energy Community of Practice Portal

Objectives of the CP

The objective of the Energy Community of practice (ECP) is to support GEOSS outcomes related to the application of Earth Observation data for energies.

Relevant areas are:

- Siting of power plants and facilities including environmental and sociological issues
- Optimized design of power systems and facilities
- Yield estimation and resource monitoring based on historic information
- Yield forecast based on near real time weather and forecasting
- Integration into existing energy supply, e.g. grid & utility system integration
- Operation and management of power plants incl. automatic failure detection
- Trading and monitoring of power and environmental credits
- Environmental monitoring of impacts
- Life cycle considerations
- Economic analyses

[Road more...](#)

[GEOSS-ECP General Documents](#)

European Space Agency

→ GEO AND SCIENCE

A report prepared by the European Space Agency in the framework of the GEO Science and Technology Committee in support of the GEO Task ST-09-01 "Catalyzing Research and Development (R&D) Resources for GEOSS"



▶ GMES

- *Italscar, SLAM, KytoINV, Human, TEMIS, Medspiration, GlobColour*

▶ ESA Climate Change Initiative

- *GlobCarbon, GlobCover, GlobAerosol, GlobColour, GlobIce, GlobGlacier, GlobModel, GlobAlbedo, GlobVapour, GlobWave*

▶ Integrated Applications Programme

- *SevesEO, Tiger Innovators, Epidemio*

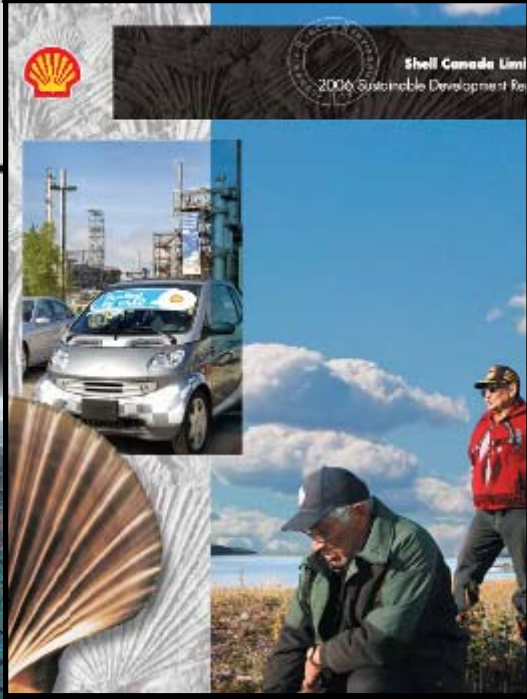


Communicating the benefits of EO

Convinced users do it best!



- Trade journals / magazines / articles



FOREST STEWARDSHIP COUNCIL
Because forests matter

SPACE TECHNOLOGY OFFERS COST EFFECTIVE SERVICES FOR FSC FOREST MANAGEMENT

Today's view on our planet from space is the clearest ever - and cover changes such as forest fires and concession roads can be easily detected with the latest Earth Observation (EO) technologies.

A project of FSC, the European Space Agency (ESA) and several partners shows how the latest EO technology improves its potential as a cost effective tool for forest management certification (Table 1).

EO experts mapped, measured or monitored FSC certified forests in the following three countries during the two year long project: York Timber Organization in South Africa, Compagnie Industrielle des Bois in the Republic of Congo; and Grupo Orsa in Brazil.

Resolution	Mappped Area (KM ²)	Cost Range / KM ² and Use Classifications
Low	>1000	<1000
Med	1000-100	1000-10000
High	<100	>10000

Table 1. Estimated costs, include satellite design, data processing and map interpretation and analysis. © Eric Courlet

FSC certified forest companies with GIS capabilities can seamlessly integrate those large scale maps into the operations. This may save considerable cost and compared to conventional ground-based forest survey, says Justin Butler, Chief Executive Officer of Ambient, Francisco Hoese, Chief Executive Officer of Biomass, comments: "This also ensures that forest product maps and measurements are totally unbiased and independent. And, once ground verified, reliable."

FSC Criteria 10.5 in plantations for example, requires the restoration or maintenance of a proportion of the over forest management area as natural forest cover. If analysis could help FSC certification bodies to evaluate and monitor compliance with FSC requirements regarding set aside areas based on up-to-date and easily assessable land cover maps and EO information.

The three companies participating in the project confirm that the EO services provided valuable support for forest management decisions. The additional or alternative data source helped to make decisions and to address specific management issues such as fire damage and assessment of burned areas. The impact of decisions over time can also be monitored and easily verified by FSC certification bodies.

Legend:
— GPS Derived
— EO Derived

Image 1. Land classification map showing the nature and spatial using distribution of land use change. © DMT

The results present EO as practical across a range of services including the documentation of land change cover between two dates making even negative impacts visible (Image 2). The new data is a source of valuable information for FSC certificate holders to show their compliance with FSC's Principles and Criteria over time as well as with national regulations.

The EO maps illustrate areas of deforestation and fire breaks as well as agriculture, rivers and flooded vegetation (Image 3). Furthermore, experts were able to estimate timber volumes in a plantation and areas which were destroyed by fire and later successfully re-established (Image 3). With this EO technology it was even possible to detect and map concession roads as an indicator of deforestation risk or project accessibility.

For the study the specialists combined the latest generation of low cost, high resolution satellite imagery with complementary data mapping of radar and optical sensors within a Geographical Information System's (GIS) framework (Image 2).

Image 2. Improved accuracy of GPS road detection (green line) by EO derived data and processing (dotted line). © DMT

... continued on page 10

Subscribe/subscribe at www.fsc.org/newsletter.html
 Forest Stewardship Council International Center, Charles-de-Gaulle Str. 6, 53113 Bonn, Germany
 Phone: +49 (0)21 307 66 0 Fax: +49 (0)21 307 66 30
www.fsc.org



Looking to the future...



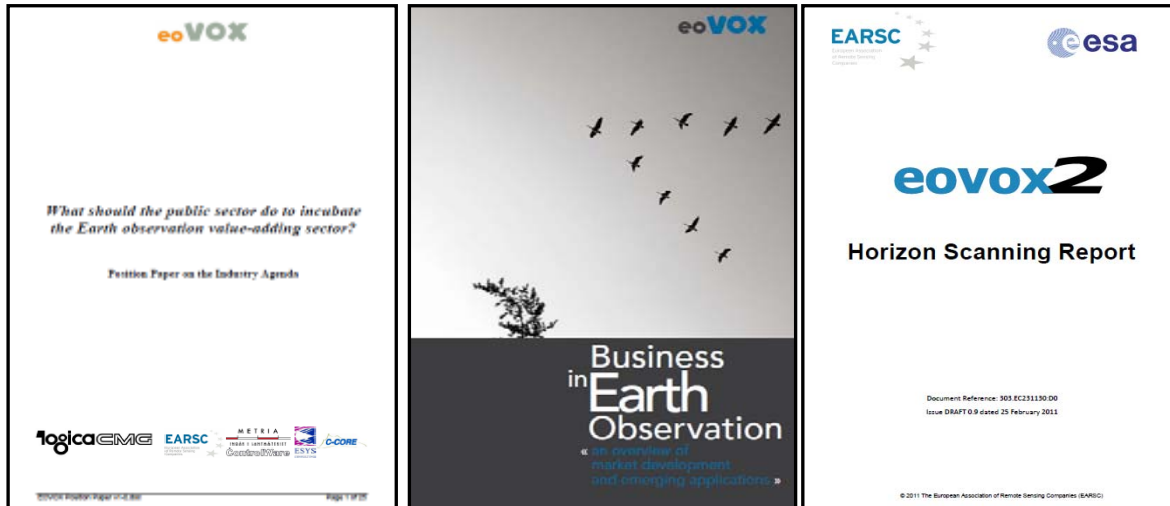
- Further progress addressing scientific challenges of the Changing Earth by exploiting ERS and ENVISAT missions
- New scientific breakthroughs with Earth Explorer missions
- Continued progress developing advanced EO methods and algorithms
- Enhanced user tools, advanced data products, NRT data assimilation
- Advances in Earth System Science via analysis of decadal-scale global observation time-series
- Expanding use of EO to other science communities



- *Free and open access to Global Sentinel Missions Data*
- *Scientific Synergy of Explorers & Sentinel data*
- *Scientific advances in cryosphere, oceanography, solid earth, land processes, atmosphere*

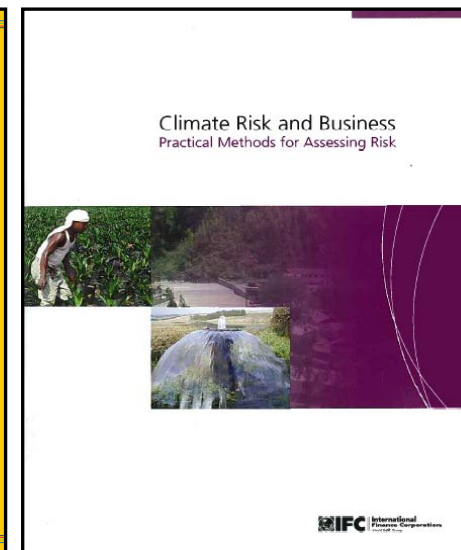
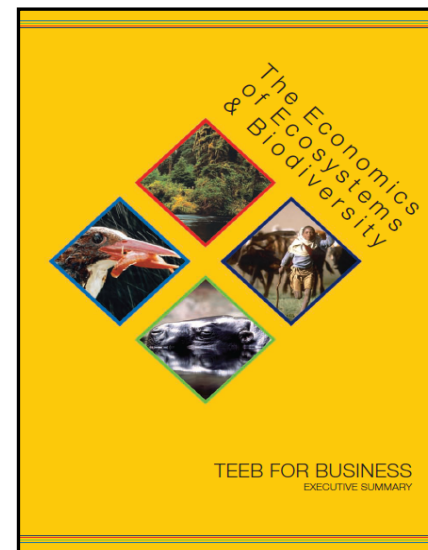


EO Service Industry : Future priorities



- *Cooperation with European Industry Trade Association*

- **Industry Position Papers**
- *GMES operations, International Development*
- **Horizon Scanning : Big Issues**
- *Climate Change, Sustainable development, Mobile technology, Standards, GMES*
- **Emerging Information requirements**



THANK YOU

