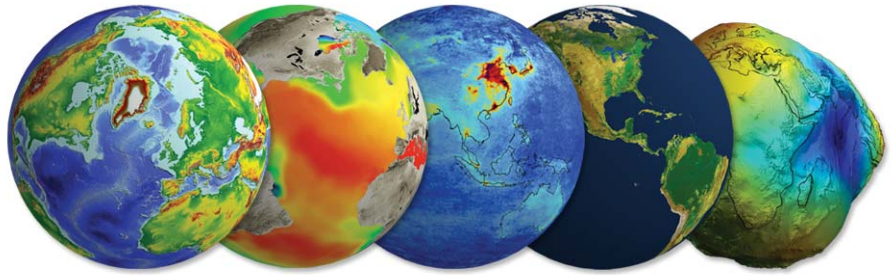
EOEP REVIEW SEMINAR

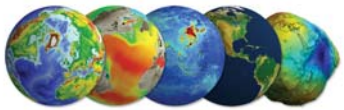
Mission Exploitation

15-16 June 2011



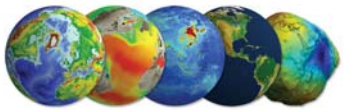
Overview

- *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…*

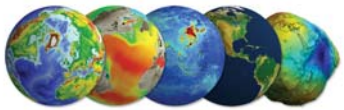


Which elements are involved ?
EOEP Data Exploitation

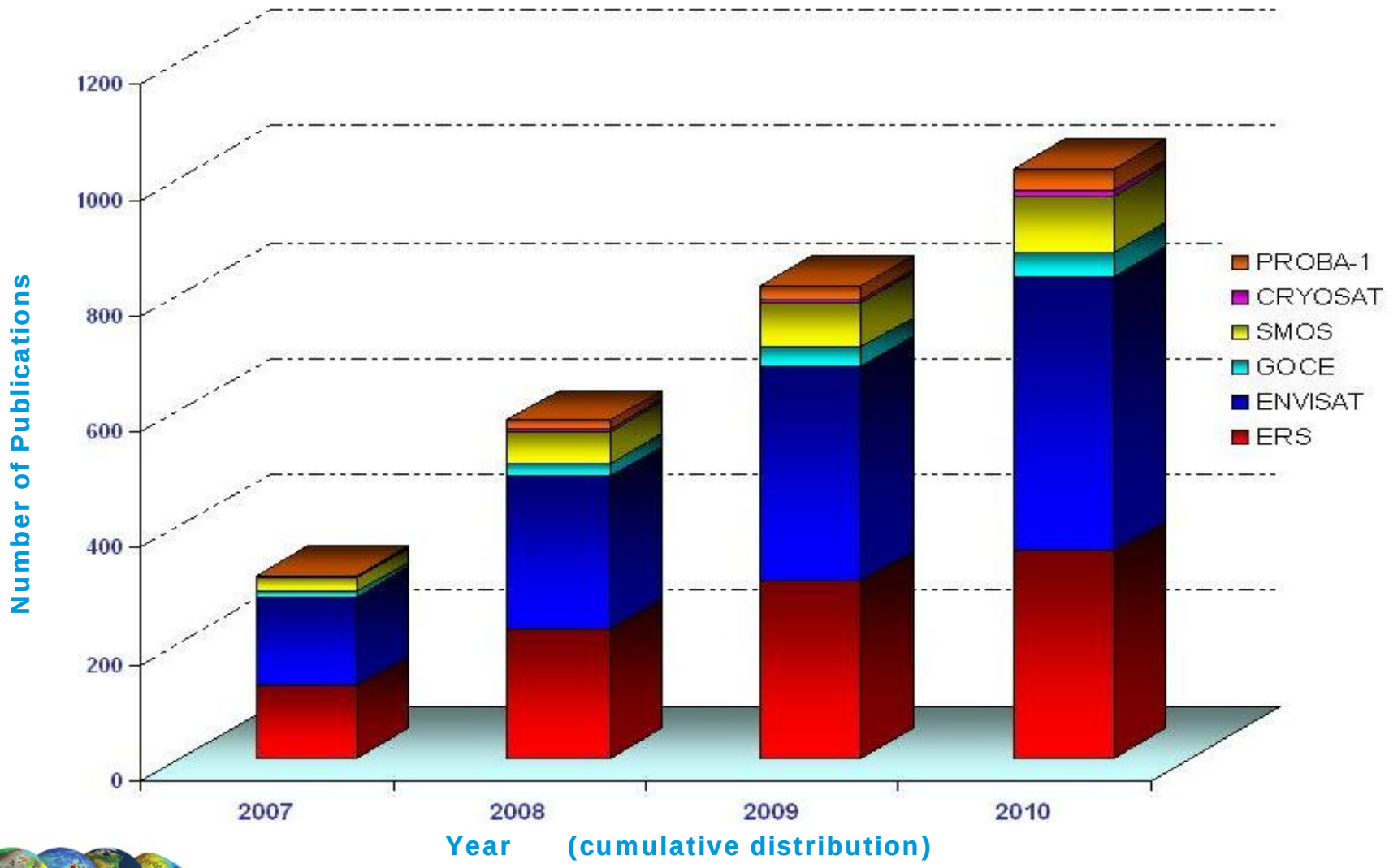
- ***Continuity of Missions***: provides support to PIs, with multi-mission toolboxes, thematic workshops, advanced training courses, targeted R&D (ERS and ENVISAT to date)
- ***Data User Element***: transfers new EO research results into user-driven applications and engages end-user organizations
- ***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



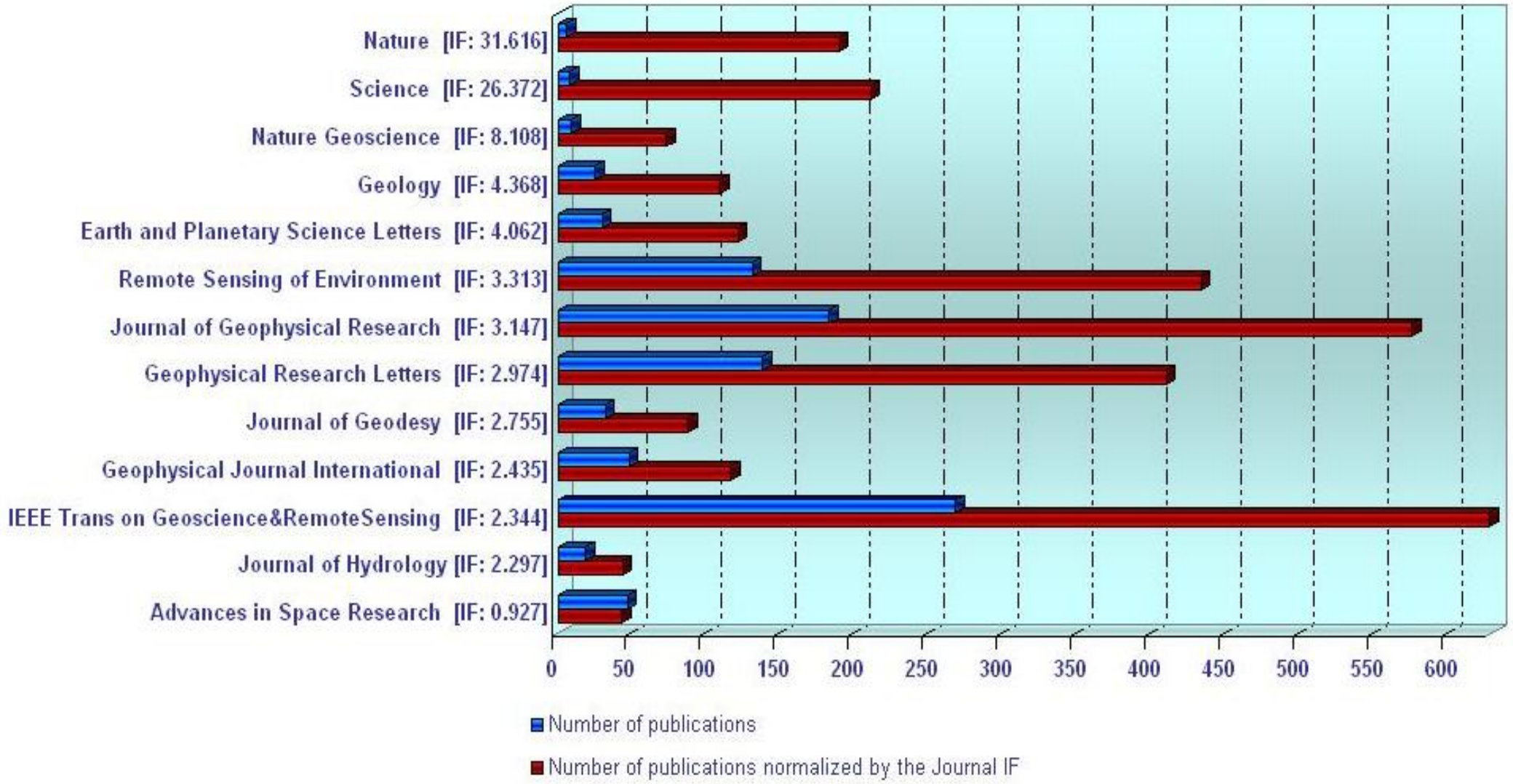
Scientific Excellence and Innovation…



Scientific impact
Peer reviewed publications

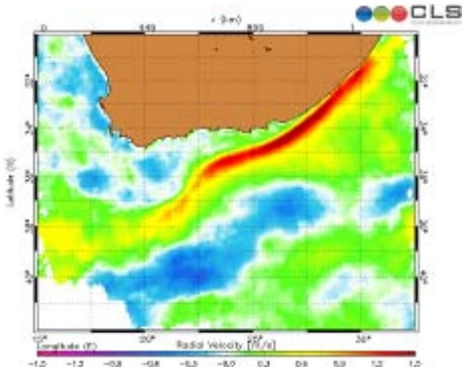


Main peer reviewed Publications (2007 – 2010)

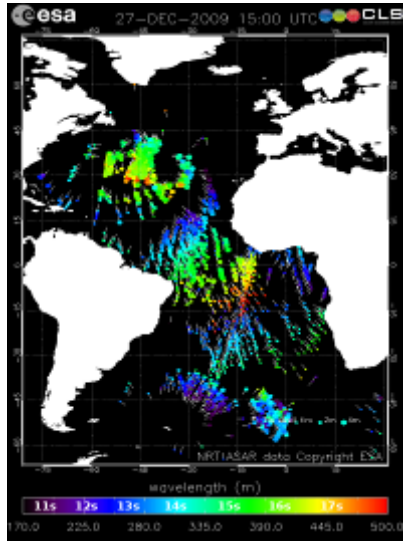


New scientific results made possible
ERS and ENVISAT

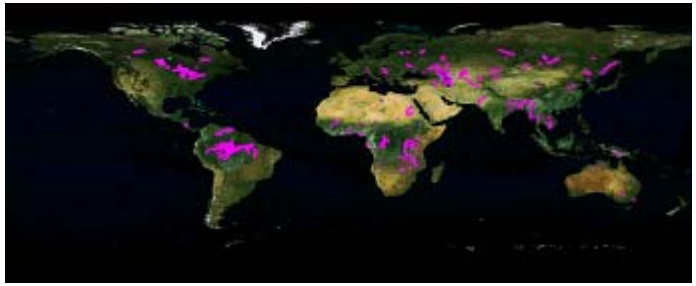
1. Radial Surface currents retrieval from SAR Doppler anomaly



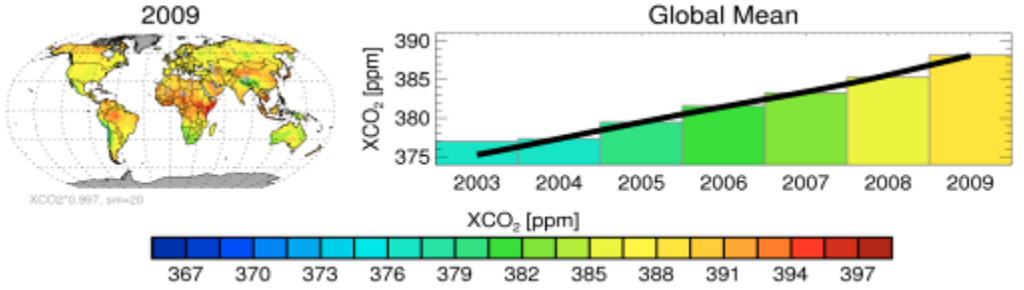
2. Global Swell tracking from SAR wave mode

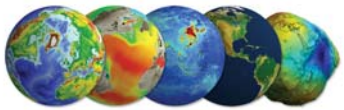


3. Global River and Lakes measurements from space

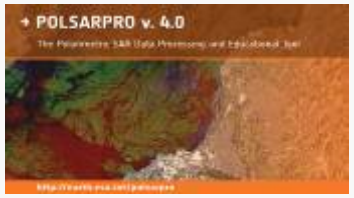
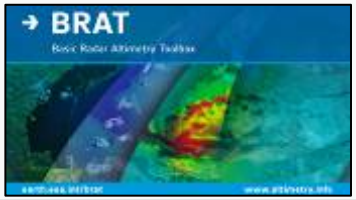


4. Greenhouse gases monitoring

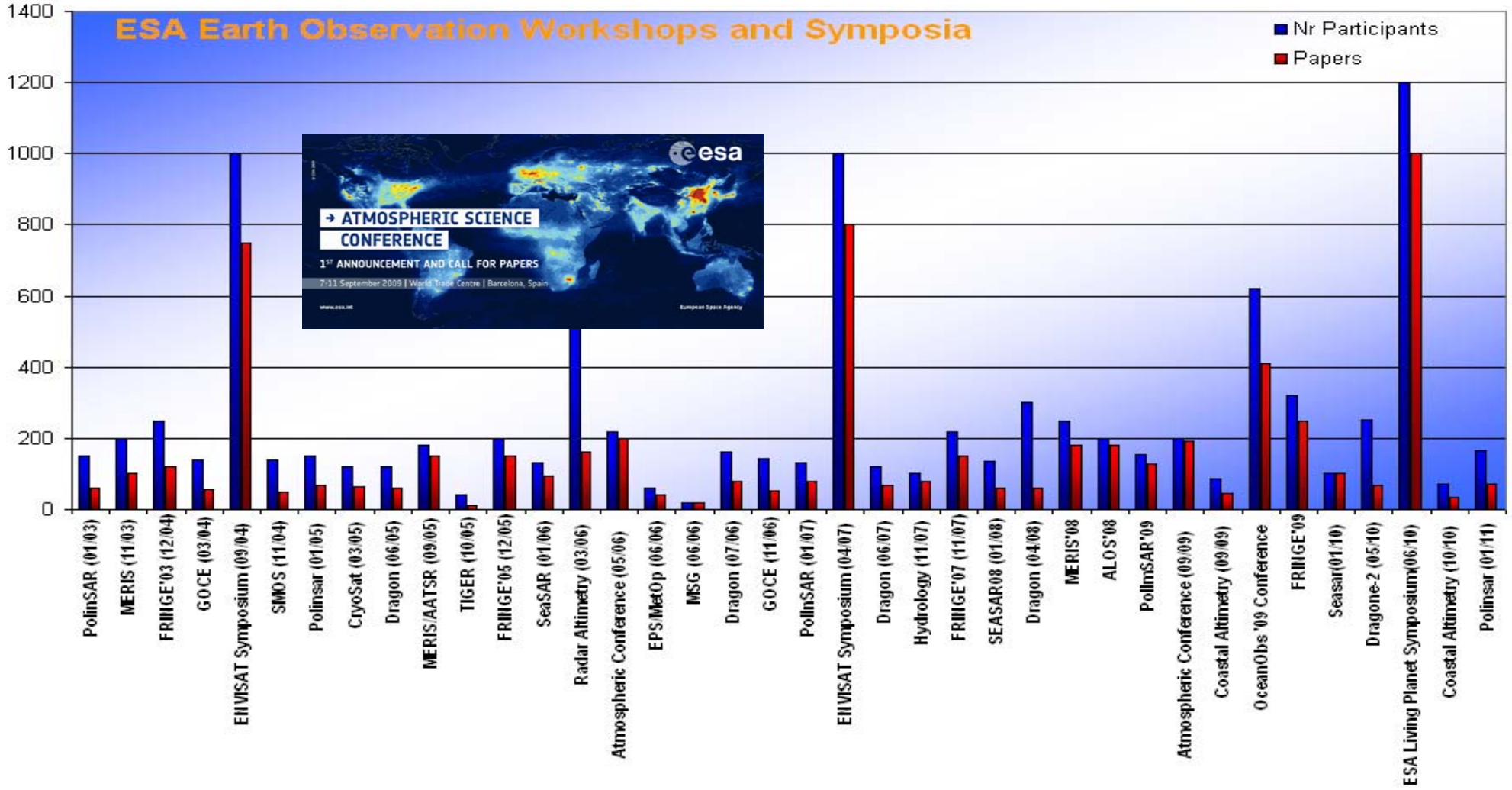




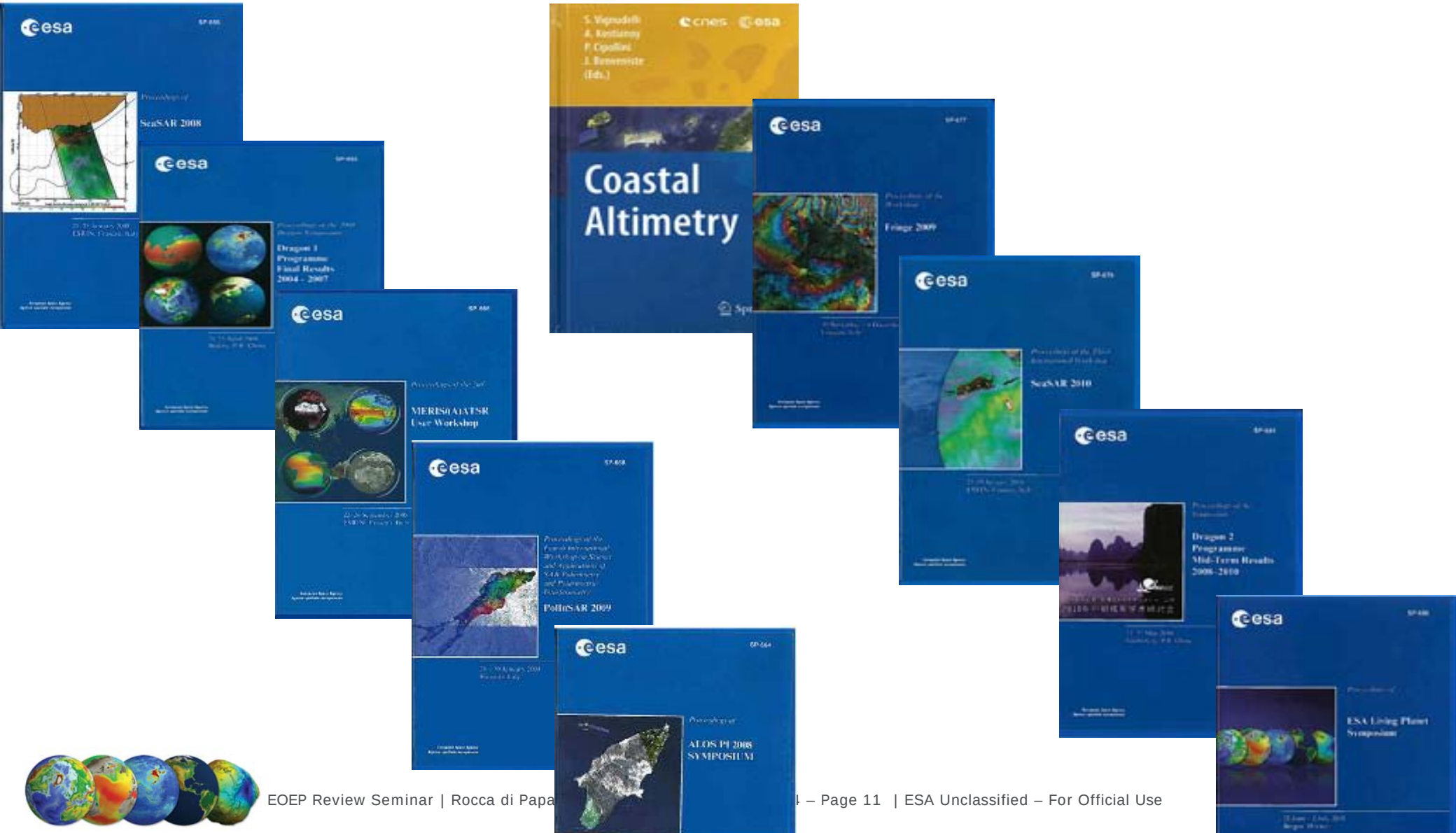
Innovative methods
Open Source Multi-mission Toolboxes

	Example of innovative features	Mission	Users
	– Level 3 Binning and Mosaicing 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
	– Polarimetric Coherence Tomography – Stack data processing – Fully coherent Forest simulator – Pol-InSAR capabilty – 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
	– GTC product – Mutitemporal/Multisensor data processing – Full InSAR capabilty with DORIS – Ocean exploitation Tools	Envisat ASAR, ERS-1&2, ALOS PALSAR, Radarsat-1&2, TerraSAR-X, Cosmo-SkyMed, JERS SAR	3100
	– Atmospheric multi-mission data handling (*Co-funded by EUMETSAT*) 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
	– Application use cases (Hydrology, Oceano,cryosphere) – Full tutorial on Radar Altimetry Principles and applications – Data exchange with GOCE user Toolbox **Toolbox Co-funded by CNES*	ERS-1, Topex-Poseidon , ERS-2, Jason-1, Envisat, Jason-2, GFO, Cryosat,	1400

A high pace of ESA EO Thematic Workshops



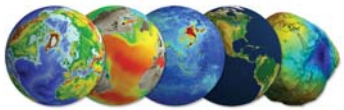
A matching pace of ESA EO proceedings and publications



Expanding the Scientific User-base

Building alliances with international science programmes

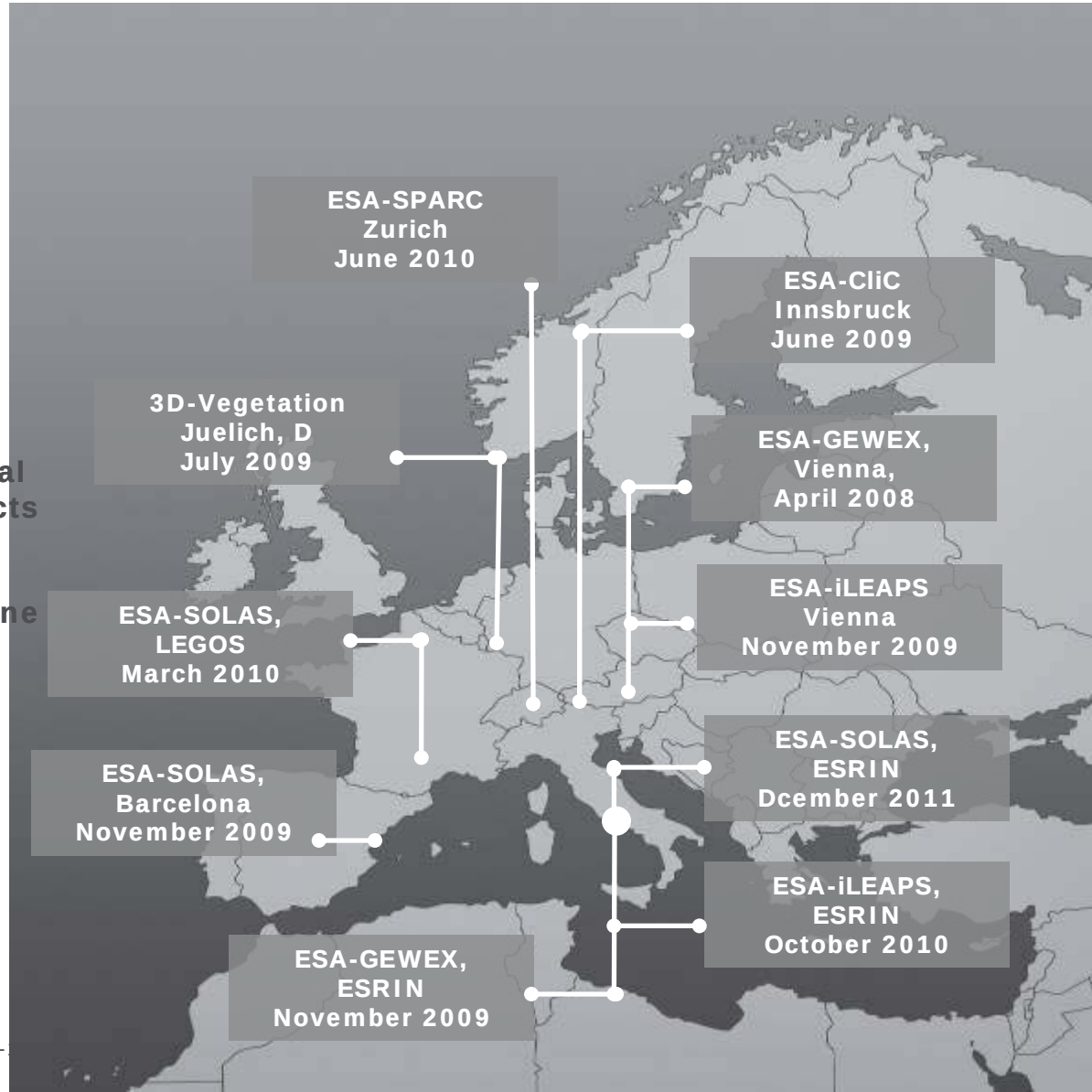
- *ESA data contribution to major international scientific efforts*
- *Promote ESA missions tp wider Earth science communities*
- *Coordination of STSE activity with international scientific priorities*

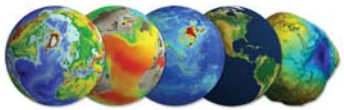


Consultations with international science programmes

10 international workshops & conferences since 2008

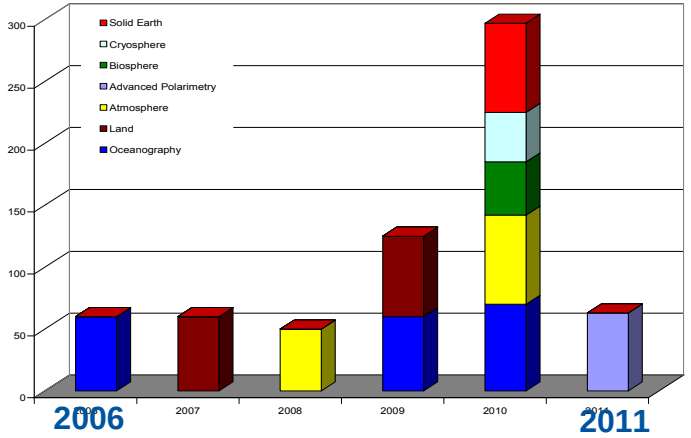
- Scientific consultation workshops to identify scientific needs
- Major conferences where international scientific community assesses projects results
- Workshop to present results and define future roadmaps;



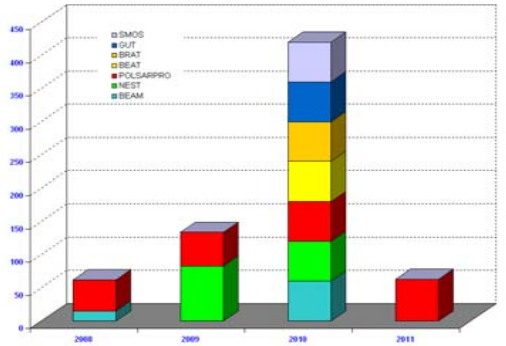


Advanced training opportunities
for young scientists

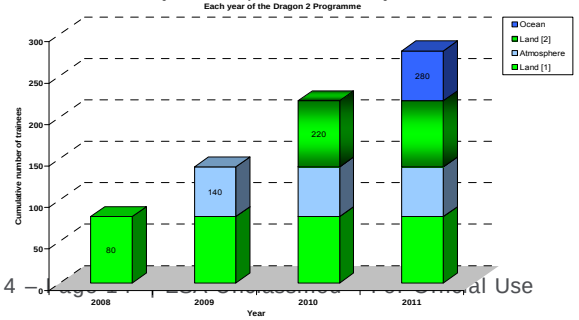
ESA Advanced EO training courses and tutorials



Toolbox-based training at ESA thematic workshops



DRAGON 2 Advanced training

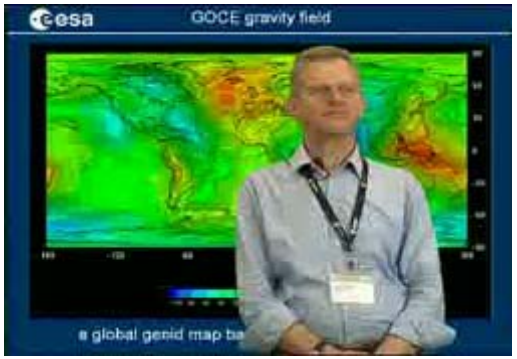


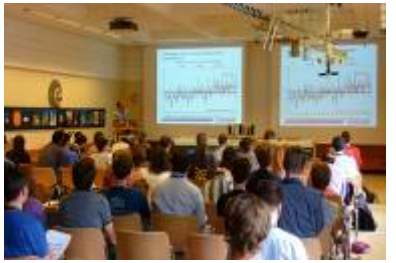
ESA EO Summer School
Earth system monitoring & modeling

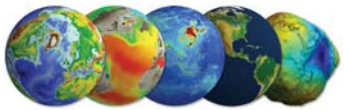
About **70+young researchers** (e.g. Ph.D. Student, Young PostDoc) selected from more than **240 applications** joined **20+ leading scientists** in Earth Observation, Modelling and Data Assimilation in ESRIN for *keynote lectures*, *hands-on computing practical* and *poster sessions*.

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

Interview R. Rummel







The Changing Earth Science Network

science network
support to science element

esa

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.

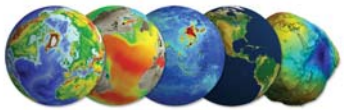
• Promote better interactions and links between ESA and the next generation of scientists in member states via stages in ESA centres;

• 20 Activities have been launched between 2009 and 2010;

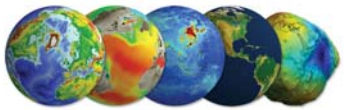
• First Science Network Workshop, ESRIN, 12-13 November 2009;

• 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);



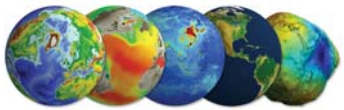
Engagement and Benefits for End-Users



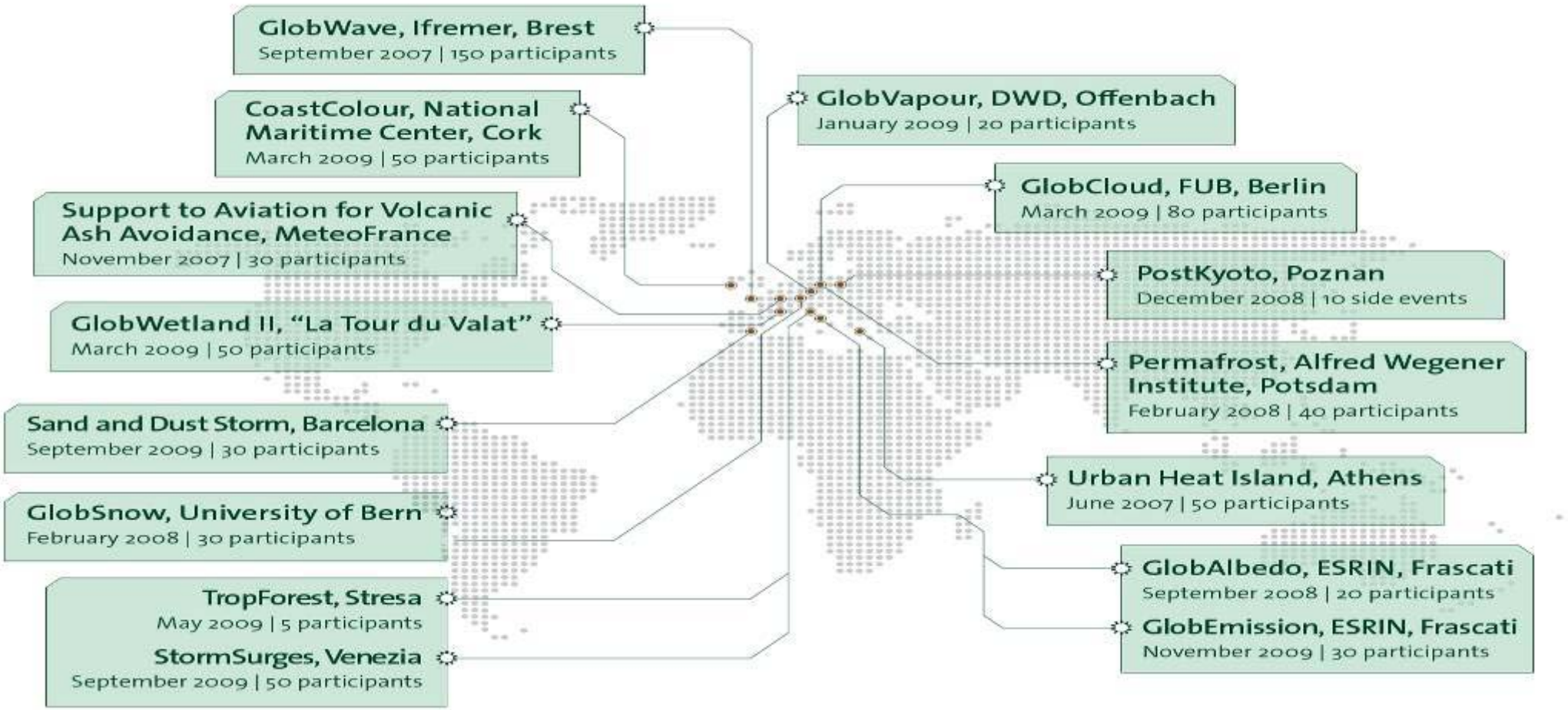
Engagement & Benefits for end-users

key questions

- **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

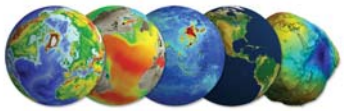


New products for Global Change Research
GlobSeries

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

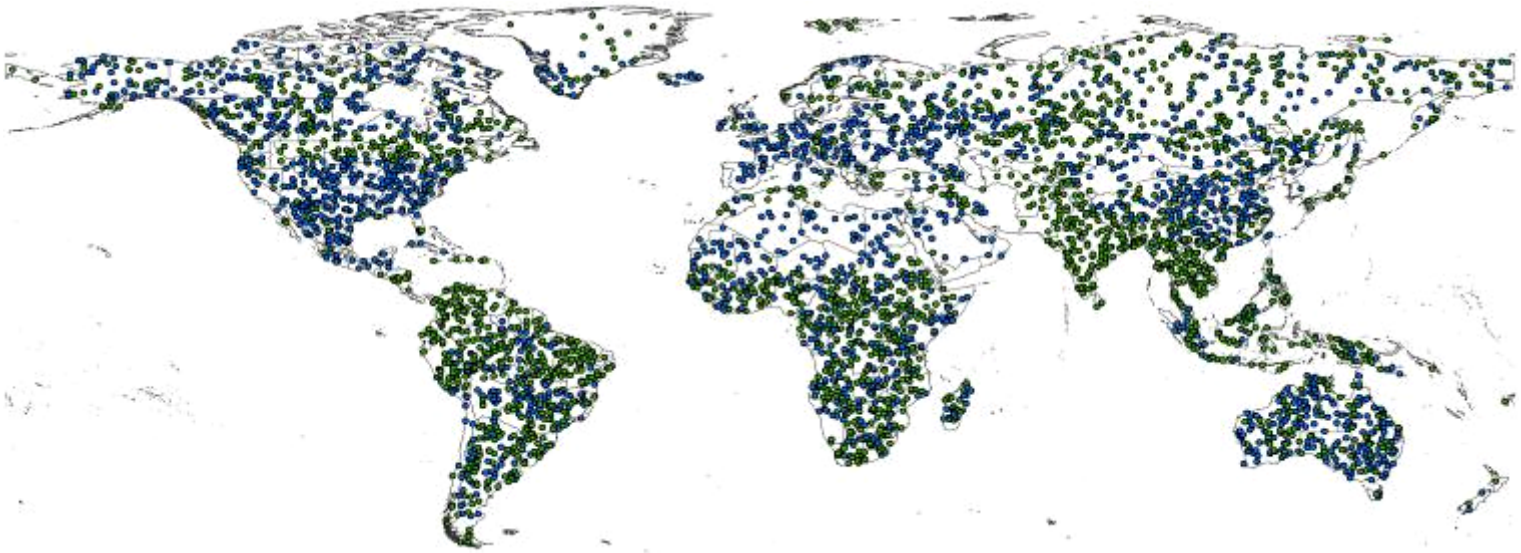
SERVING THE GLOBAL CHANGE COMMUNITY

scholar.google.com



Extensive independent validation
Globcover example

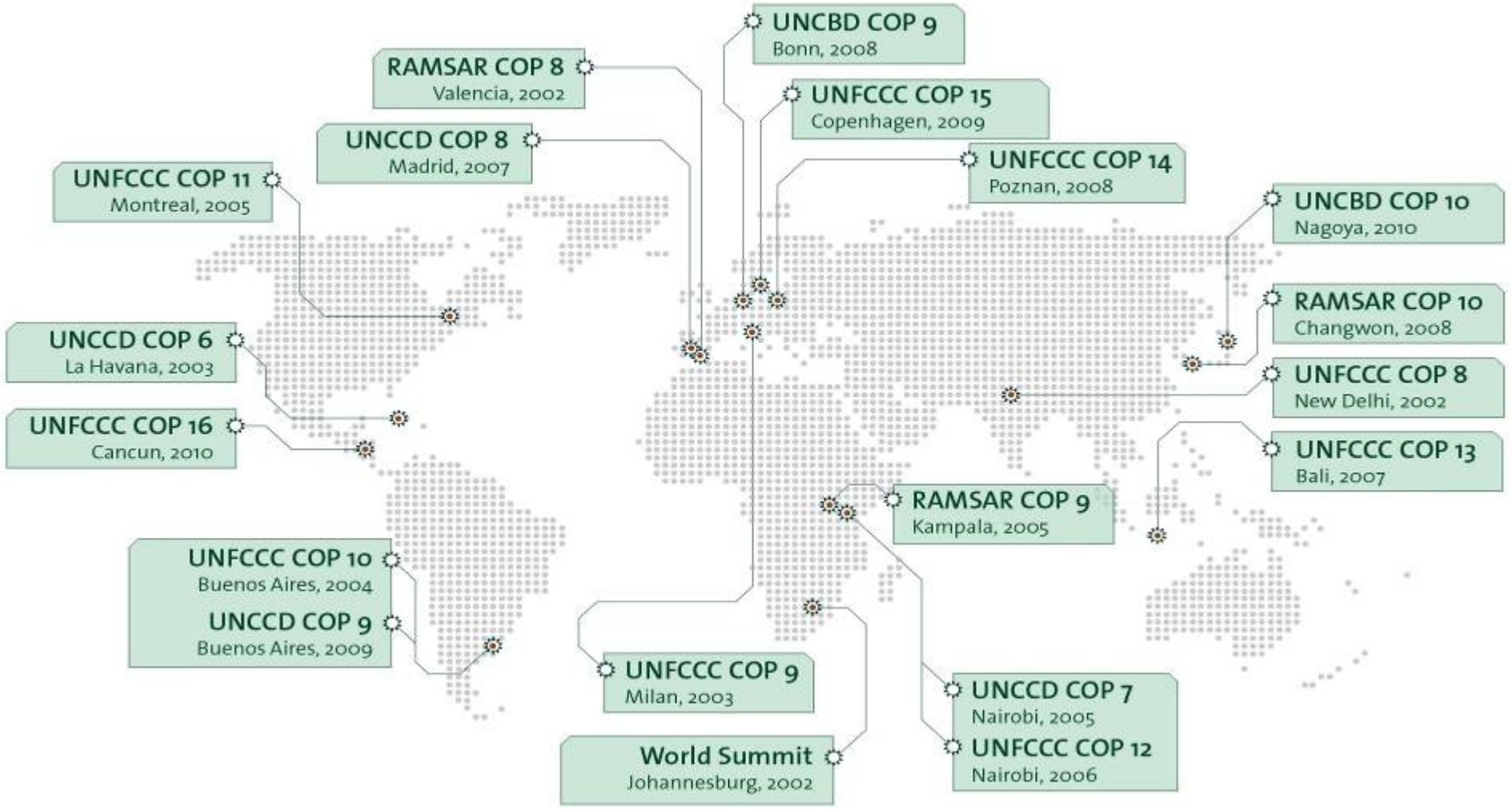
- Assessed by a global network of **14 land cover experts**
- Dedicated interpretation and validation tool
- **3134 sample points** were interpreted by the experts
- Overall weighted-by-class accuracy **67,5%**



Blue points: GlobCover 2005 heritage samples

Green points: New additional samples

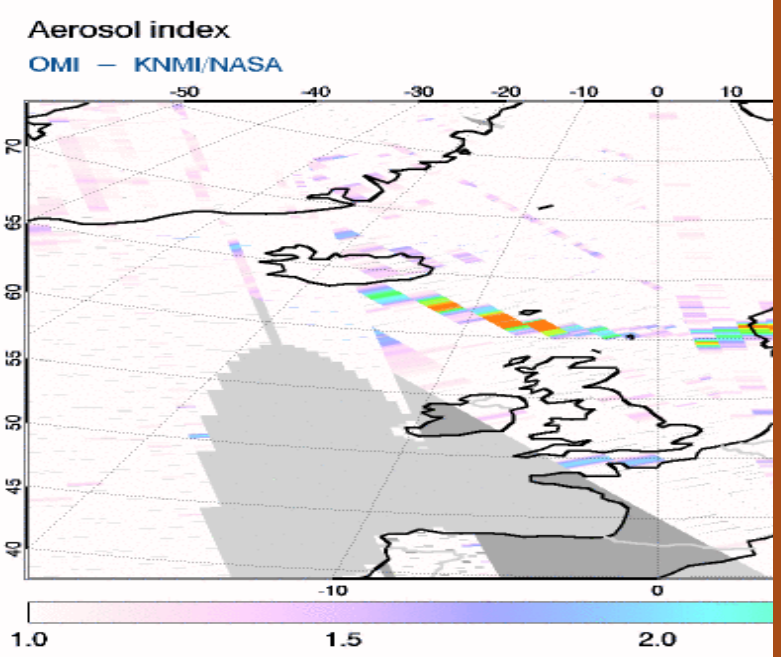
Supporting International Environmental Conventions

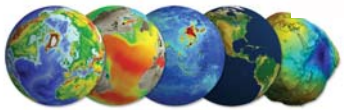


Responding to societal needs

web-based global volcanic ash alert ser

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





EUMETSAT esa

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

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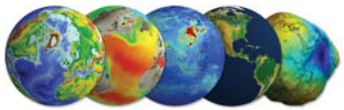
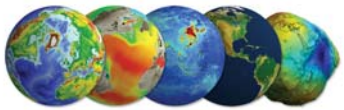
Engagement and Benefits for Value-adding Industry

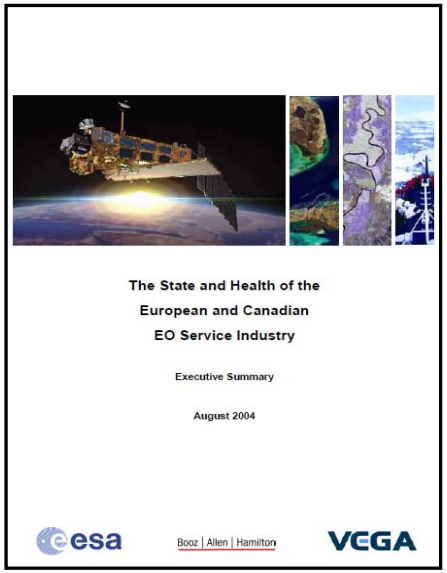


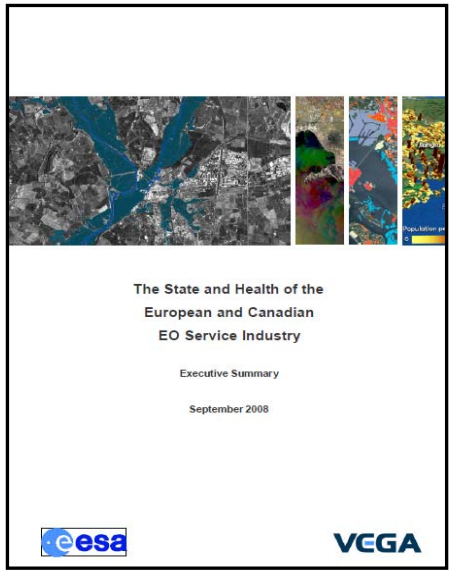
Engagement & benefits: value-adding industry
key questions

- ***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?***



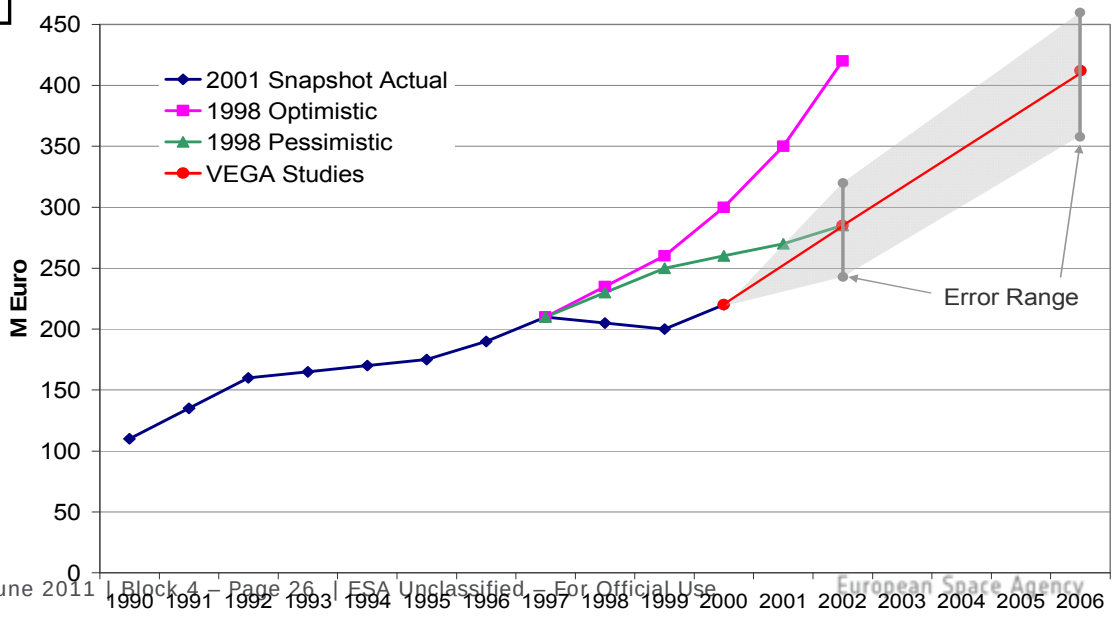
EO service industry surveys
chart progress…

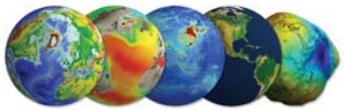




- Unique, in-depth survey of European EO Services industry capabilities, constraints, issues
- Baseline 2003, Updated 2006, Update for 2010 in progress
- Cited by Euro-Consult, OECD

- 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)



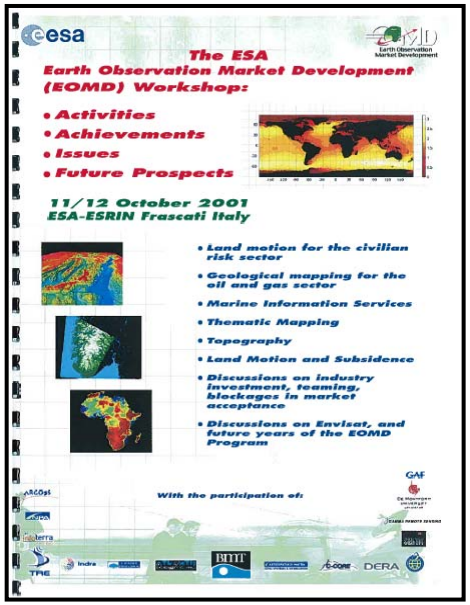


Industry Consultations
identify evolving market needs…

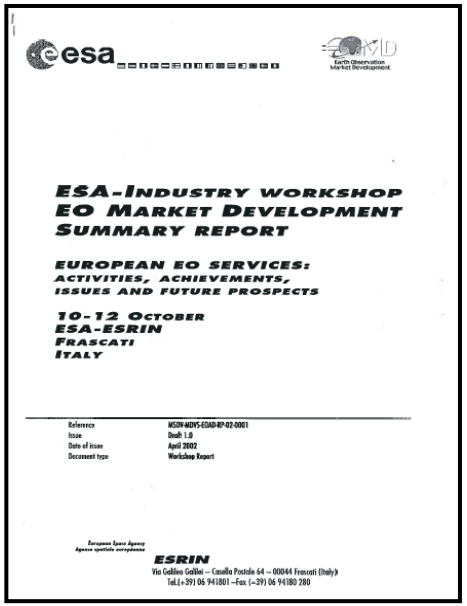
Corporate Industry & Multi-Lateral Development Banks

- 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)

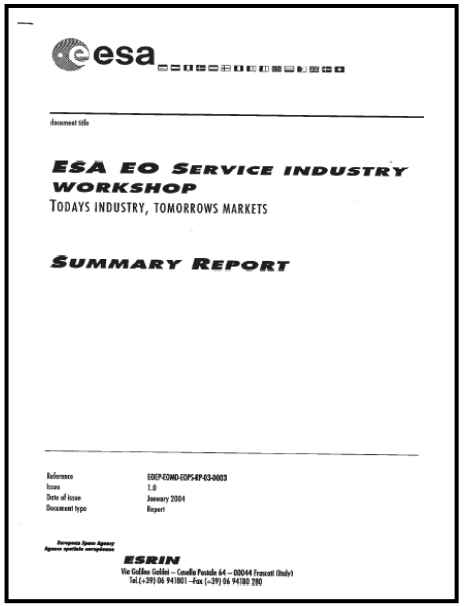
Value-adding industry
sets priorities…



Oct 2001



April 2002

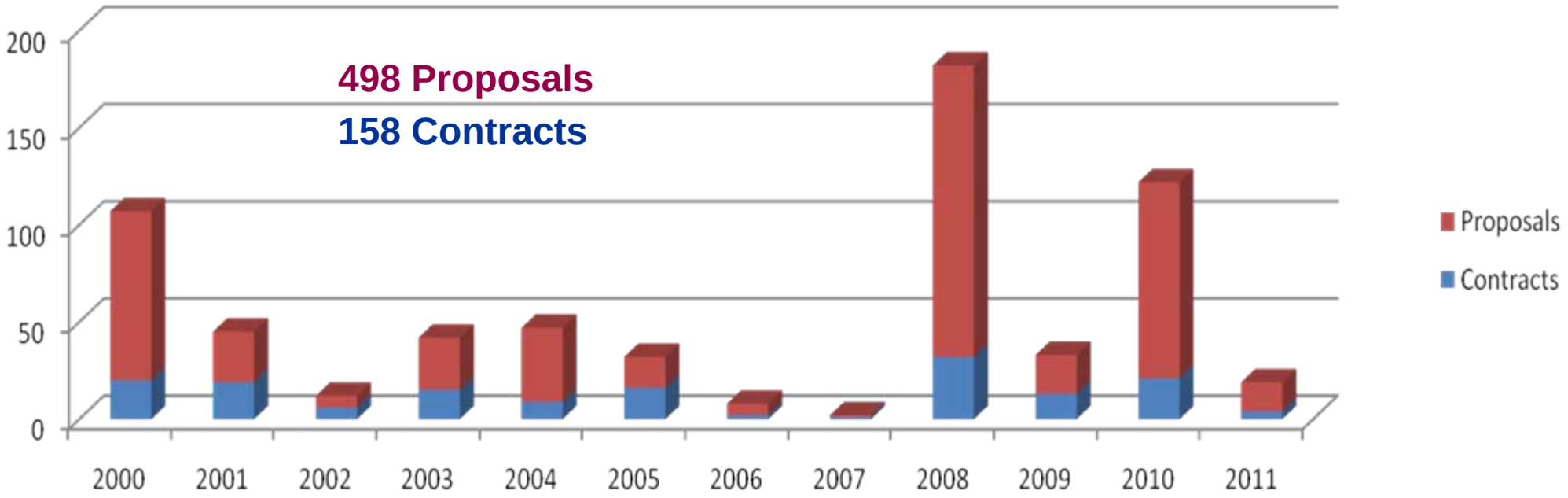


Jan 2004

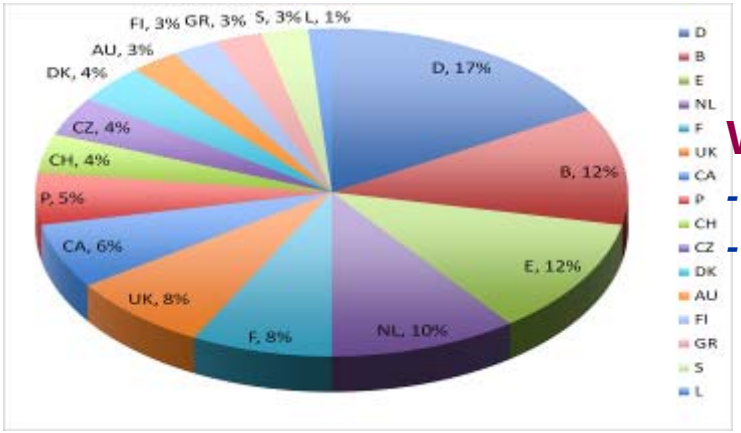
Nov 2007

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

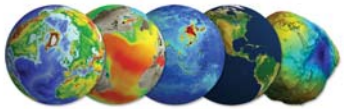
EOEP Open Competitive ITTs
offer opportunities for Value Adding Industry



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

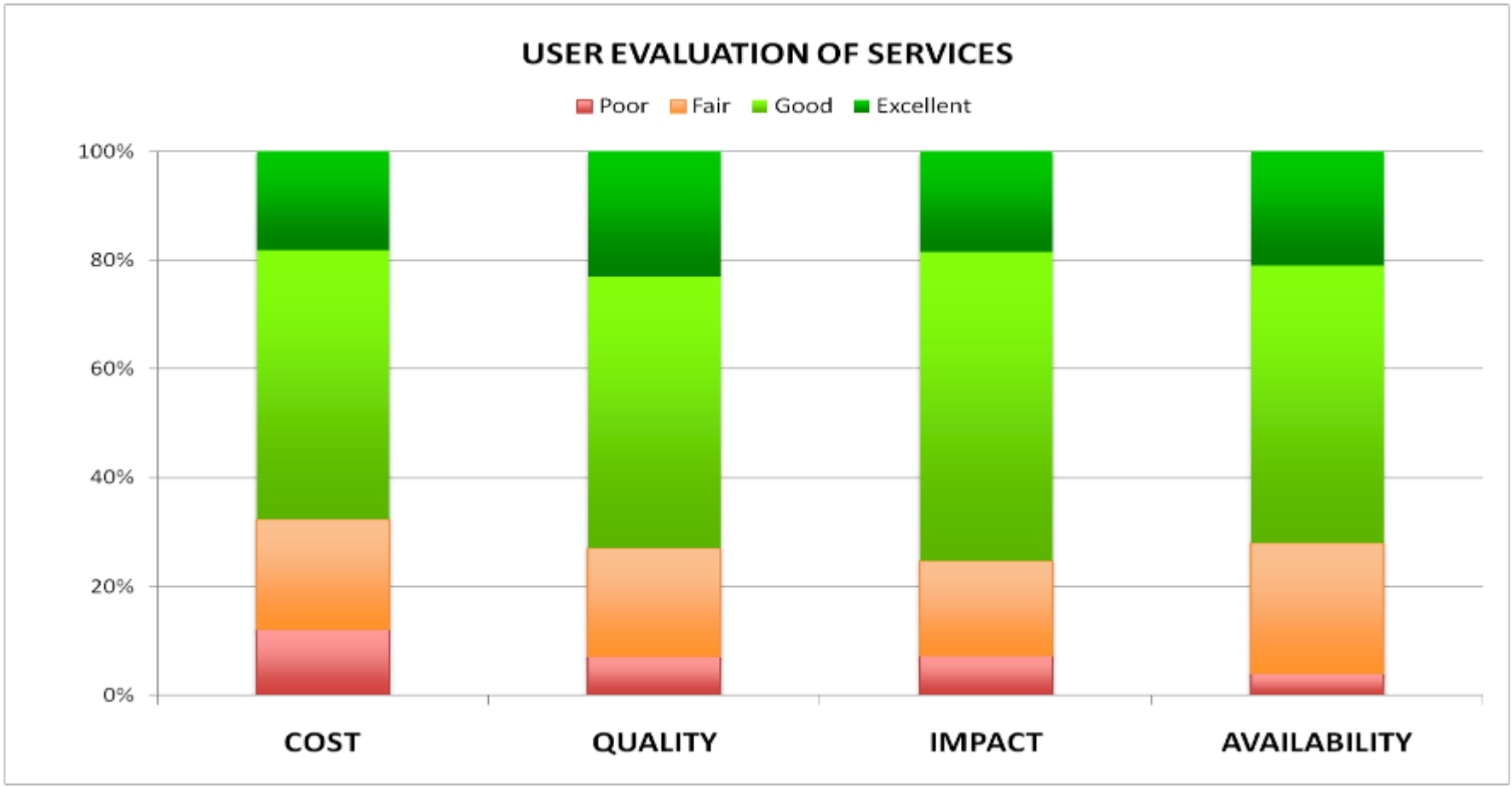


WB Projects
- 78 proposals
- 16 MS



Industrial users
evaluate new products and services

100+ service trials *35+ industry sectors*

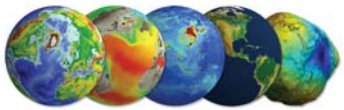


Good prospects

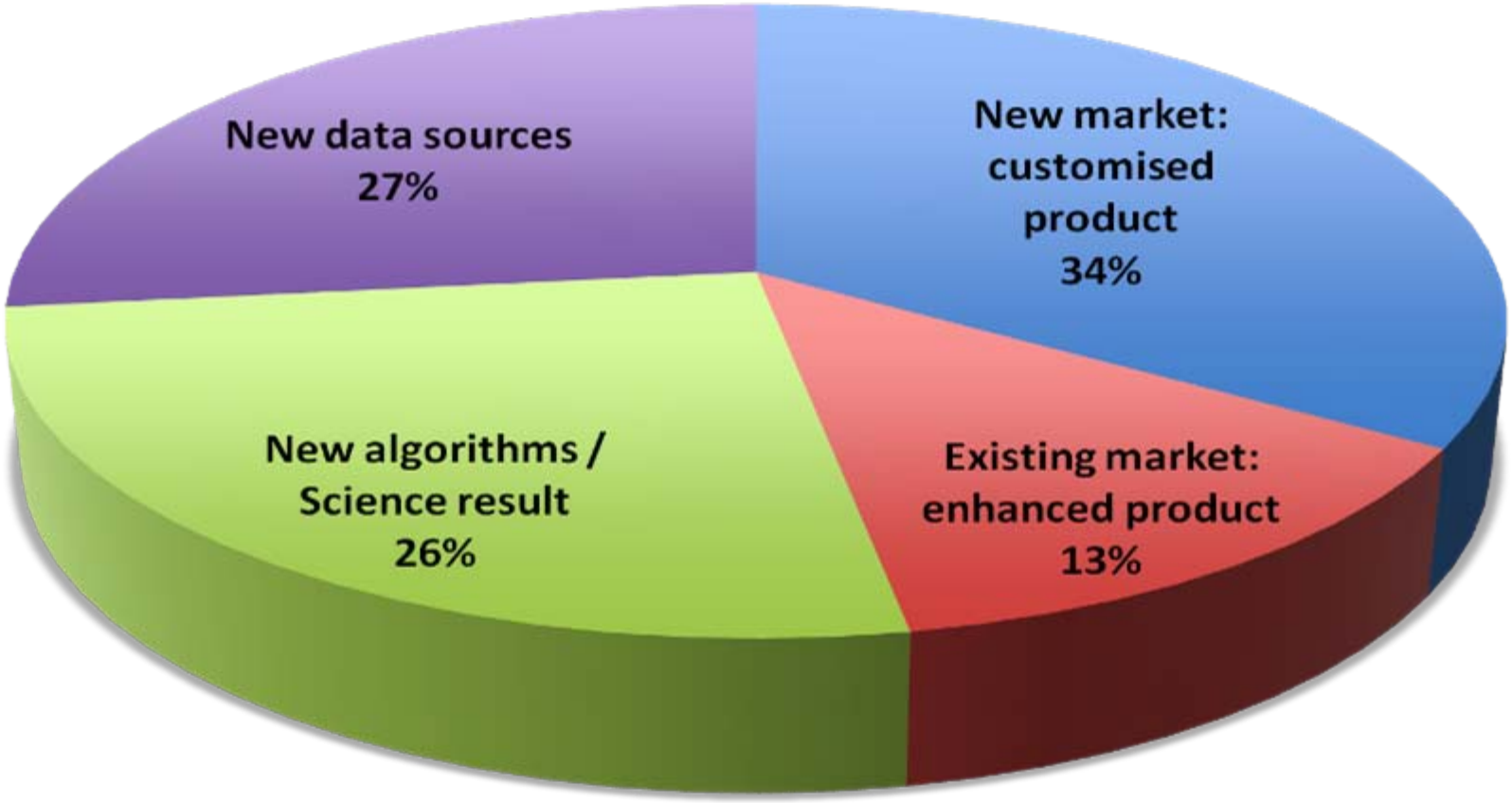
- *Solar irradiance*
- *HR off-shore winds for Renewable Energy*

Poor prospects

- *Land motion for oil & gas pipeline monitoring*



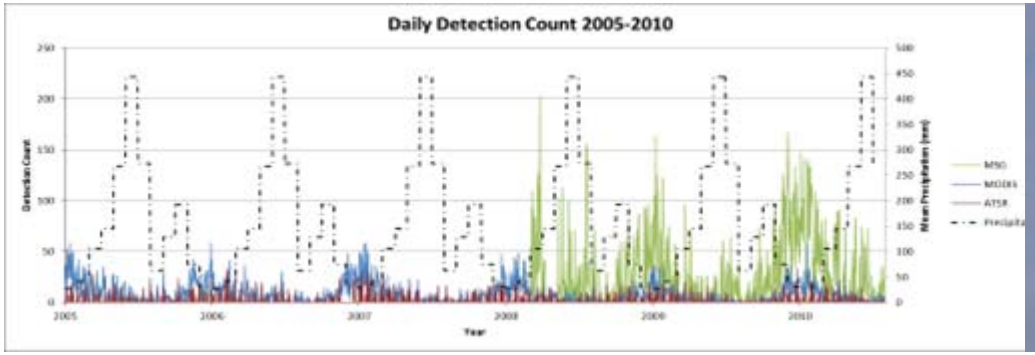
Sources of innovation in EO Services

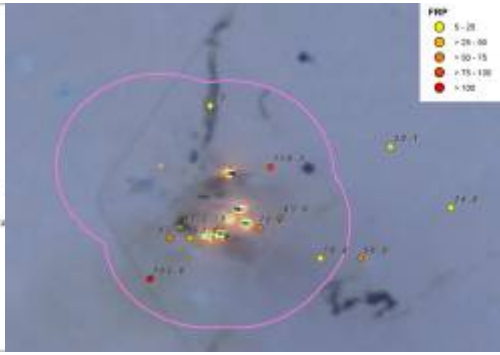


- **Innovation in EO services addressed equally along several fronts,**
- **Analysis of 68 activities (since 2007).**

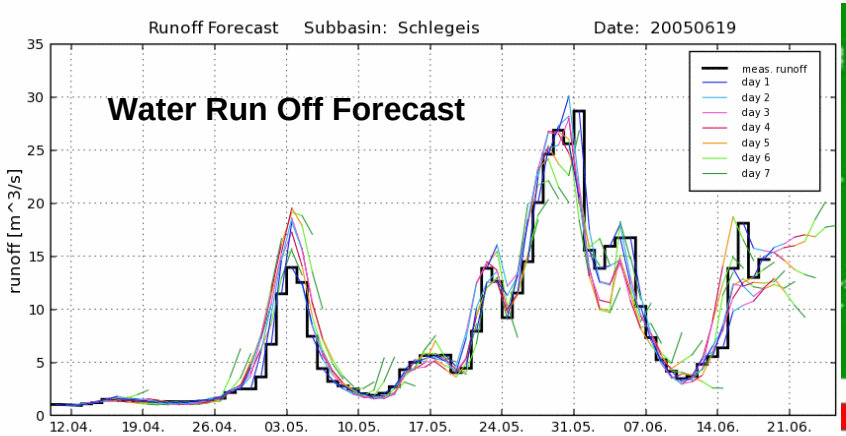
- **35 + activities integrating New Developments (new techniques, new EO data) to produce enhanced EO Services** (based on existing capabilities)

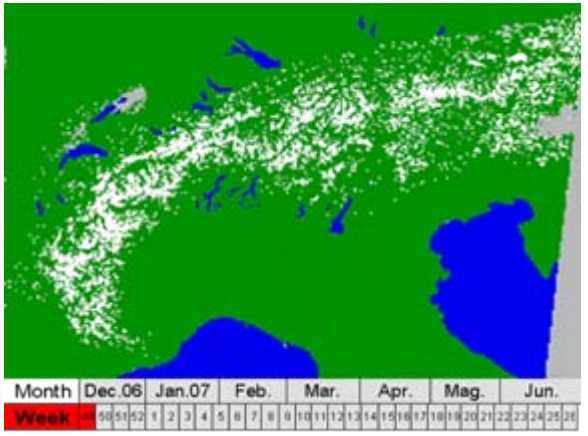
- **Gas Flares**
- **MODIS +ATSR + MSG improved algorithms,**
- **Monitor at 1km res, 4xday,**
- **Optimisation for cold (Siberia) and warm (desert) environments,**
- **Fire Radiative Power (FRP) estimation.**

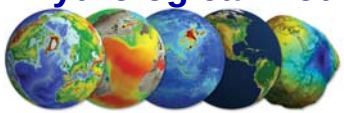




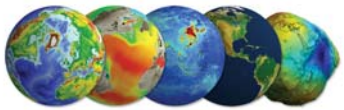
- **HydroPower**
- **Weather Conditions (MSG) + Snow Cover + DEM + Land Cover (ENVISAT/MERIS)**
- **Water run-off Forecasting via Hydrological model.**





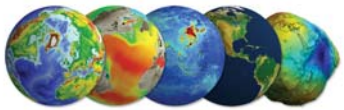


Coordination with other Programmes



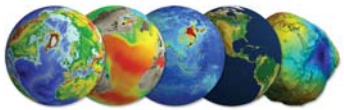
Coordination with other Programmes
key questions

- ***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 ?***



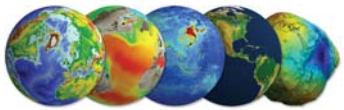
Coordination with National Programmes

- *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***

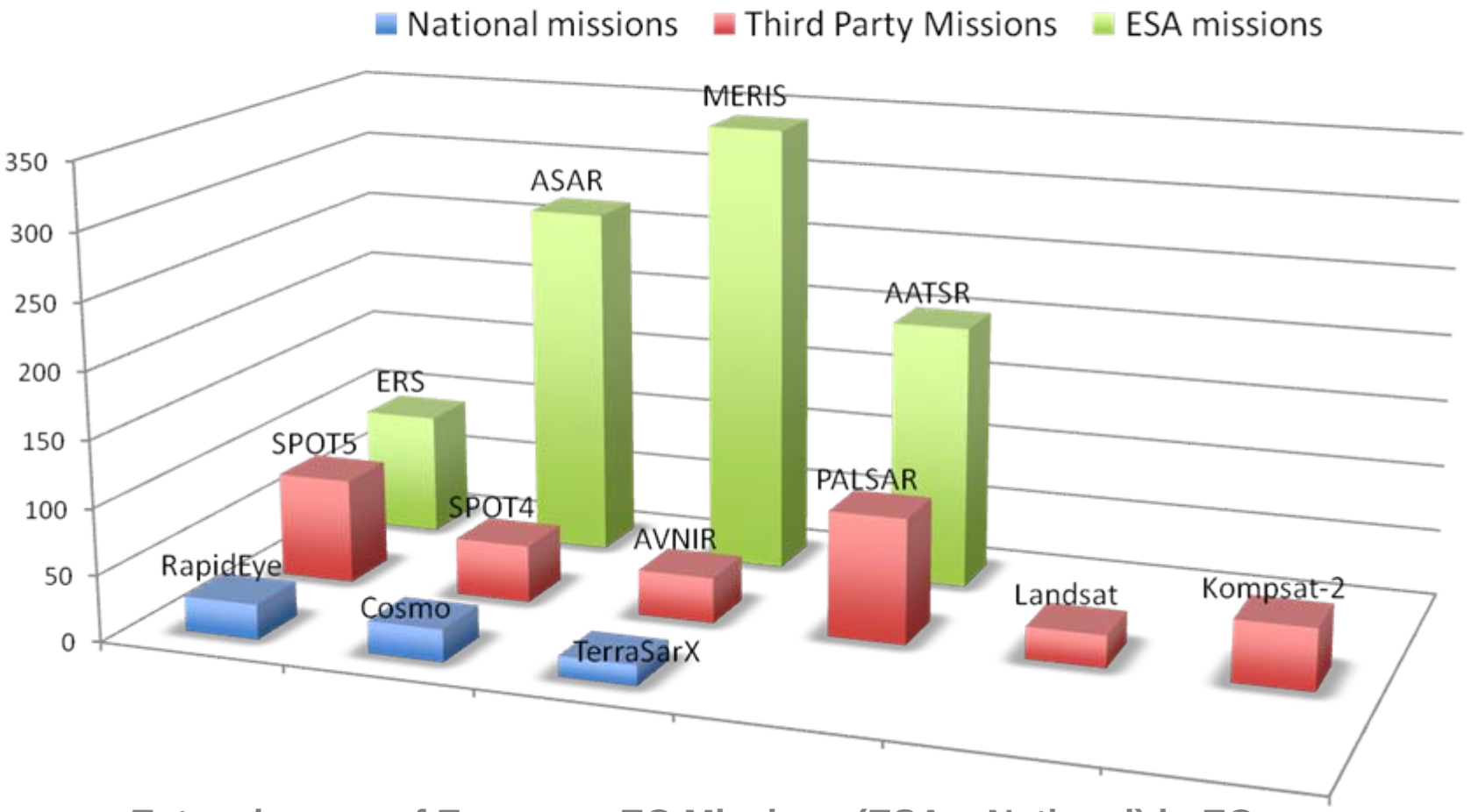


Coordination with European Programmes

- *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***

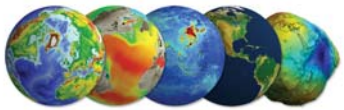


Promoting exploitation of data from ESA National and Third Party Missions



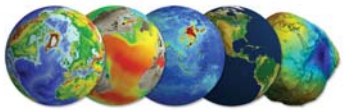
e.g.: Extensive use of European EO Missions (ESA + National) in EO services to support World Bank Projects.

Achievement of Programme Objectives



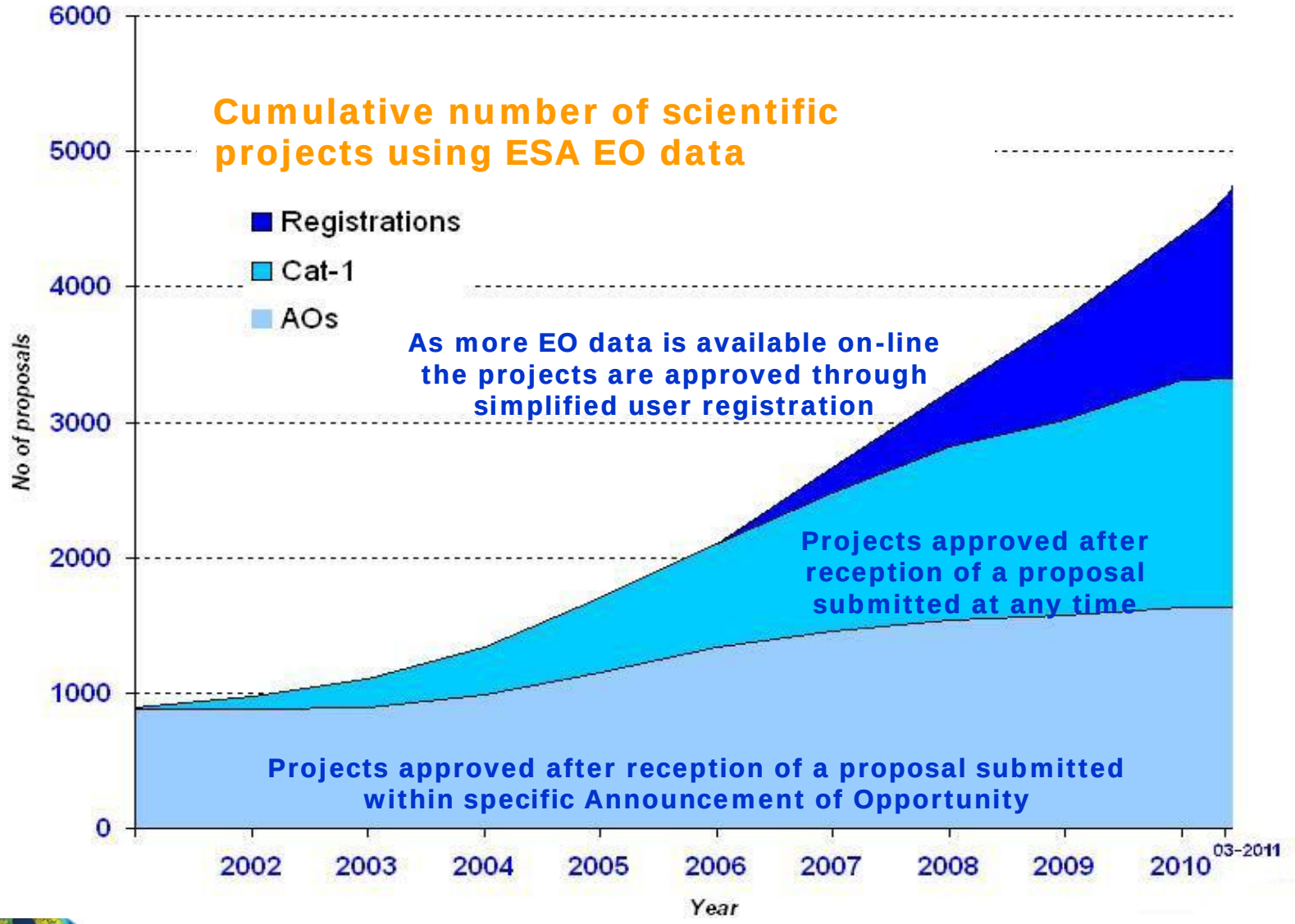
Achievement of Programme Objectives
key questions

- ***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



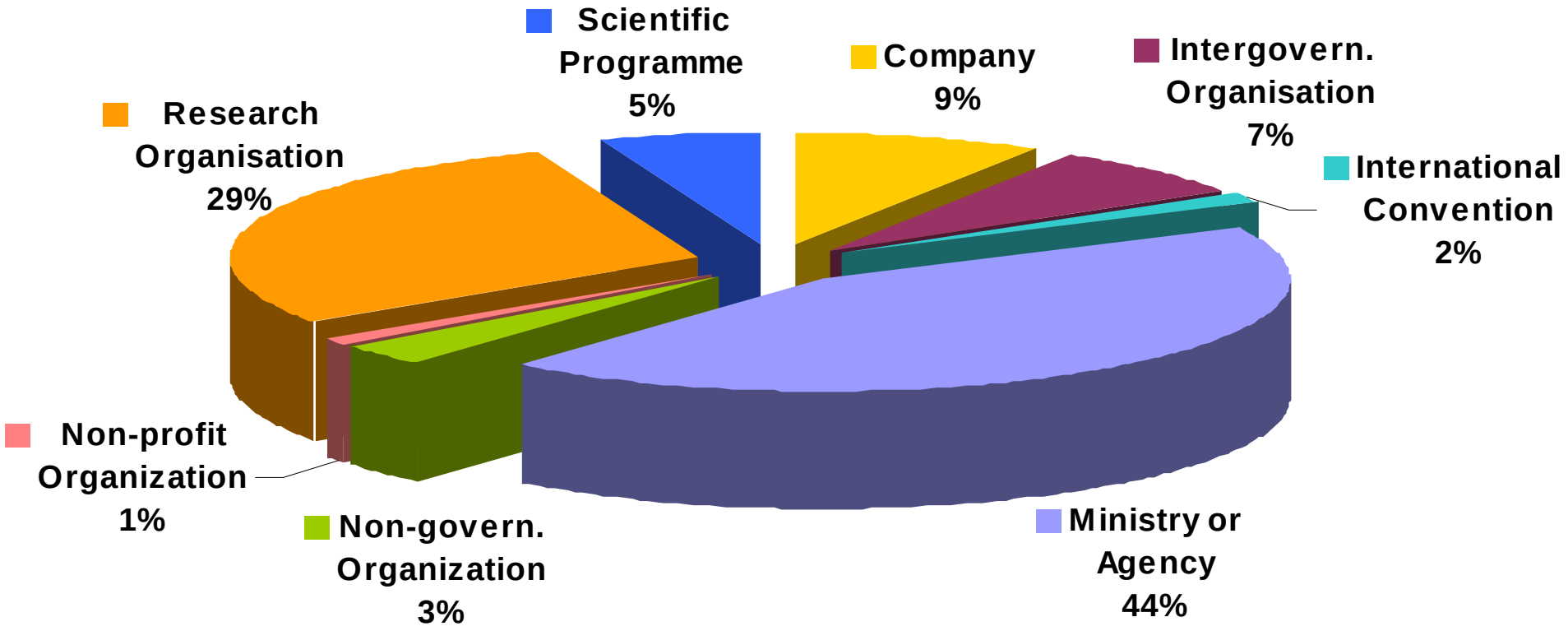
Fostering international scientific collaboration
Major conferences and symposia

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.

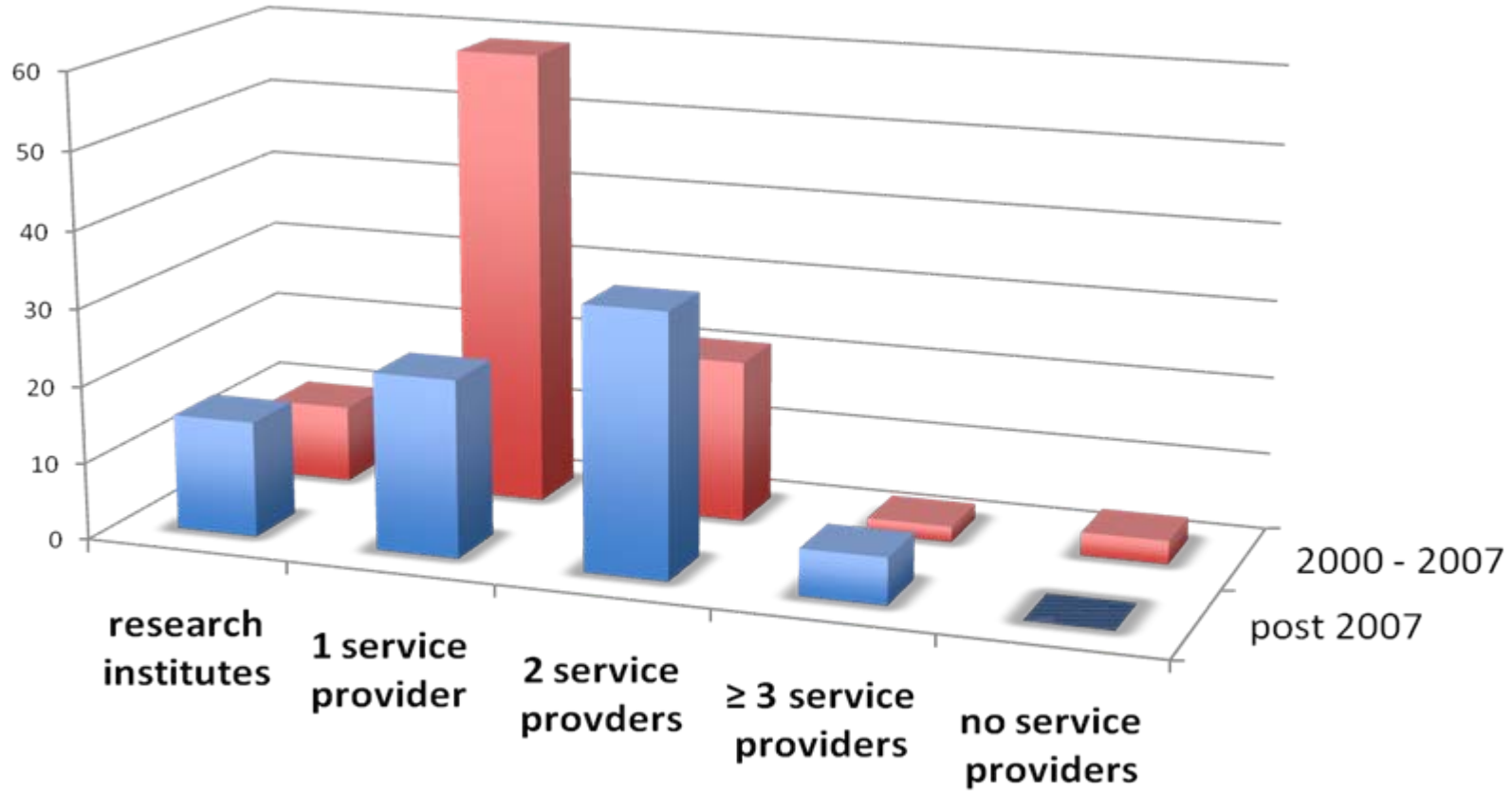
ESA Yearly Presence at:
- EGU, AGU, IUGG, IAG, etc.

Engaging end-users



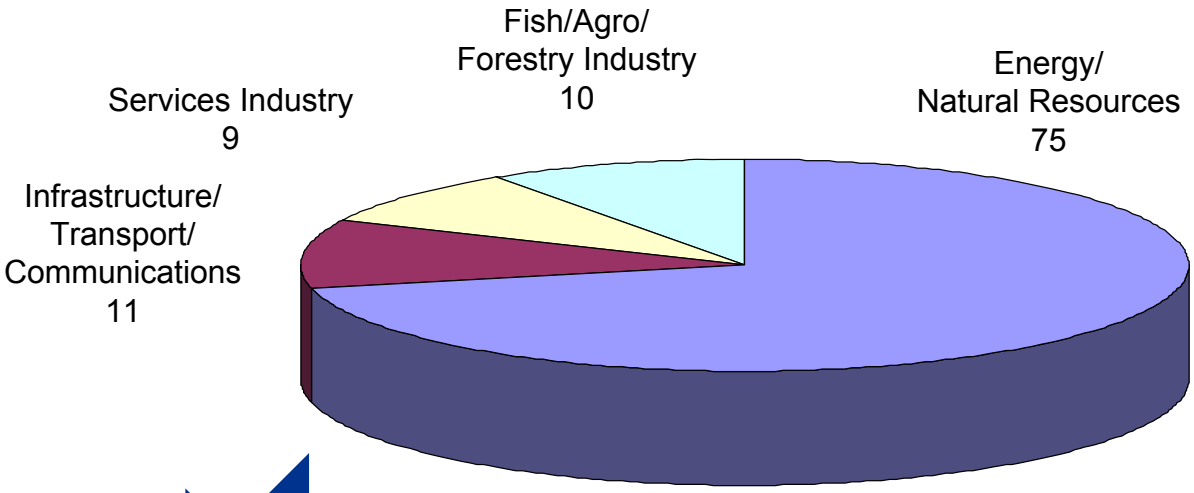
388 new user organisations for EO

Fostering Research and Value-Adding partnerships



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

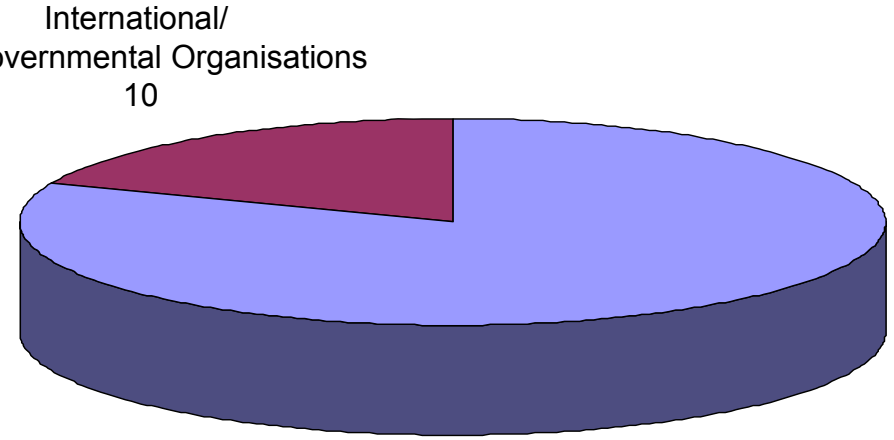
Enlarging the Industrial User Base



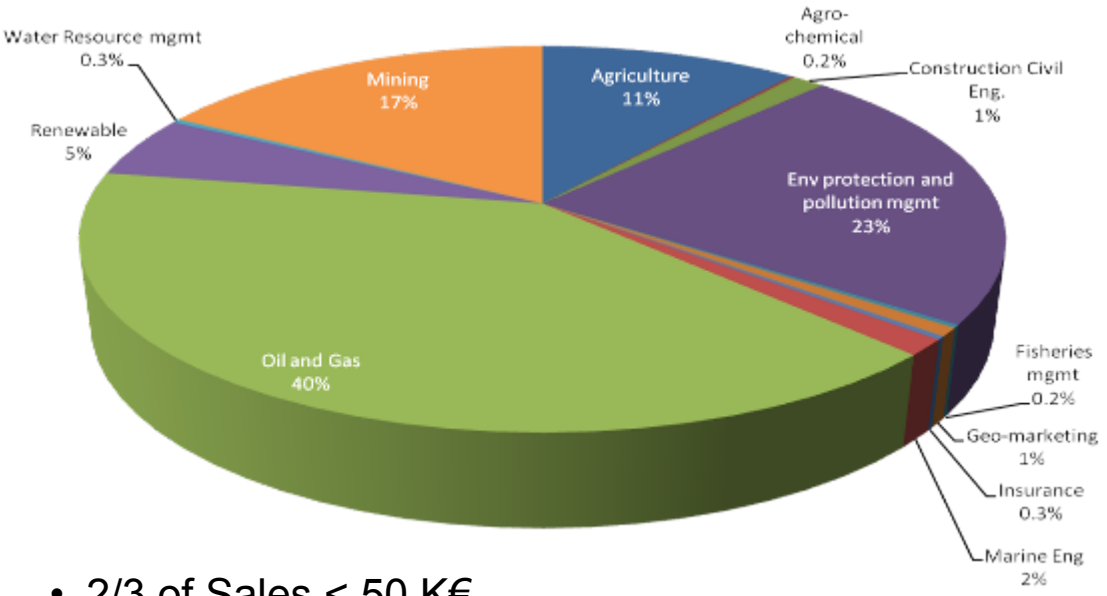
- **105 Users Private Sector**

Up 44% wrt 2004

- **53 Users Public Sector**

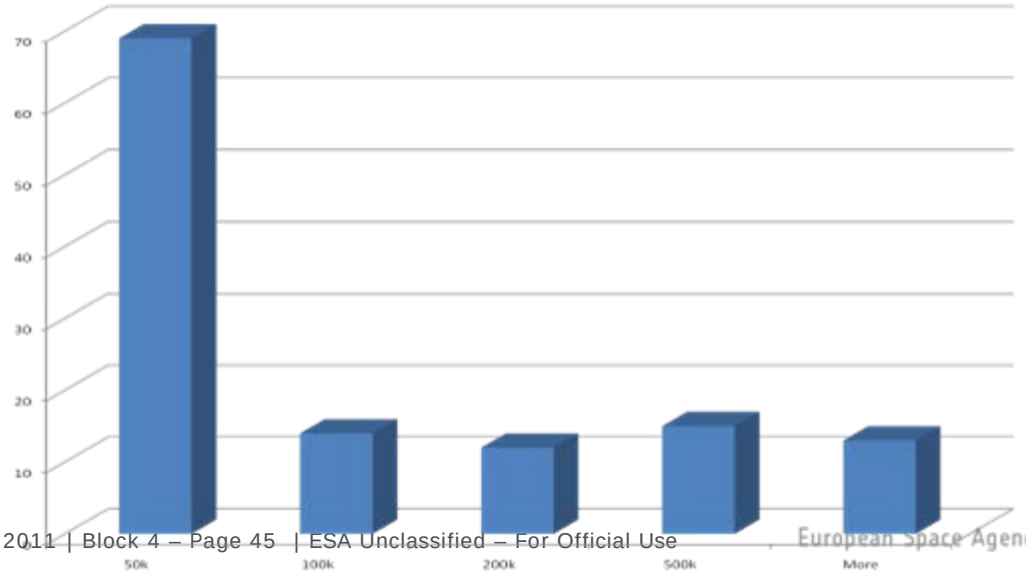


Improving the competitive position
of European EO value-adding industry



- **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.



Advancing International cooperation
China - Dragon

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

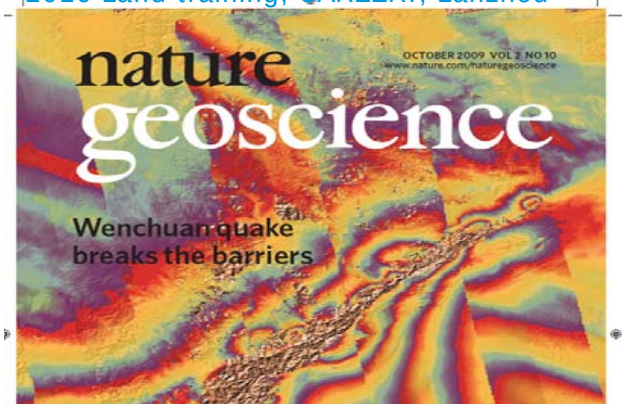
- ***Starting in 2012***, *4 years*
- *exploitation of* ***new European and Chinese EO missions***

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

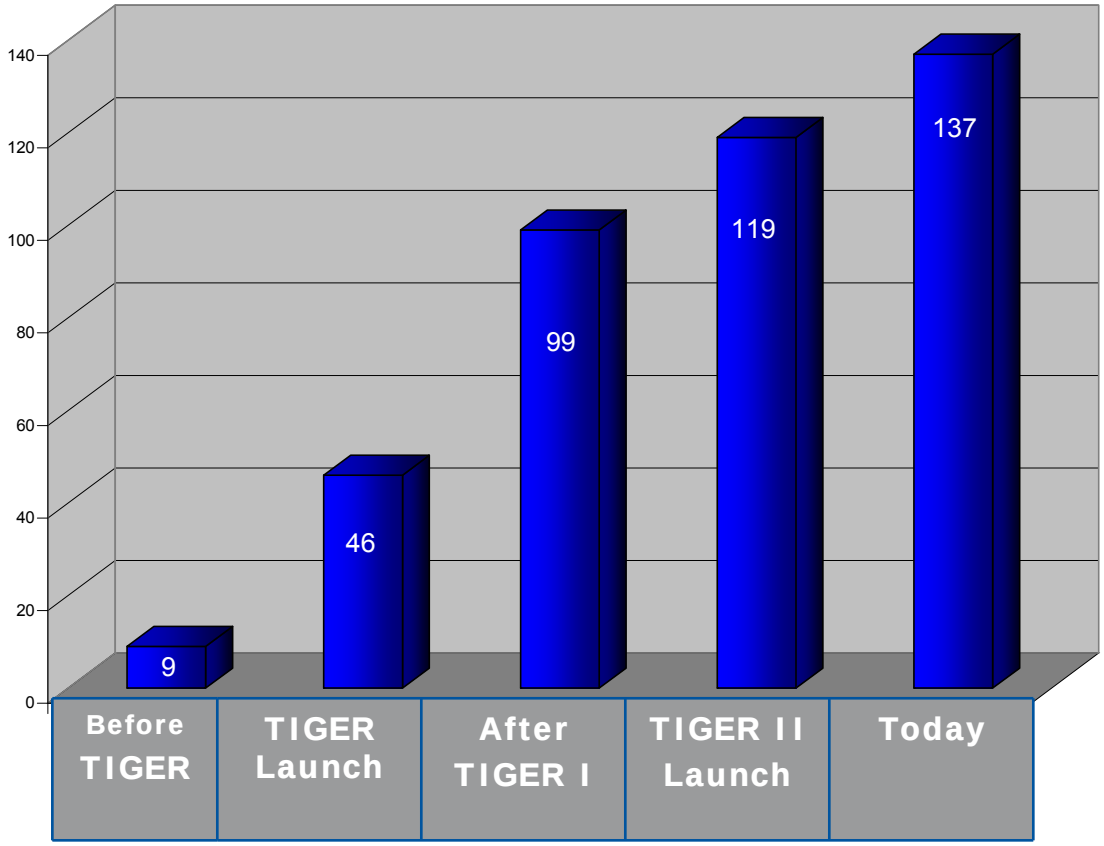
Africa - Tiger

- Developed critical mass of African scientists and technical centres using ESA EO data.

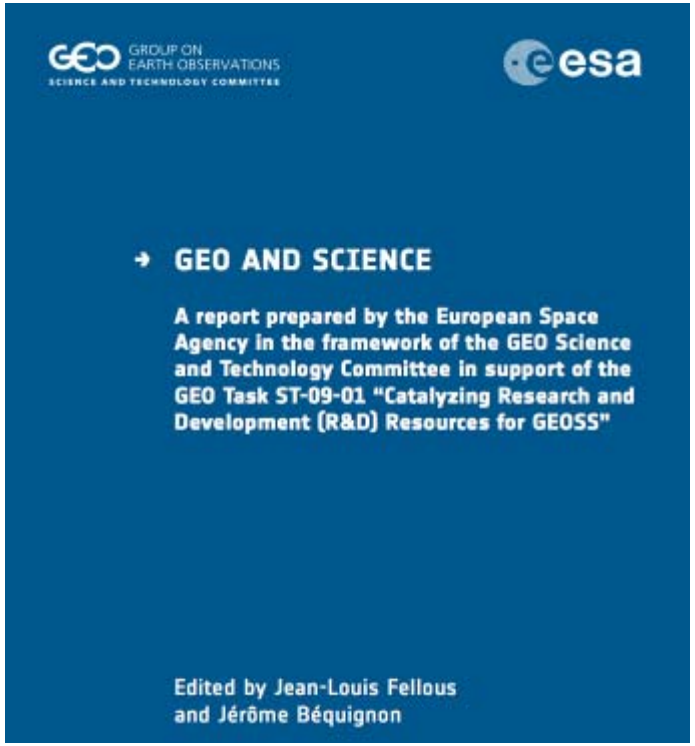
- 9 African PIs before TIGER
- 137 African PIs now.

- 20+ training sessions in Africa

- 150+ African scientists to research and advance courses in European labs

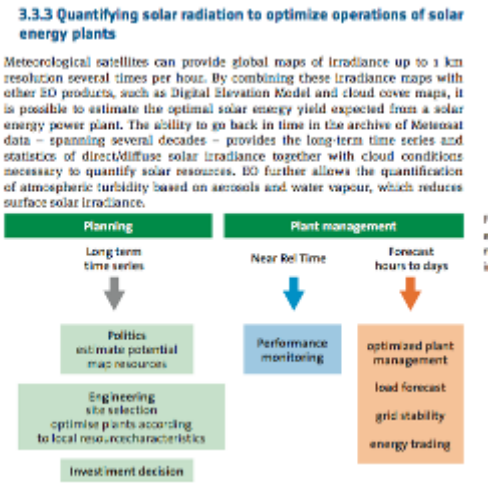


Contributing to GEO



GEO 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"

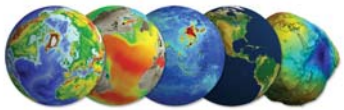


Participation in

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

Laying the basis for new Programmes

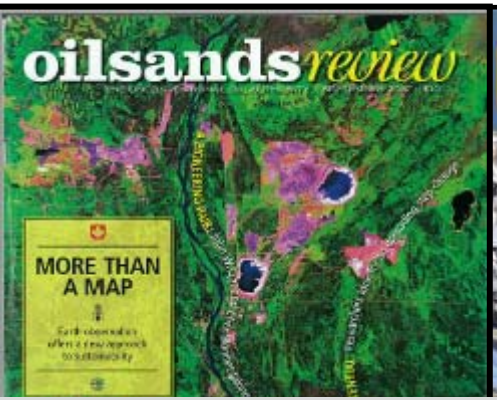
- **GMES**
  - *Italscar, SLAM, KytoINV, Human, TEMIS, Medspiration, GlobColour*
- **ESA Climate Change Initiative**
  - *GlobCarbon, GlobCover, GlobAerosol, GlobColour, GlobIce, GlobGlacier, GlobModel, GlobAlbedo, GlobVapour, GlobWave*
- **Integrated Applications Programme**
  - *SevesEO, Tiger Innovators, Epidemio*

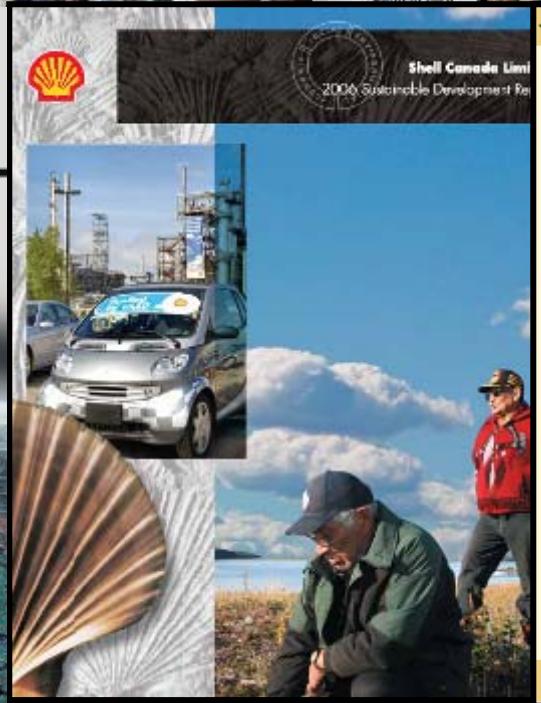


Communicating the benefits of EO

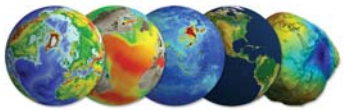
Convinced users do it best !

- **Trade journals / magazines / articles**





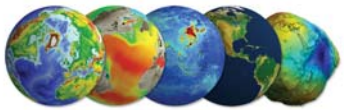
Looking to the future…



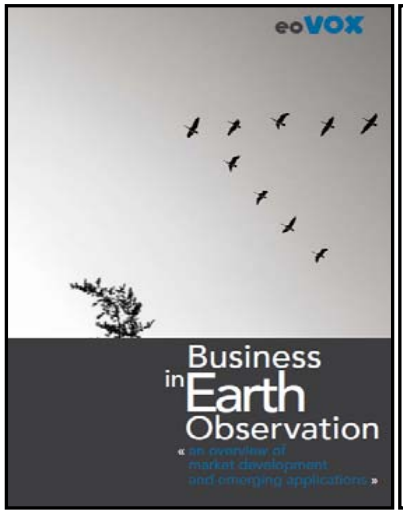
Science users : Future goals

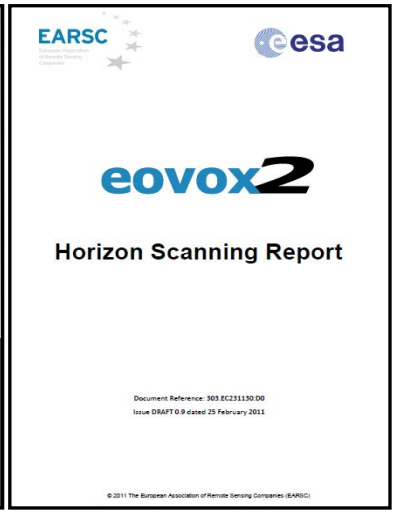
- Further progress addressing scientific challenges of the Changing Earth by exploiting ERS and ENVISAT missions
- New scientific breakthroughs with Earth Explorer missions
- Continued progress developing advanced EO methods and algorithms
- Enhanced user tools, advanced data products, NRT data assimliation
- 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

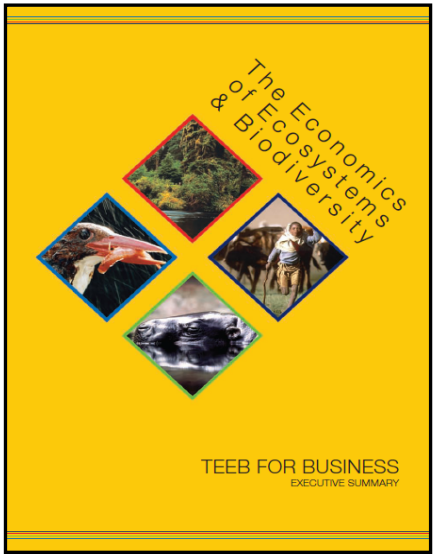


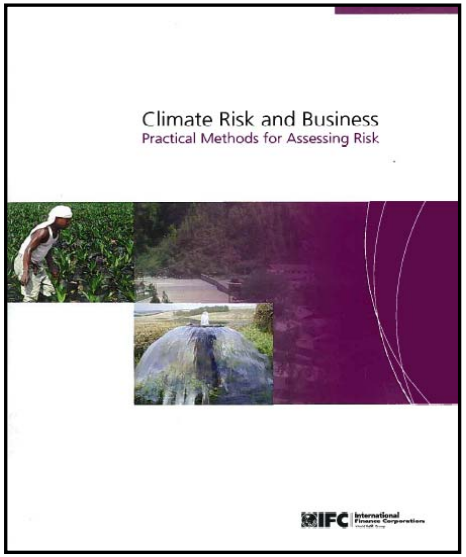


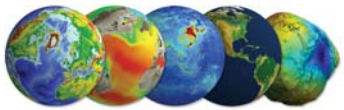
EARSC
European Association of Remote Sensing Companies

- *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