

"Symposium on HPC and Data-Intensive Applications in Earth Sciences: Challenges and Opportunities"

Trieste 13-14 November 2014
M.Cristina Pedicchio



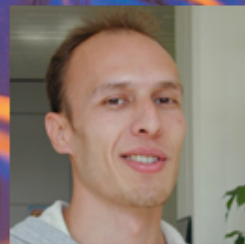
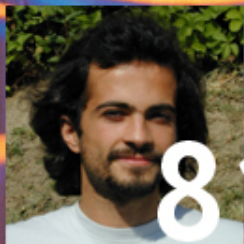
Friuli Venezia Giulia Science System

- ✓ Science and technology hub
- ✓ Large community of Italian and foreign scientists
- ✓ At the heart of the enlarged Europe

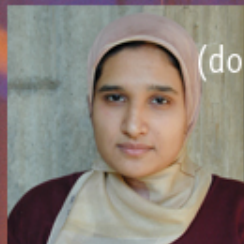
Trieste



Regional network of research



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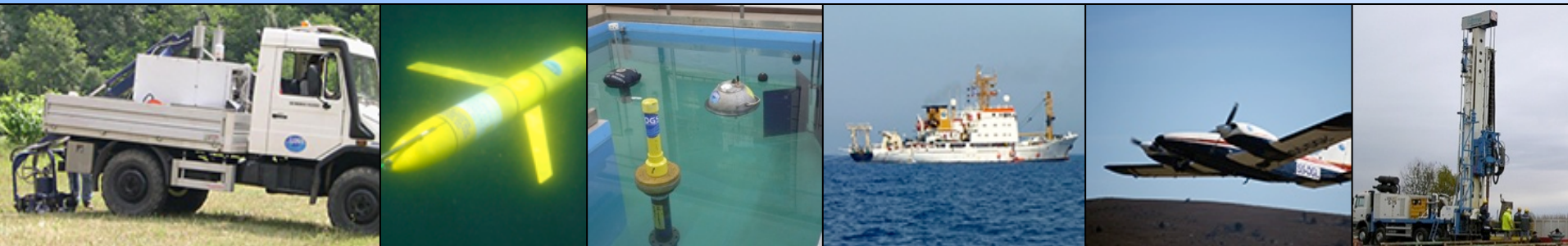


ricercatori stranieri in entrata, anno 2004
(docenti, ricercatori, post-doc, dottorandi, studenti)

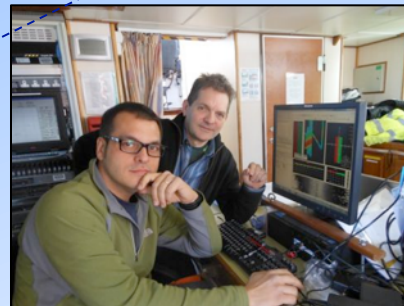


OGS is an internationally-oriented **public research institute** monitored by the Italian Ministry of Education and Research.

OGS' roots date back to the **School of Astronomy and Navigation** founded in Trieste by empress Maria Theresa of Austria in 1753.



Located in the Friuli Venezia Giulia Region in Trieste (*Borgo Grotta Gigante - Marina di Aurisina*) and Udine



OGS: four Research Sections

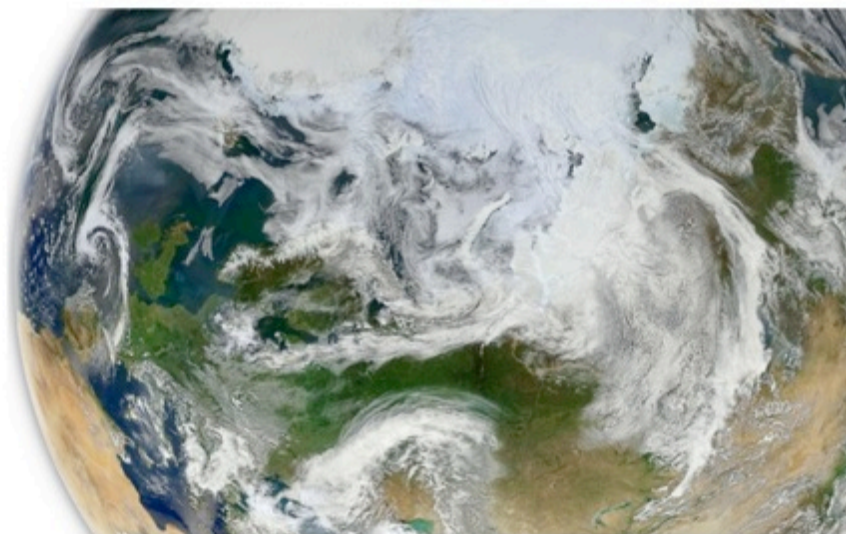
Infrastructures - Geophysics - Seismology - Oceanography



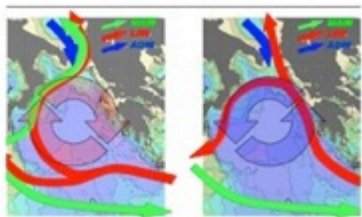
ISTITUTO NAZIONALE
DI OCEANOGRAFIA e DI GEOFISICA SPERIMENTALE

HOME | L'ENTE | LA RICERCA | PERSONE | LABORATORI | TRASFERIMENTO TECNOLOGICO | OPPORTUNITÀ

Earth Sustainability Research



Oceanografia



Oceanografia biologica, chimica, fisica ed operativa

Geofisica



Geoscienze, Geofisica di pozzo, modellazione ed inversione

Sismologia



Reti sismiche, sismogenesi, ingegneria sismica, GPS RTK

Infrastrutture



Nave da ricerca, Geofisica aerea, Geofisica a terra, gestione dati

HPC applications: Operational short term forecast of biogeochemical properties in the Mediterranean Sea

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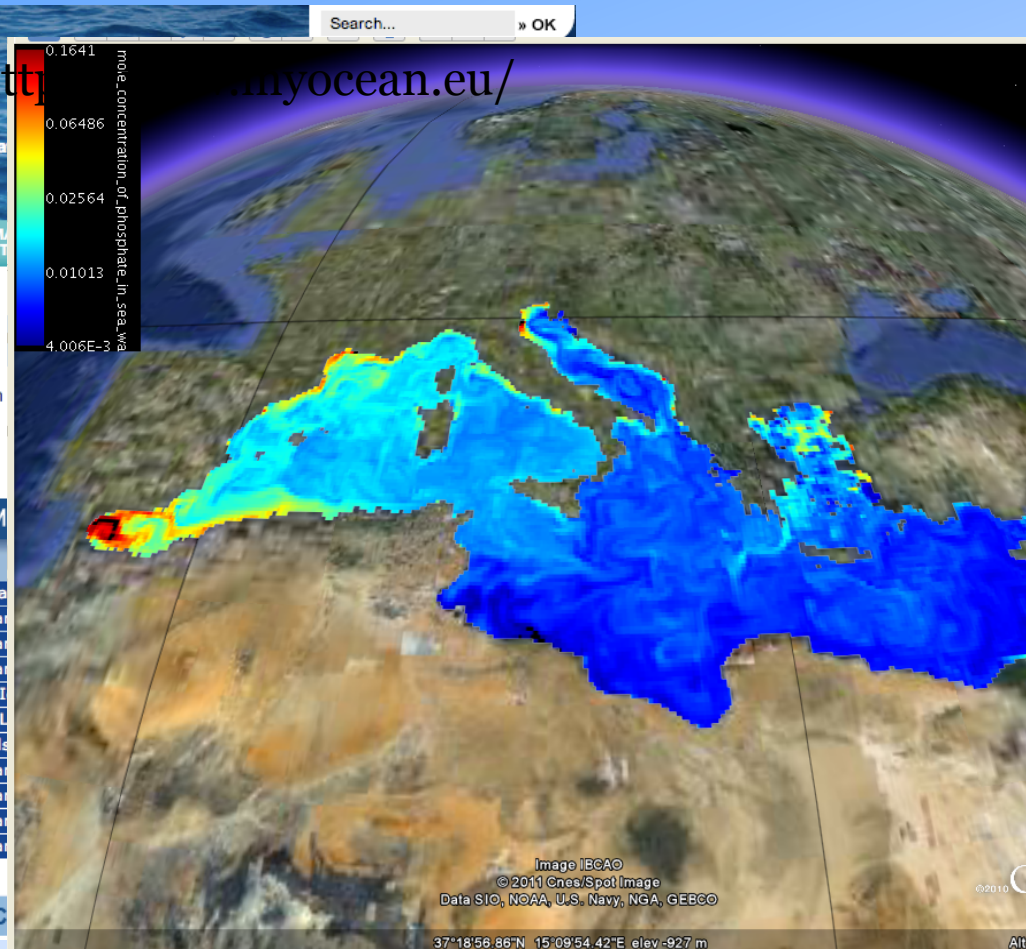
» Service commitments & licence

1 AN AREA **2 A PARAMETER**

- All areas
- Global Ocean
- Arctic Ocean
- Baltic Sea
- Atlantic-European North West Shelf-Ocean
- Atlantic-Iberian Biscay Irish-Ocean
- Mediterranean Sea
- Black Sea

» All parameters
» Ocean temperature
» Ocean salinity
» Ocean chlorophyll
» Ocean nitrate
» Ocean phosphate
» Ocean silicate
» Ocean dissolved oxygen
» Ocean dissolved silicon
» Ocean dissolved iron
» Ocean dissolved manganese
» Ocean dissolved cobalt
» Ocean dissolved nickel
» Ocean dissolved copper
» Ocean dissolved zinc
» Ocean dissolved cadmium
» Ocean dissolved lead
» Ocean dissolved molybdenum
» Ocean dissolved vanadium
» Ocean dissolved selenium
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KEYWORD SEARCH

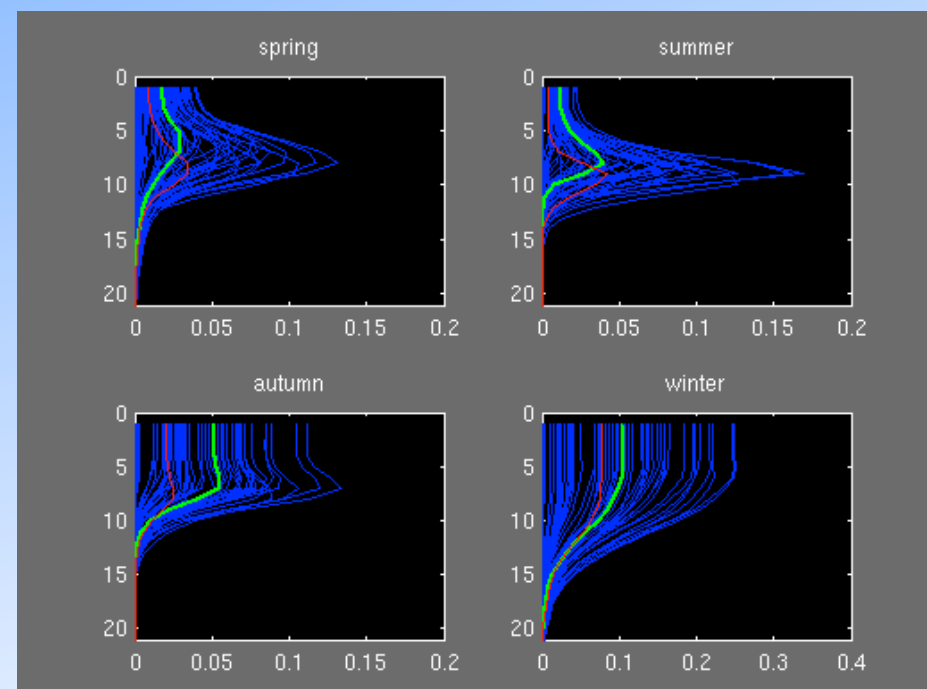
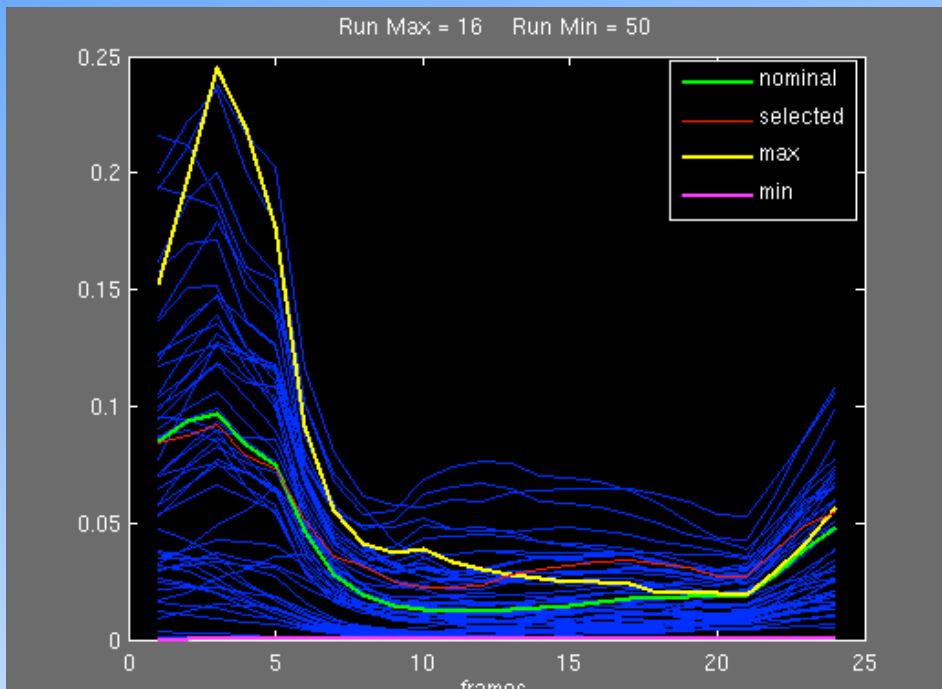
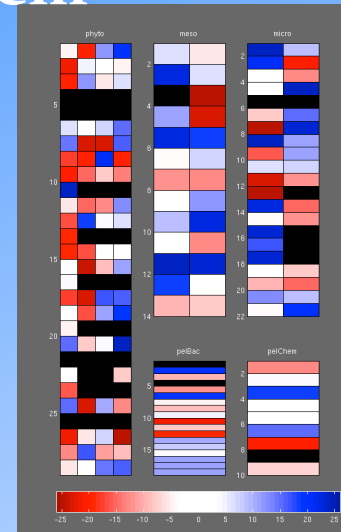


HPC applications: UNCERTAINTY/REALIBILITY of projection of Climate change on marine ecosystem



Impact of 200 parameters uncertainty on biogeochemical projections over the Mediterranean scale

3D global sensitivity analysis based on OAT Morris method



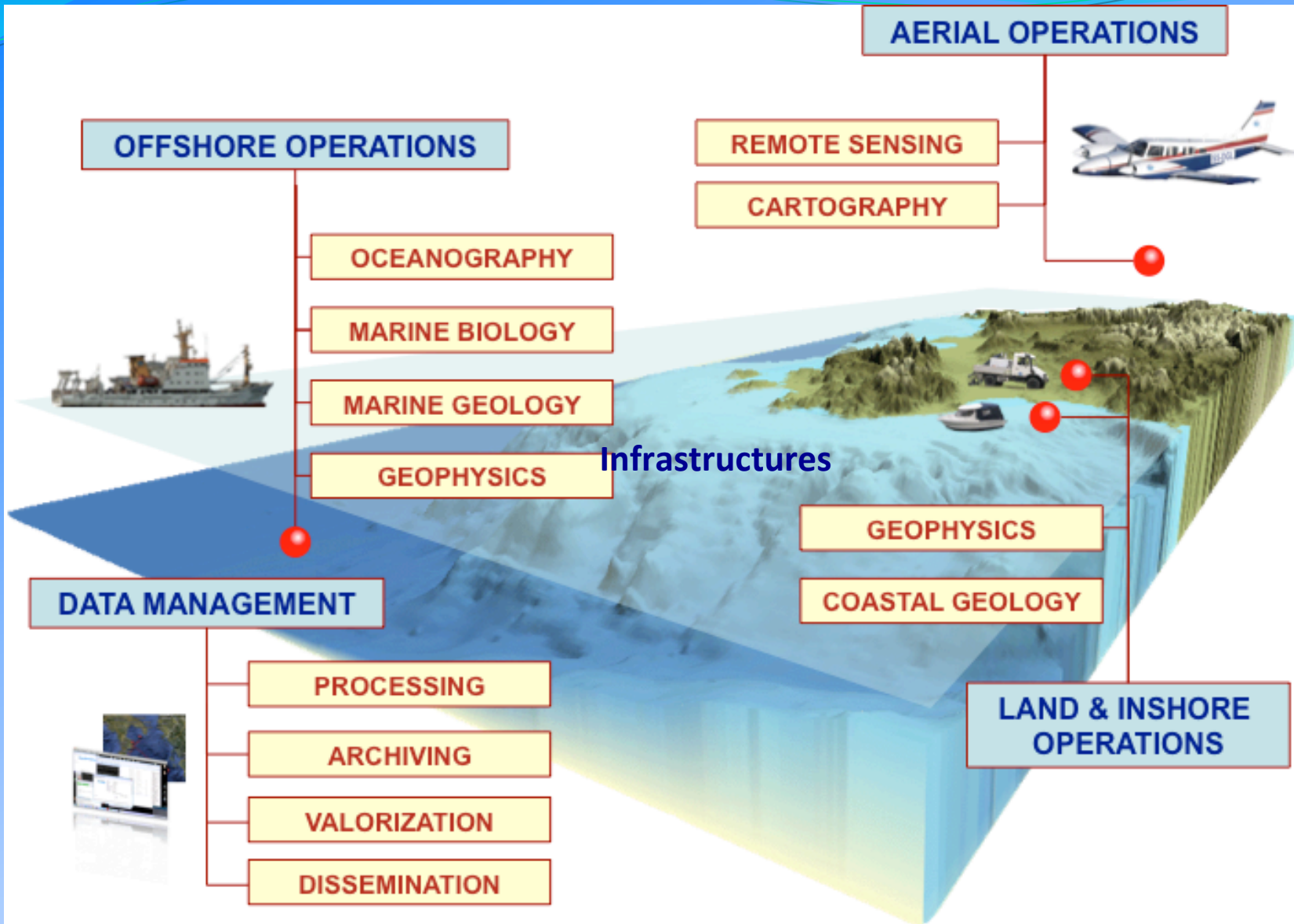
OGS policy and strategies

- ✓ Integration of research, innovation - technology transfer, education
- ✓ Multidisciplinary and multisetorial activities (public - private)
- ✓ Attention to the Social Challenges
- ✓ Strong international collaboration
- ✓ National and International Networks

OGS Priority: Research Infrastructures



Research Infrastructures



OGS-Explora



Research Vessel OGS-Explora

ESFRI Infraestructures

✓ Euroargo – Infrastructure for climate change research and operational Oceanography (floats, gliders...)



✓ Explora - Eurofleet – Alliance of European Research Fleets for marine research in Europe



✓ Eccsel – Centres of Excellence on Carbon Capture and Storage research (CCS)

✓ Prace – HPC e-infrastructure



OGS: Services for industry

Safety of large infrastructures

- Trans-Adriatic Pipeline
- Vandellos II nuclear power plant
- Seismic hazard of Italian dams
- Harbour in Cameroun
- Geological storage of fluids (methane and CO₂)

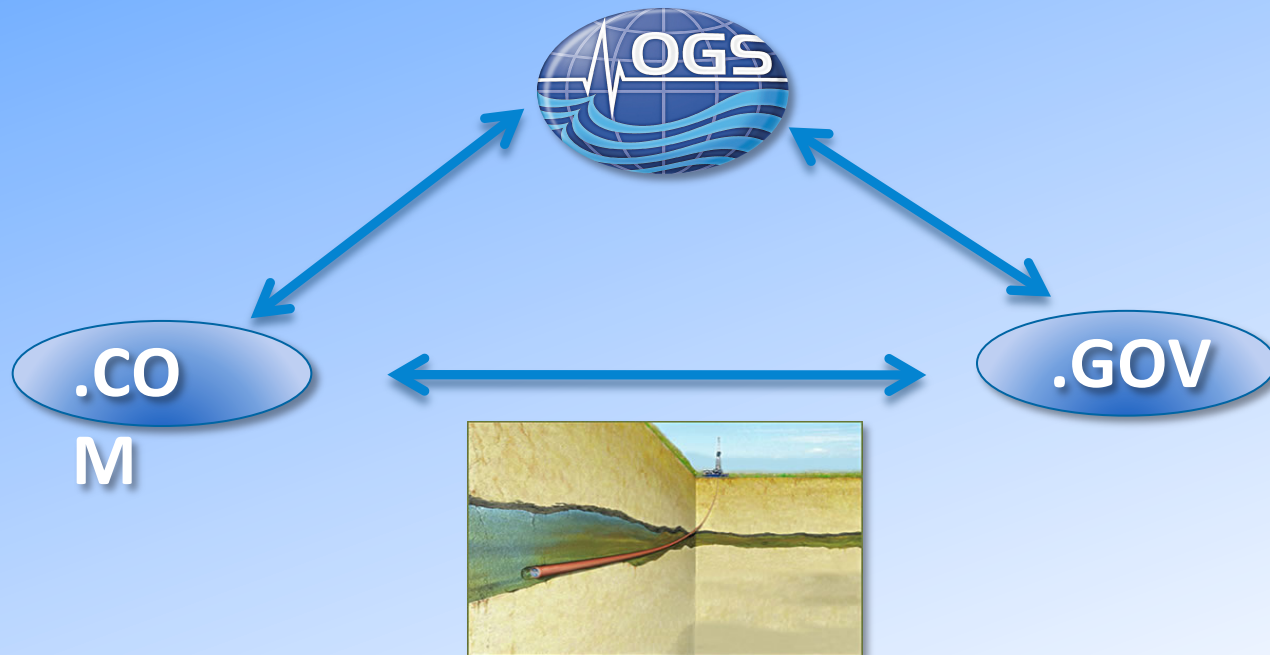


OGS: Services for civil defence and protection of the environment

- ✓ Isola del Giglio
- ✓ Earthquake Emilia
- ✓ Trieste harbour
- ✓ Polluted natural sites (Laguna di Grado-Marano, Trieste)



OGS: Knowledge transfer



OGS main priority : human resources

- ✓ 300 people working in OGS
- ✓ EC recognition of “HR excellence in Research”



OGS: Training Opportunities

- ✓ Marie Curie
- ✓ Talents
- ✓ International Doctorate School in Earth Science and Fluid mechanics
- ✓ Summer schools (Blue Economy, Energy issues, Risk Management, Marine Biology)



Earth Science and Fluid Mechanics PhD Program

PhD Program: University of Trieste - International Centre for Theoretical Physics (ICTP) - National Institute of Oceanography and Experimental Geophysics (OGS)

- ✓ It aims to the advanced training of students in the fields of earth science, fluid mechanics and applied mathematics.
- ✓ Incoming students may have different backgrounds in geology, engineering, physics and mathematics. 50% from abroad.
- ✓ Theoretical and applicative investigation are promoted and developed by the research groups of the involved institutions, also in collaboration with qualified foreign structures.

OGS: Dissemination to general public

www.sigra.it

UNIVERSITÀ
DEGLI STUDI DI TRIESTE

DEPARTIMENTO DI
SCIENZE DELLA VITA

Caffè Tommaseo
Via Tre Novembre, 5 - Trieste

Caffè delle Scienze

Caffè Tommaseo, Trieste
www.caffedellescienze.eu

dal 26 settembre
al 12 dicembre 2013

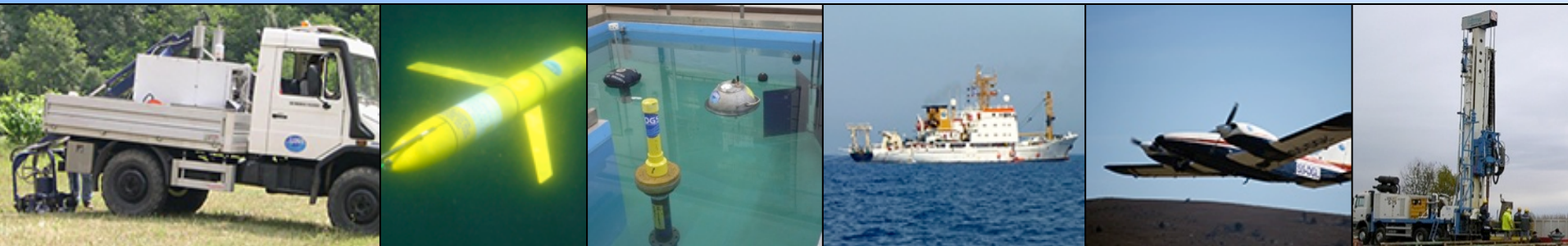
OGS Geographic priorities

- ✓ Polar Areas
- ✓ Mediterranean Sea and Adriatic Ionian Macro Region
- ✓ Balcan Area





OGS operates and develops its mission within the European Research Area



European Research Area: main documents

✓ EUROPE 2020: “2020 Vision for the European Research Area”

A strategy for **smart, sustainable and inclusive** growth

3% of GDP invested in R&D

European Commission Communication (COM 2010) 2020



✓ Innovation Union: “Europe 2020 Flagship Initiative Innovation Union”

turning ideas into jobs, green growth and social

progress

European Commission Communication COM (2010) 546



Societal challenges

- Climate change
- Health and ageing
- Use of natural resources
- Energy security
- Clean transport
- Land use
-

- **Powerful drivers of change in economy and society**
- **Major global market opportunities**
- **Requiring EU-scale approaches**
- **From research to market**

New needs → new ideas → new markets



European
Commission

DIRECTORATES-GENERAL FOR RESEARCH AND INNOVATION (RTD) AND COMMUNICATIONS NETWORKS,
CONTENT AND TECHNOLOGY (CONNECT)

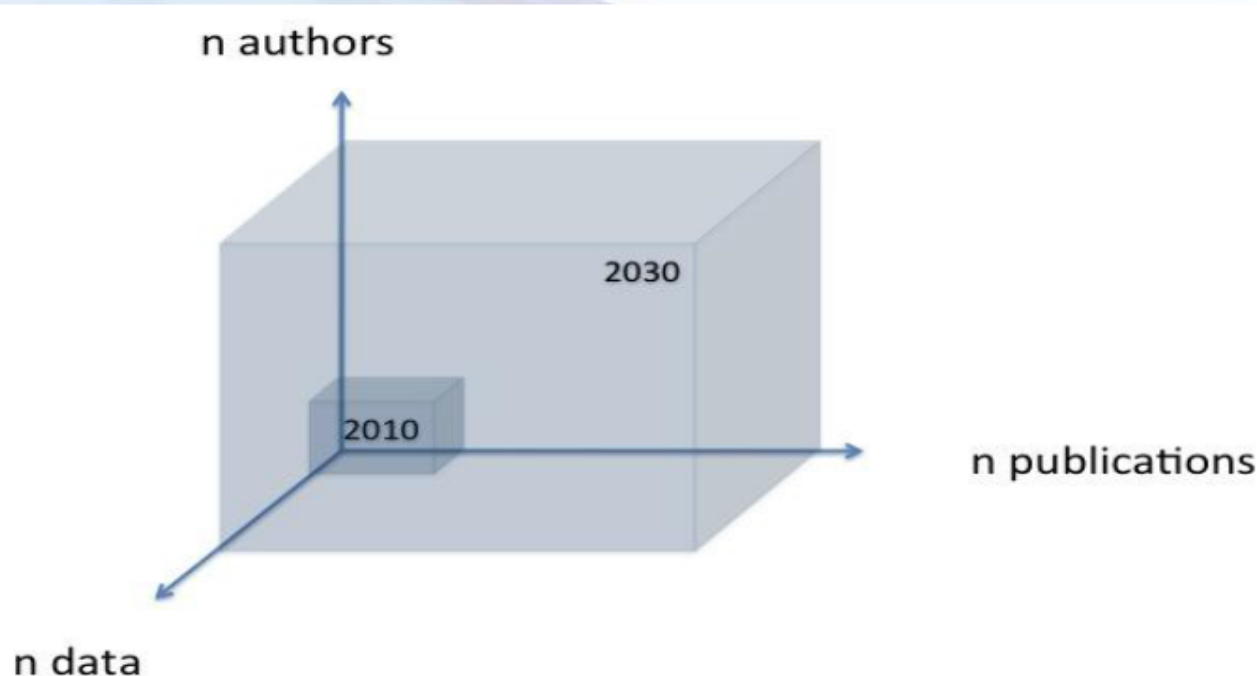
Public Consultation: 'Science 2.0': science in transition

QUESTIONNAIRE

European Commission background document public consultation 'SCIENCE 2.0': SCIENCE IN TRANSITION

1. What is going on?

Observable explosive growth of data, authors (data & intelligence producers) and publication platforms



Authorship: growing 10-fold each year vs typical 10-fold each hundred years (Pellis & Bigelow 2009)

Data: “Every 2 Days We Create As Much Information As We Did Up To 2003” (Schmidt 2008)



Science 2.0: data, people, sharing

- ✓ A new way of doing science: data-intensive science
- ✓ Explosion of knowledge and science producing actors
- ✓ Demand for faster science
- ✓ Demographics – digital natives go global
- ✓ Cheap and easy to use ICT

➔ ➔ IRREVERSIBLE TRAND

Science 2.0: data, people, sharing

- ✓ Availability of large-scale datasets (at petabyte level) processed through simulation software and enabled by high performance computing.
- ✓ Currently 52 % of scientists use datasets larger than 1 Gigabyte.
- ✓ A full 90% of all the data in the world has been generated over the last two years.
- ✓ Scientific data output increases at an annual rate of 30 percent. (Science Daily, 22 May 2013)

THE FRAMEWORK PROGRAMME FOR RESEARCH AND INNOVATION

HORIZON 2020

EXCELLENT SCIENCE

COMPETITIVE INDUSTRIES

BETTER SOCIETY

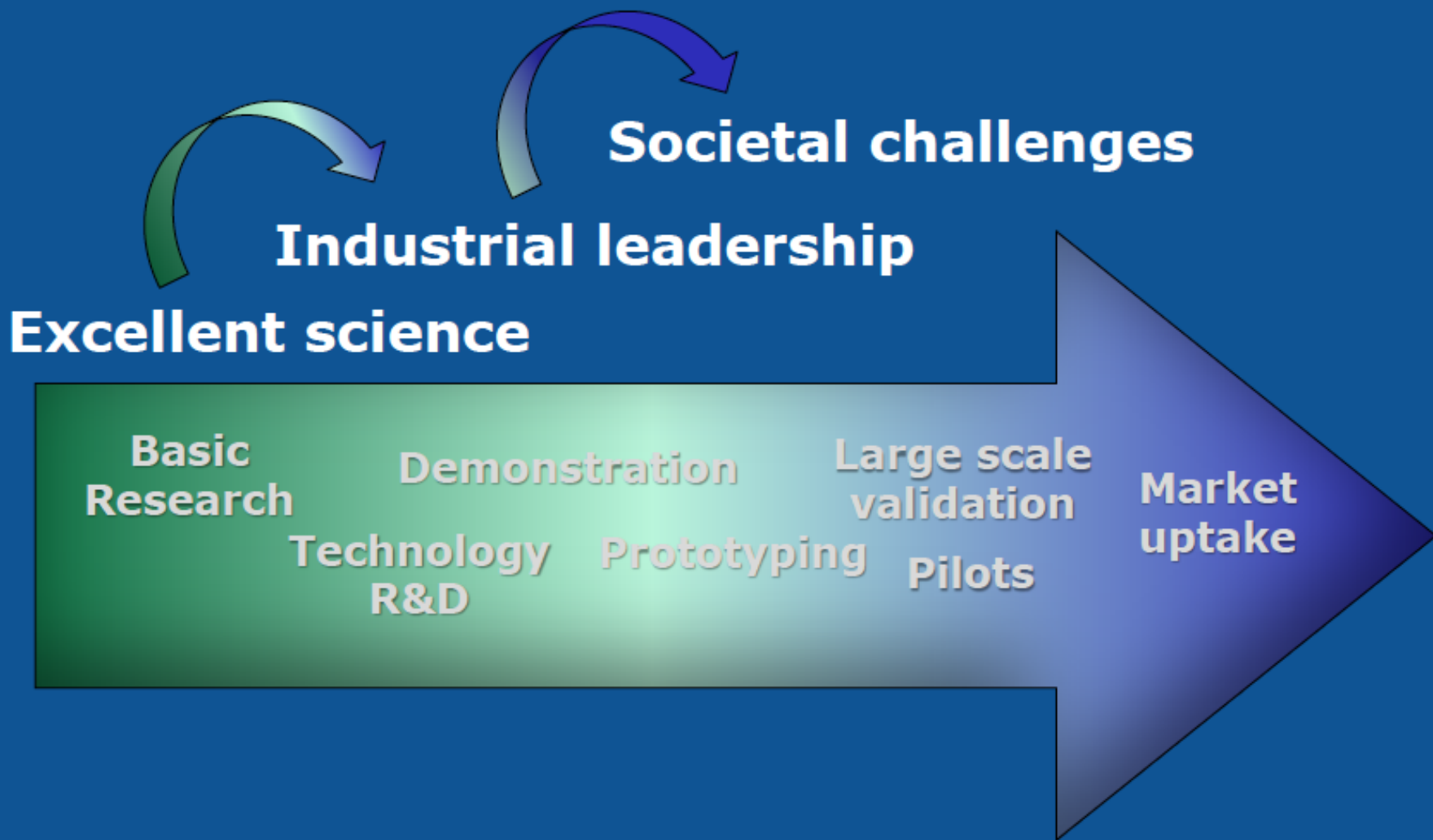


Three priorities

Excellent Science (37%) - Industrial leadership (22.5%) - Societal Challenges (38%)



Coverage of the full innovation chain



Priority 1 Excellent science

Why:

- ✓ World class science is the foundation of tomorrow's technologies, jobs and wellbeing
- ✓ Europe needs to develop, attract and retain research talent
- ✓ Researchers need access to the best infrastructures

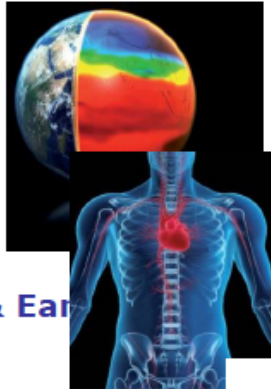
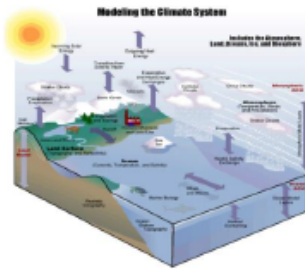
Importance of HPC

- ✓ Key for Science
- ✓ HPC Addressing Societal Challenges

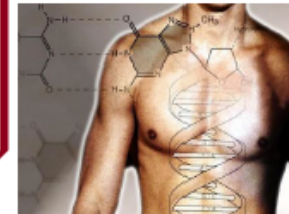
HPC: What for?



European
Commission

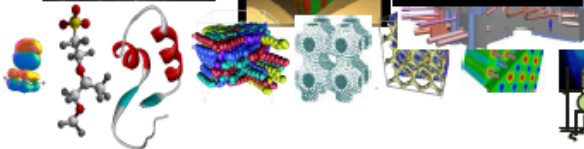
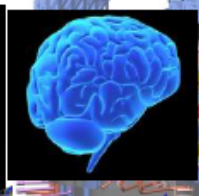
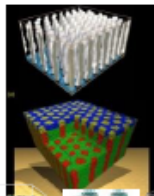


Weather, Climate & Earth

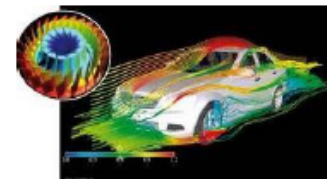
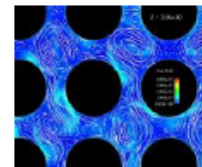


Bio/Life
Sciences

New applications
e.g. Health, Big data



Fundamental sciences: Physics,
Chemistry, Material Sciences,
Astrophysics



Industrial & Engineering



Key EU developments

HPC



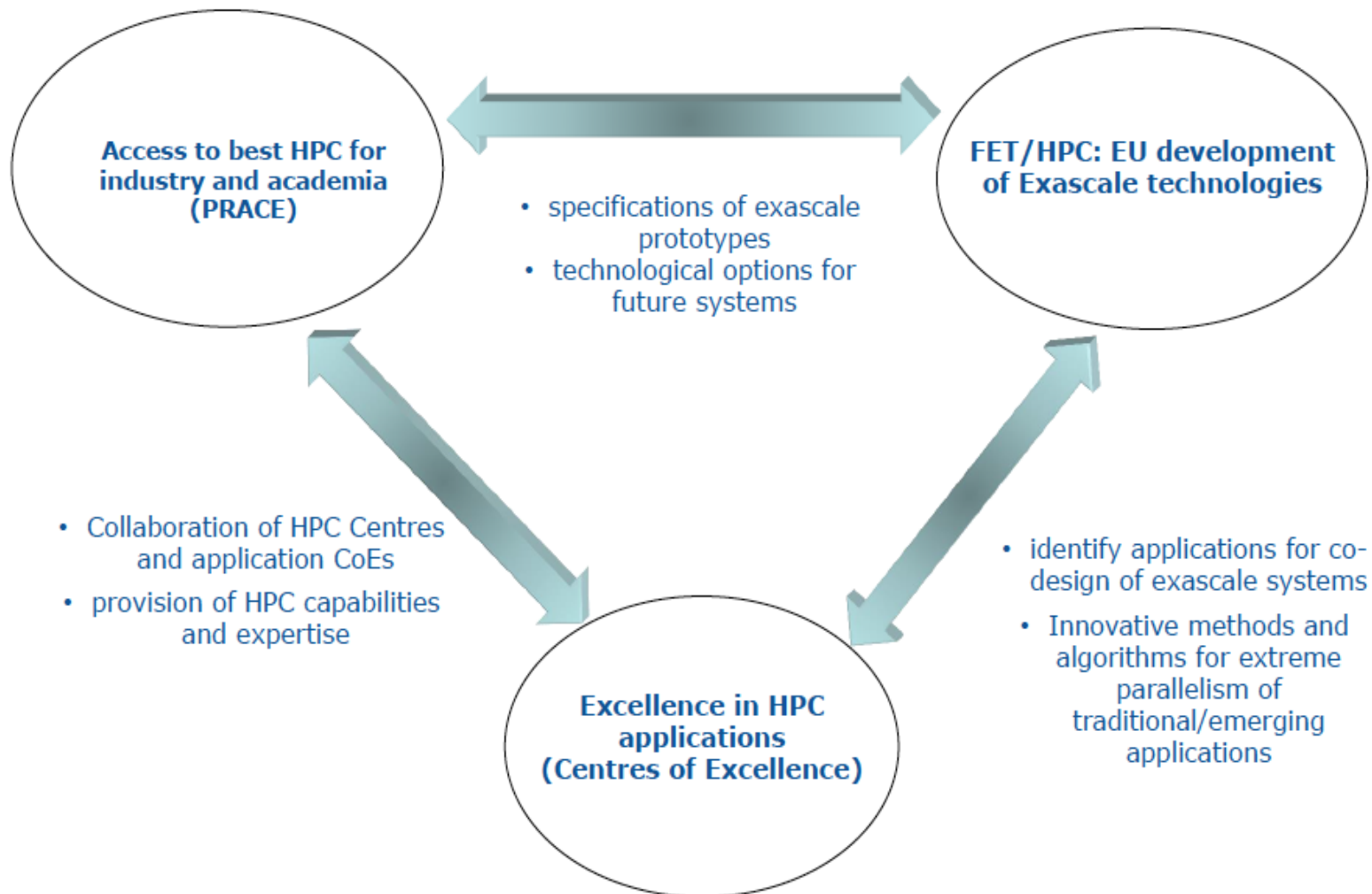
European
Commission

- *Communication from the EC: "High-Performance Computing: Europe's place in a global race" (2012) defining the main lines of the European HPC strategy*
" 15.02.2012 - The Council asked for a further development of the European High Performance Computing Infrastructure and a pooling of national investments in HPC in order to strengthen the position of European industry and academia in the **use, development** and **manufacturing** of advanced computing products, services and technologies.."
- *Council Conclusions on High-Performance Computing (Competitiveness Council – 2013)*
- *Establishment of the European Technology Platform on High-Performance Computing (ETP4HPC - 2012) and release of Strategic Research Agenda on HPC (2013)*
- *Horizon 2020 programme adopted (end of 2013)*
- *Public-Private Partnership with ETP4HPC (1st January 2014)*

Interrelation between the three elements



"Excellent Science"
part of H2020



European Technology Platform for HPC



An industry-led forum founded by stakeholders of HPC technology

Through the Strategic Research Agenda, the ETP4HPC has identified research areas and topics to reach a stronger European HPC environment that can benefit Europe and the rest of the world.

www.etp4hpc.eu



	2014 EUR million	2015 EUR million	Call Deadline
FETHPC1-2014 HPC Core Technologies, Programming Environments and Algorithms for Extreme Parallelism and Extreme Data Applications	93,4		25/11/2014 at 17:00 Brussels time
FETHPC 2 - 2014: HPC Ecosystem Development	4		25/11/2014 at 17:00 Brussels time
EINFRA-4-2014 - Pan-European HPC infrastructure and services	15		02/09/2014 - 17:00 Brussels time
EINFRA-5-2015 - Centres of Excellence (CoE) for computing applications		40 (tbc)	2015 (date tbc)
EINFRA-6-2014 - Network of HPC Competence Centres for	2		02/09/2014 - 17:00 Brussels time

All H2020 Calls and necessary documentation
are published on the Participant Portal

<http://ec.europa.eu/research/participants/portal>

HPC Call texts available
in the FET and e-infrastructures
Workprogrammes

Conclusions:

OGS supports:

- ✓ HPC Applications in Earth Science
- ✓ Trieste Network: ICTP, Sissa, OGS – same location
- ✓ Researchers mobility and training (Marie Curie, PhD Program....)
- ✓ International cooperation and joint participation in Horizon 2020 calls

Thank you for your attention



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