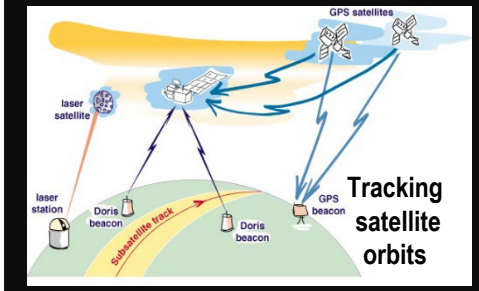
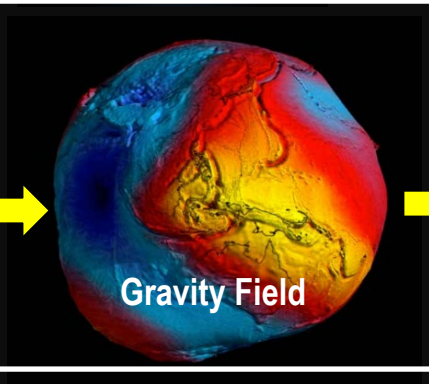
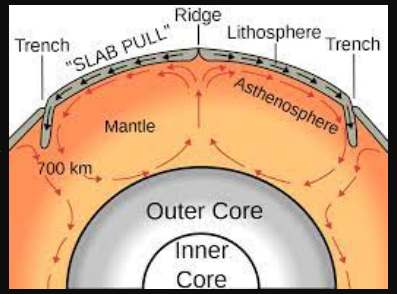
Anny Cazenave
LEGOS-CNES

My research:
The Earth and the Environment observed from space

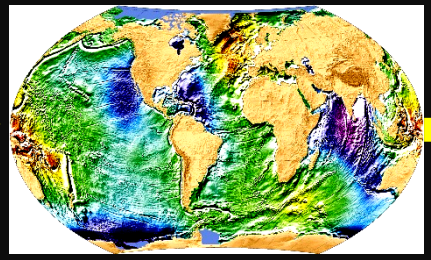




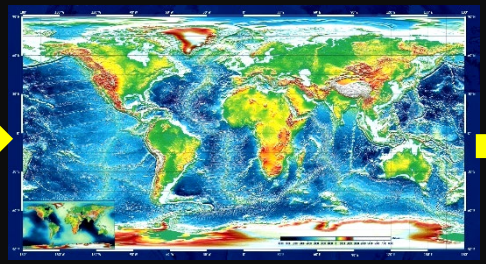


Satellite altimetry

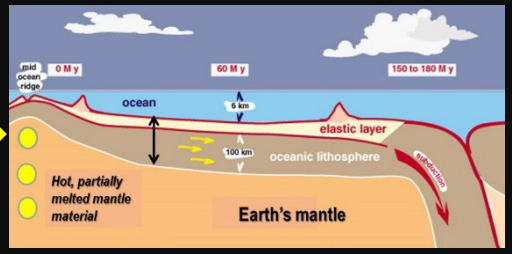
Sea surface topography



Seafloor topography

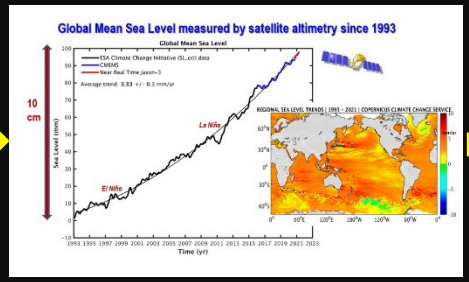


Tectonic plates structure

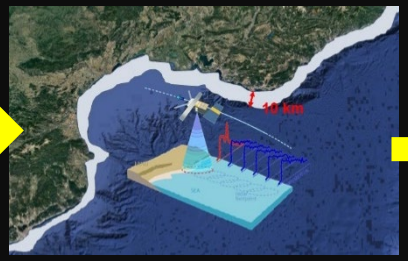


High precision satellite altimetry

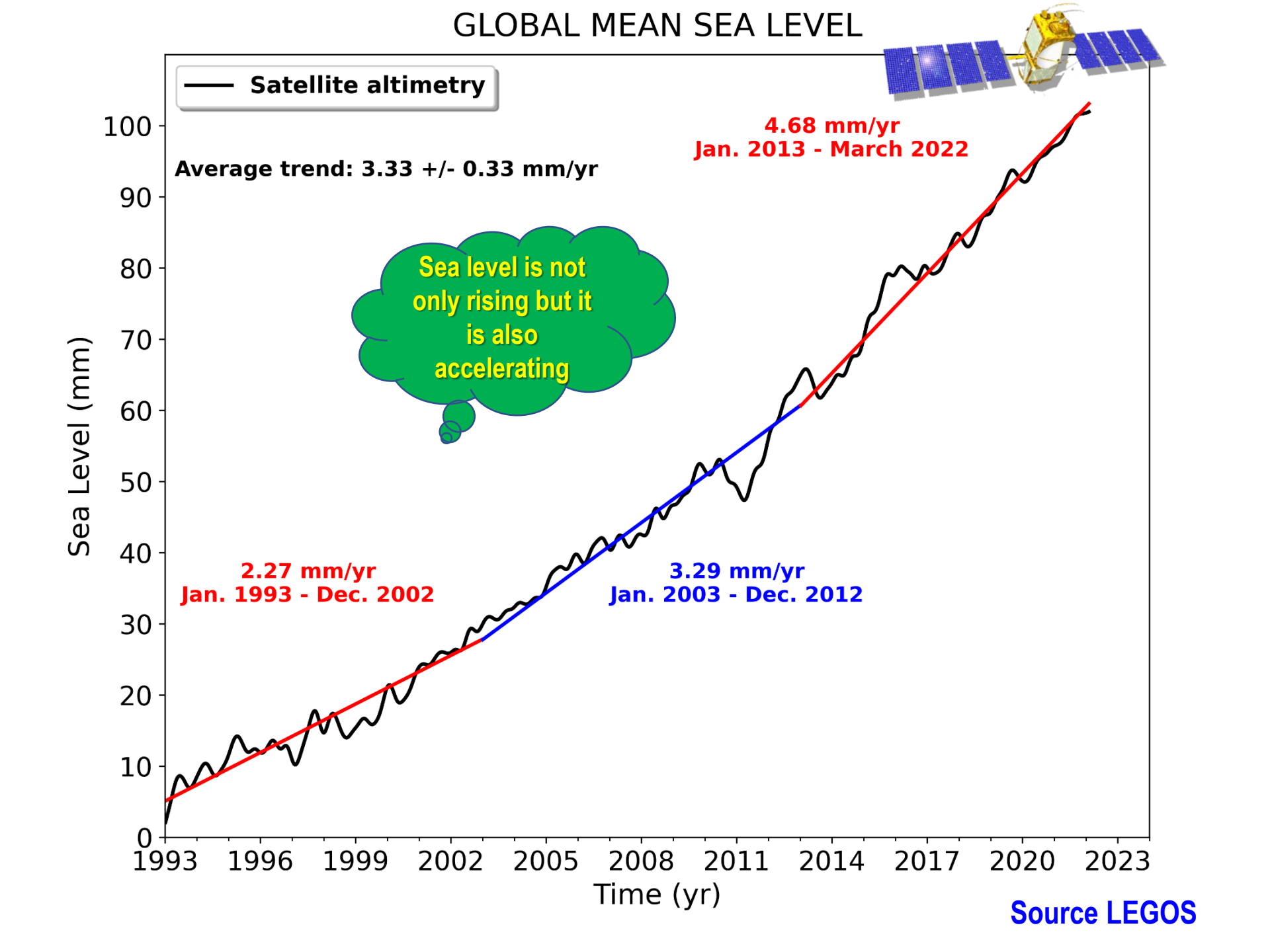
Sea level rise and climate change



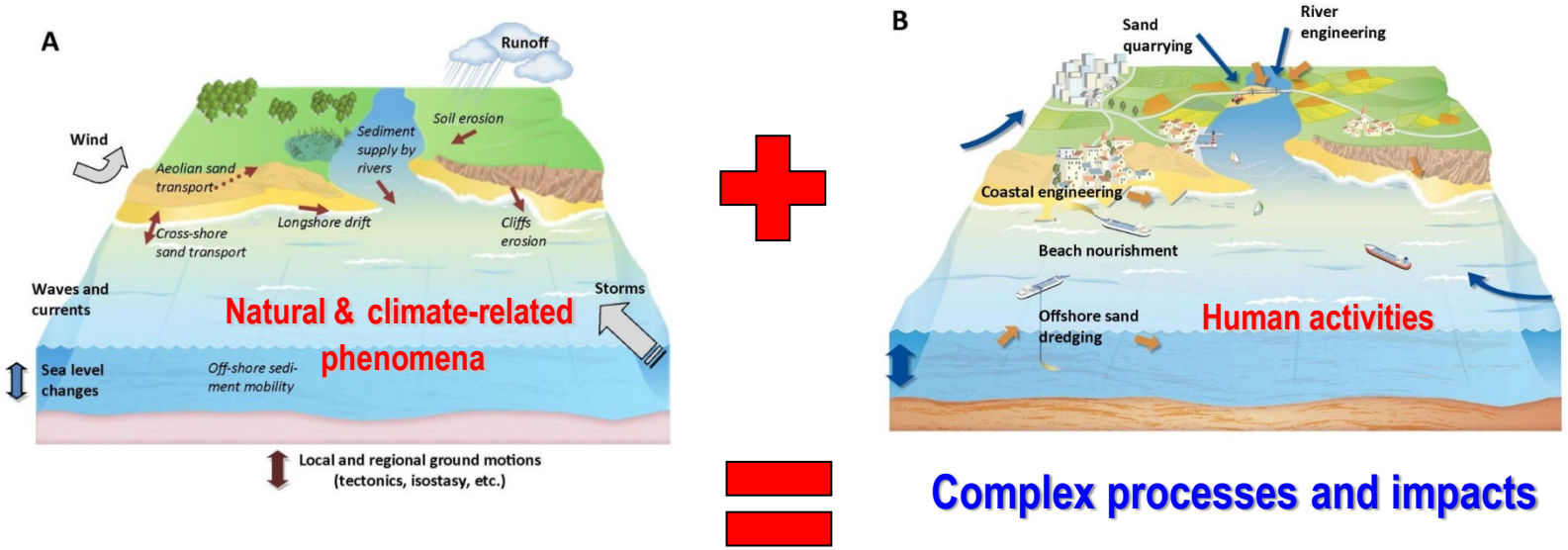
Sea level rise impacts on the world coastlines



Water cycle & water resources


GLOBAL MEAN SEA LEVEL
Satellite altimetry
Average trend: 3.33 +/- 0.33 mm/yr
4.68 mm/yr
Jan. 2013 - March 2022
Sea level is not only rising but it is also accelerating
2.27 mm/yr
Jan. 1993 - Dec. 2002
3.29 mm/yr
Jan. 2003 - Dec. 2012
Sea Level (mm)
Time (yr)
0
10
20
30
40
50
60
70
80
90
100
1993
1996
1999
2002
2005
2008
2011
2014
2017
2020
2023
Source LEGOS

World Coastal Zones



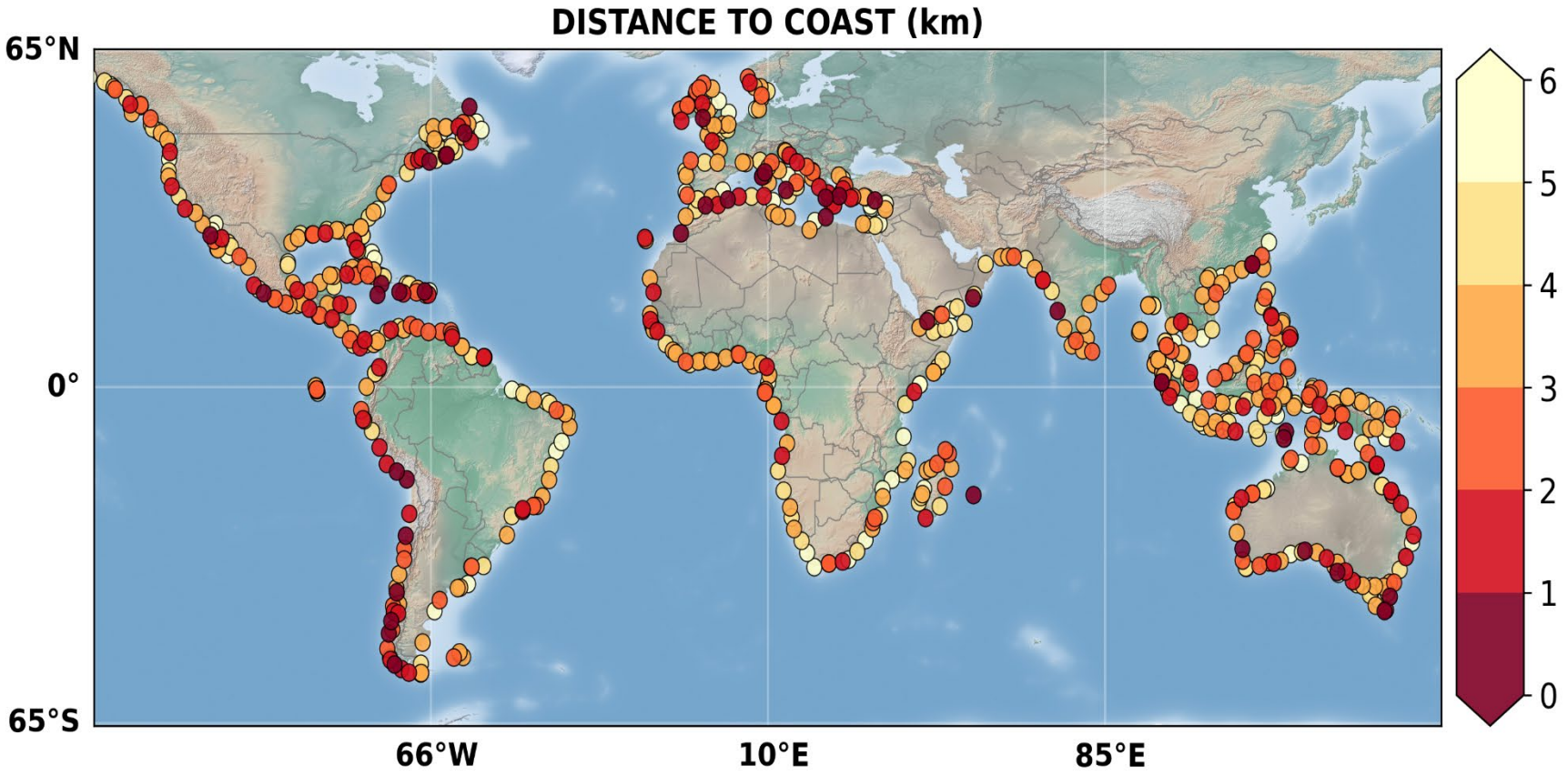
Climate & Other Drivers

- Sea level rise
- Hurricanes, Storm surges
- Extreme waves and winds
- Changes in sea state, coastal currents & eddies, nutrient supply
- River floods
- Ground subsidence
- Coastal engineering
- etc……

Coastal Impacts

- Shoreline erosion & retreat
- Temporary and permanent flooding
- Changes in sediment stores and seafloor topography
- Changes in estuaries morphology
- Changes in coastal ecosystems
- Salinization of coastal aquifers
- etc……..

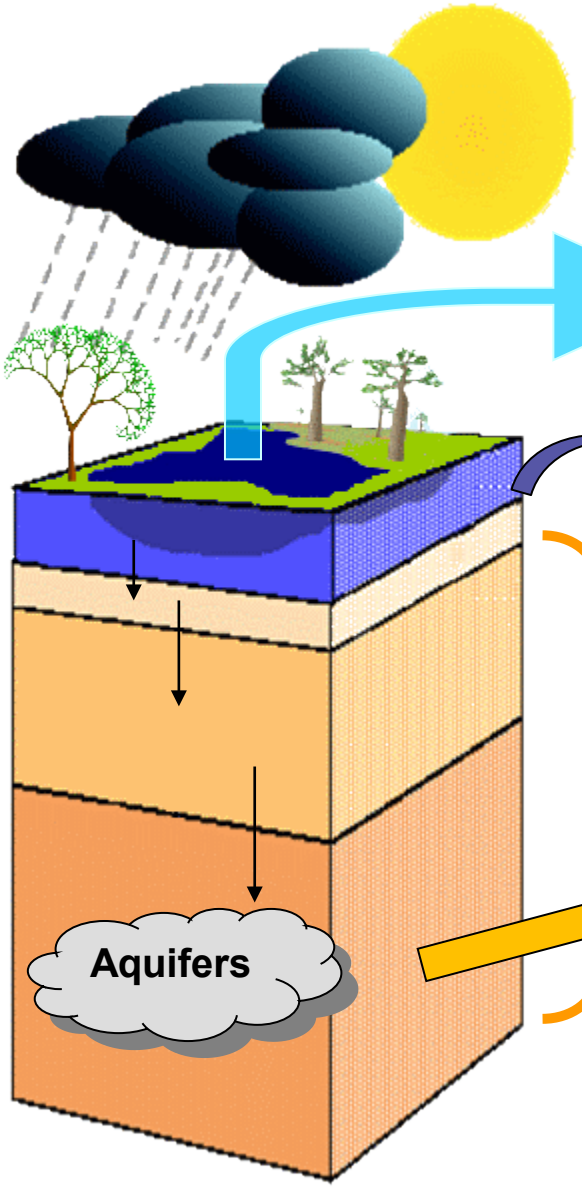
Distance (km) to the coast with valid sea level time series from satellite altimetry



ESA Climate Change Initiative Coastal Sea Level Project

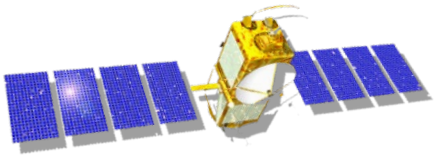
Cazenave et al., Nature Communications, May 2022

Space observations of terrestrial waters

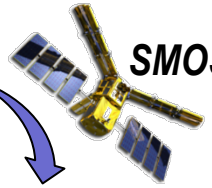


Satellite altimetry

Jason series, Envisat, Sentinel-3A/B, …

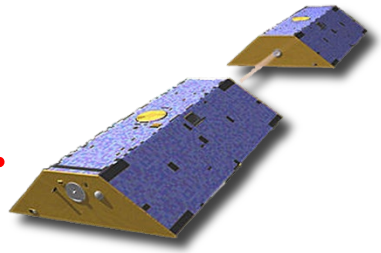


Surface waters



Soil moisture

Ground waters

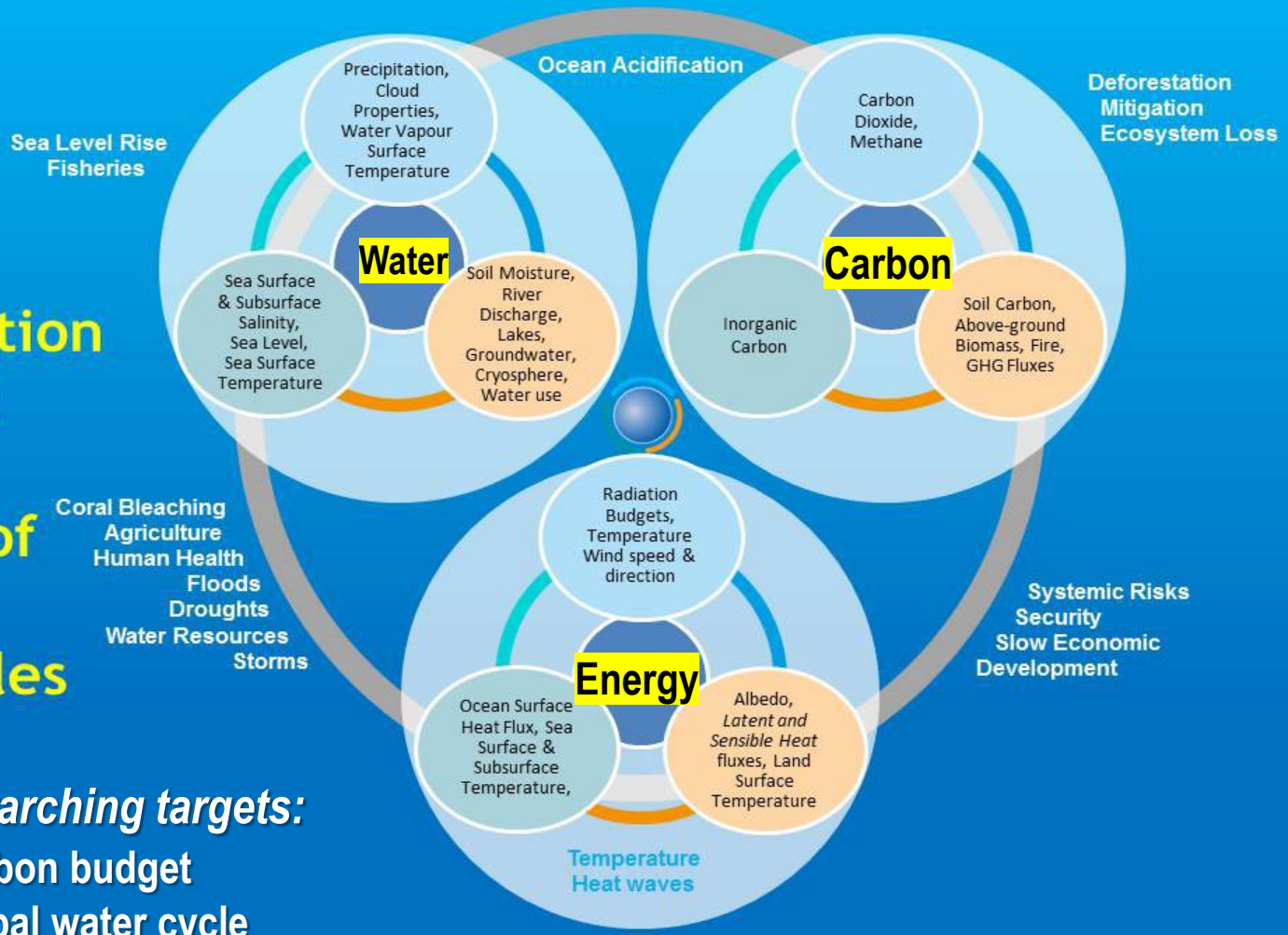


GRACE ***space gravimetry***

→ total water storage

GLOBAL CLIMATE OBSERVING SYSTEM (*GCOS*)

GCOS new Implementation Plan aims to improve monitoring of Global Climate Cycles



4 long-term, overarching targets:

(a) Closing the carbon budget

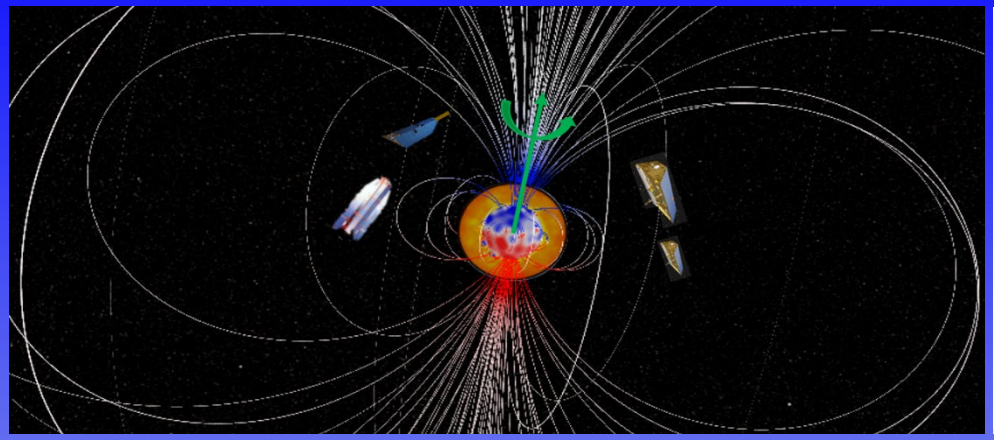
(b) Closing the global water cycle

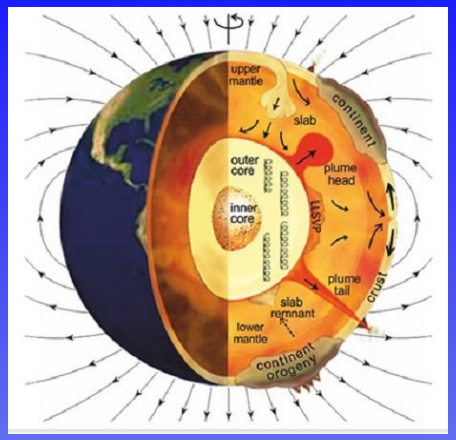
(c) Closing the global energy balance

(d) Explaining changing conditions to the biosphere

→Future ESA CLIMATESPACE Programme

ERC: European Research Council





GRACEFUL project (ERC SYNERGY)

"Probing the deep Earth's interior by synergistic use of observations of the magnetic field + gravity field and of the Earth's rotation"

3 women PIs…

Royal Observatory of Belgium

Véronique Dehant

cnes CENTRE NATIONAL D'ÉTUDES SPATIALES

Mioara Mandea

LEGOS

Anny Cazenave

The Role of Space

Space-based observations provide a global perspective which contributes to improved understanding of the Earth system

→Dynamical interactions between atmosphere, ocean, land, ice, solid-Earth and human society

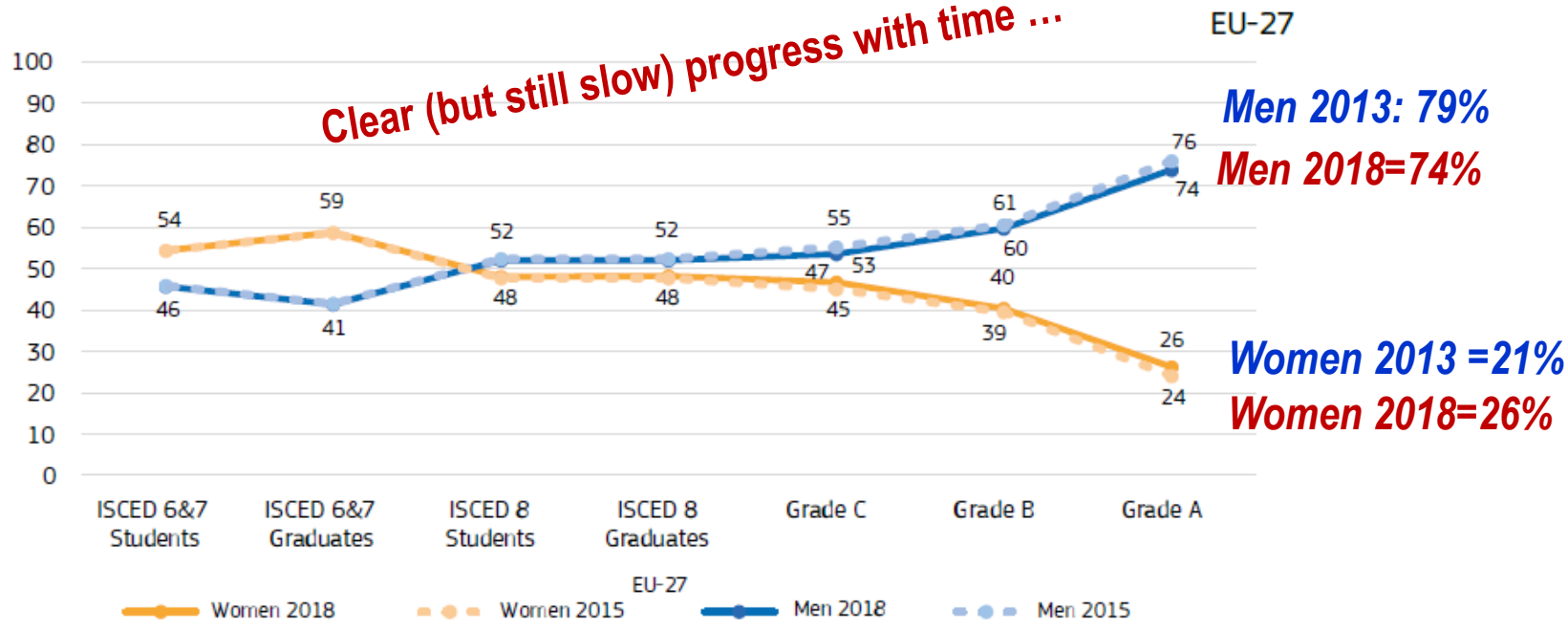
→ Societal applications

Contribution of Earth Observation from Space to the *17 Sustainable Development Goals (SDGs)*

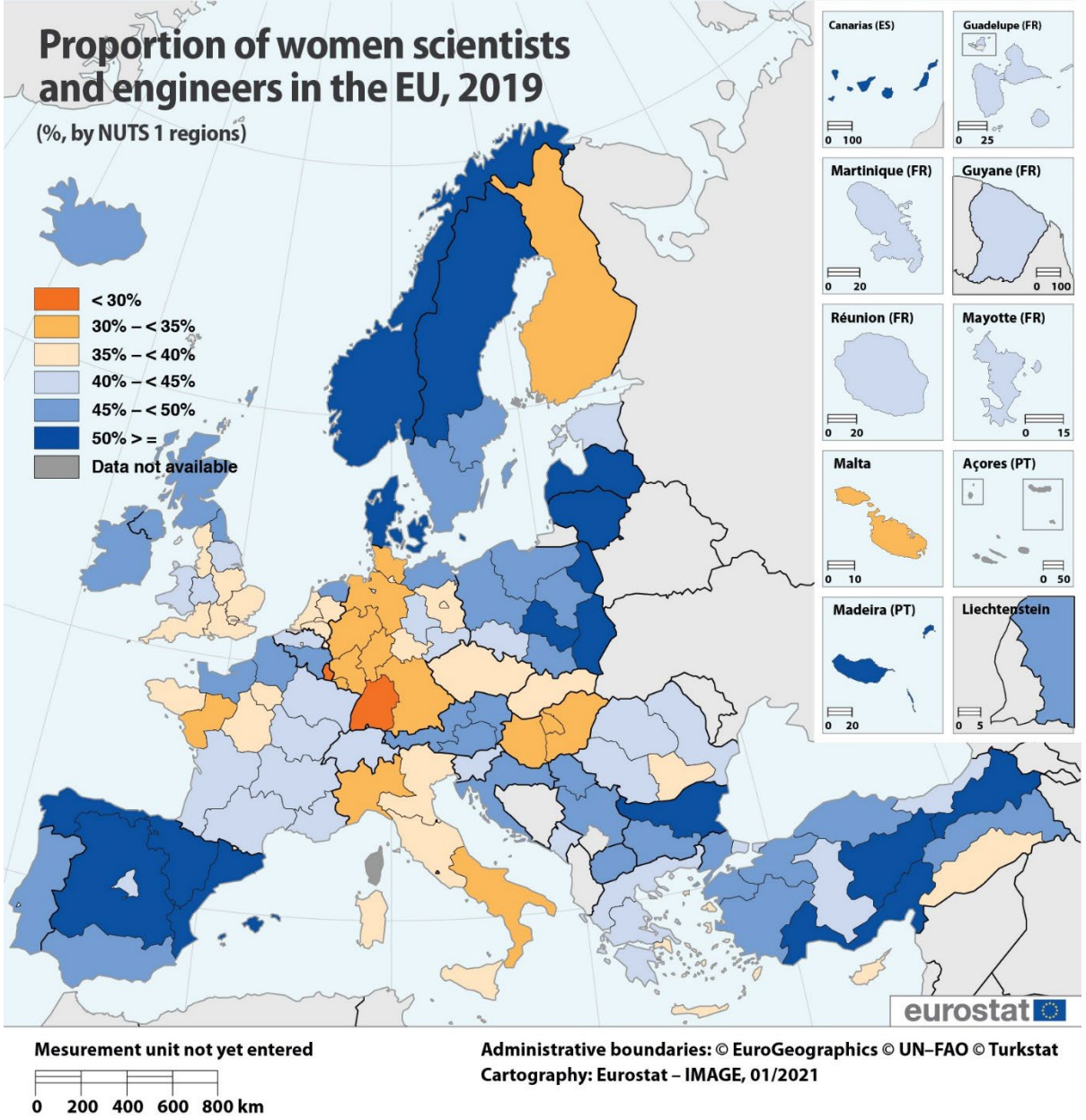

Women in STEMS
WIA
STEMS→
Science, Technology,
Engineering & Mathematics

Proportion of women and men in Science, Technology, Engineering and Maths (STEM) in a typical academic career (2015-2018)

Figure 6.1 Proportion (%) of men and women in a typical academic career, students and academic staff, EU-27 & EU-28, 2015-2018



Report of the European Commission « She Figures, 2022 »



Average
Women 41%
Men 59%


Support and mentoring


How senior (women) scientists
can help the younger generation?

- Peer-mentoring provided by and for women scientists is extremely important

- Women who occupy higher positions within academia can serve as role models for other more junior women

Educate and support women PhD students, post-docs and early career scientists, at the research lab level, conveying basic messages such as:

- work with passion
- develop curiosity
- pursuit excellence
- increase self-confidence ….

Provide financial support to young women scientists for participation to international meetings & conferences :

→ important for gaining scientific visibility and developing their personal research networking

→ social relationship important in research!

Fight against "push" factors leading women scientists to leave research between PhD and faculty position, because of:

- Family pressure,
- Lack of mentorship and encouragement
- Lack of structural support for child care
- Lack of mobility due to partner's position
- …….

Importance of mentoring

- Same-gender mentoring more effective
- Encouragement and supportive climate very important
- Help junior scientists to apply for grants
- Explain there is no need to choose between science and family → can do both!
- Help accommodation for family


How to increase the opportunitities for
women to grow into leadership positions?

Examples of initiatives

- Nominate women colleagues to Prizes and Awards, and other types of Honors
- When possible, propose women names for national and international committee membership
- ……

Accept scientific competition in fields mainly dominated by men.

3. Do not practice self-censorship (e.g., candidate in due course to high-level positions).

4. Participate as much as possible to international meetings/conferences.

⇨ A way of gaining outside scientific visibility.

Fight against conditioning and stereotypes about the social role of women in STEMS

→ **Education**

- Learn science by doing science, even at very young age → helps making science concepts accessible to everybody all along the life
- Develop science education for children at school (elementary and junior high-school) (e.g., programme « La main à la Pâte », initiated in 1995 by Nobel Prize Georges Charpak, Pierre Lena and Yves Queré (French Academy of Sciences)→ how to learn about science & technology through experimentation; Today, similar initiatives in several countries, in particular in the EU
- Women (and men) scientists → participate in/organize scientists-schoolchildren meetings to exchange about science questions
- ….

To conclude…
A few recommendations to young women scientists

Involve yourself in decision-making roles at every level in the research institution

→ helps women to be involved in key committees that set scientific policy, in panels that give grants and recruit candidates, etc.

→ very important to ensure gender balance (men are still over represented in such committees)

→ criteria in selecting proposals, candidates, etc., are influenced by male patterns of working…

To conclude…
A few recommendations to young women scientists

Keep a good balance between personal life and work;

Some scientific work can be done at home…

The old saying ***«the more you have to do, the more organized you get»*** definitely applies to women scientists!

The most promising way of increasing the number of women at top levels in research is through education and mentality evolution.


Thanks for your attention