OCEANGLIDERS FROM "EMERGING" TO "MATURE" GOOS NETWORK !

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Outline

GLIDERS? A LONG STORY SHORT

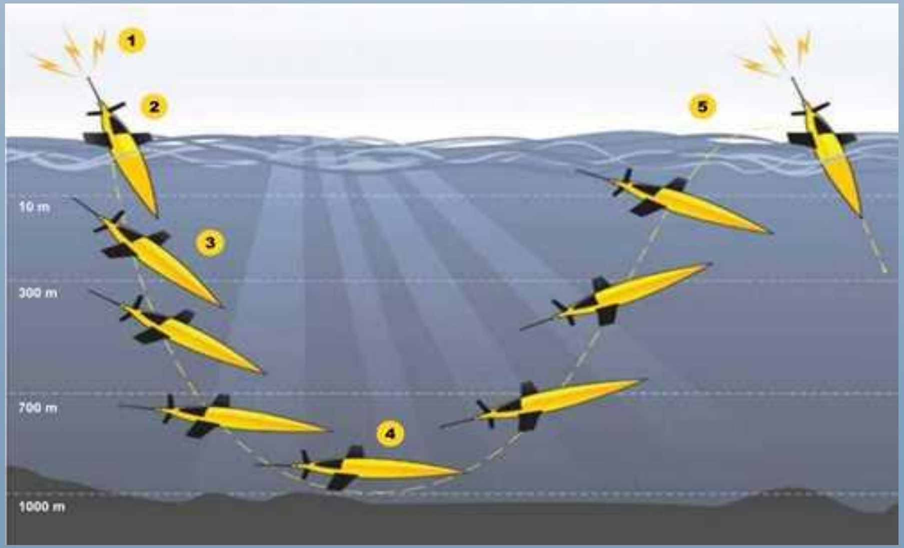
OCEANGLIDERS – THE INTERNATIONAL COORDINATION FOR A GLOBAL NETWORK OF GLIDERS

OCEANGLIDERS – FROM AN EMERGING TO A MATURE NETWORK

Gliders ? A long story short…

The different glider models. From top left to bottom right: Spray, Slocum, SeaExplorer, SeaGlider

- Autonomous Underwater Vehicles,
- Long range (more than 3 month at sea),
- Manually deployed and recovered from small boats
- Remotely piloted
- 1000m depth standard
- Standard payload: T, S, O2, Chla, CDOM, BBP, Depth average current,
- Extra payload: Nitrate, Turbulence, Hydrocarbone, PH, CO² (primilinary results), ADCP, UVP6, Acitve and passive acoustics…
- Perfectly suited to sample on the oceanic shelf



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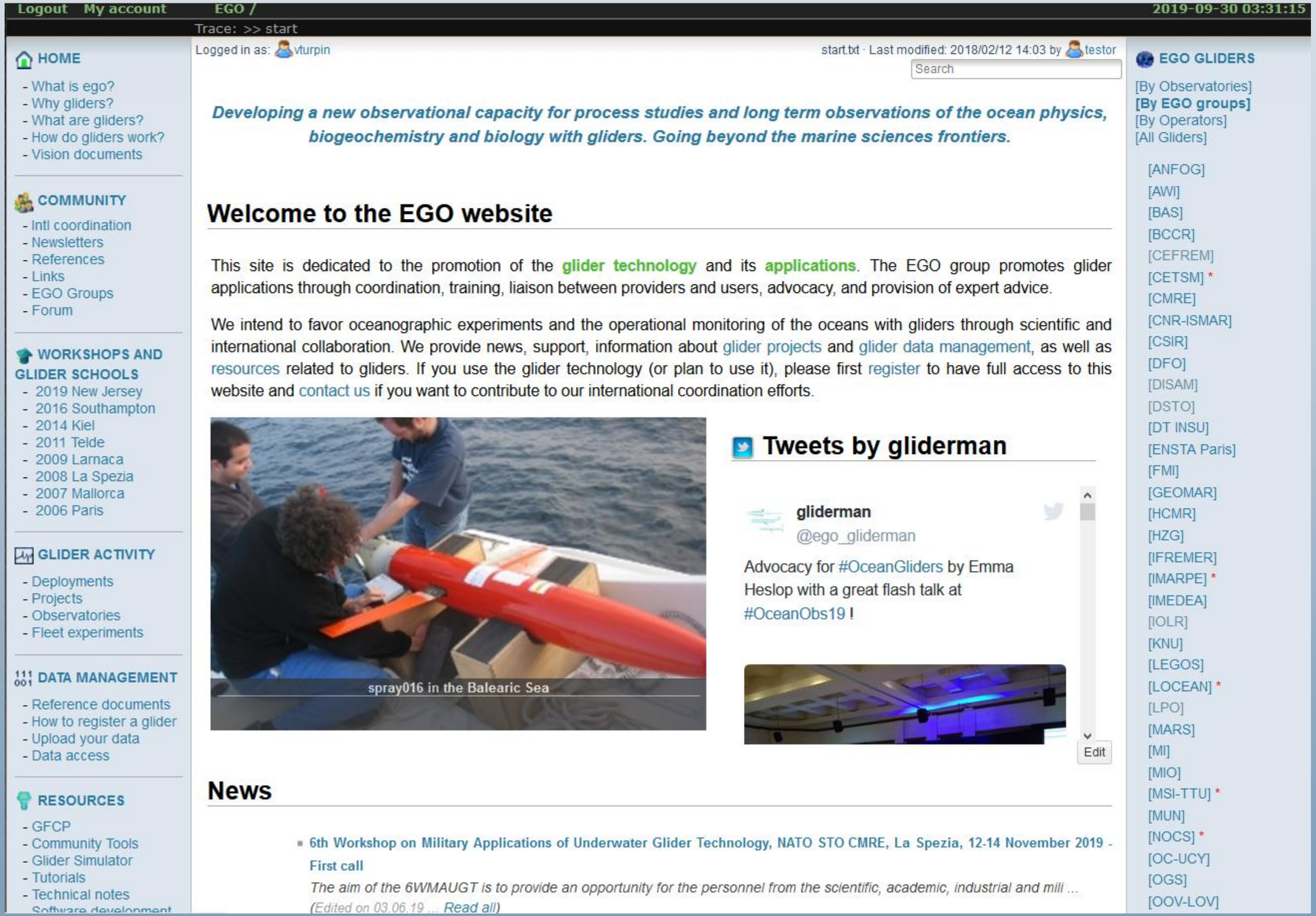
OceanGliders – the international coordination for a GLOBAL network of gliders

From a glider community …

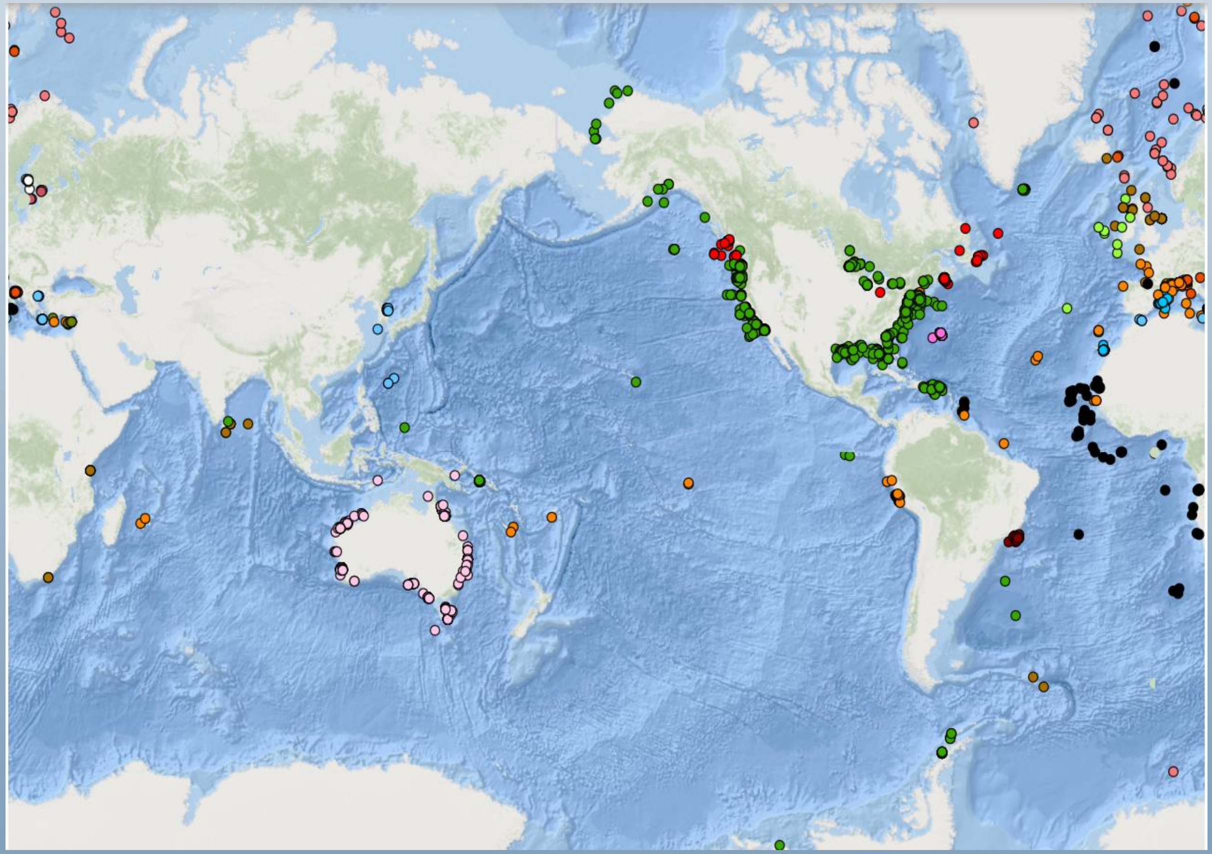
EGO – Everyone's Gliding Observatories



www.ego-network.org

OCEANGLIDERS – THE INTERNATIONAL COORDINATION FOR A GLOBAL NETWORK OF GLIDERS

… to an international program of the GOOS



OceanGliders

a component of the integrated GOOS

Testor P.[1], **B. de Young**[2], D. Rudnick[3], S. Glenn[4], D. Hayes[5], C. M. Lee[6], C. Pattiaratchi[7], K. Hill[8], E. Heslop[9], V. Turpin[1], P. Alenius[10], C. Barrera[11], J. Barth[12], N. Beaird[4], G. Bécu[13], A. Bosse[14], F. Bourrin[15], A. Brearley [16], Y. Chao[17], S. Chen[18], J. Chiggiato[19], L. Coppola[20], R. Crout[21], J. Cummings[22], B. Curry[6], R. Curry[23], R. Davis[24], K. Desai[25], S. DiMarco[26], C. Edwards[27], S. Fielding[16], I. Fer[14], E. Frajka-Williams[28], H. Gildor[29], G. Goni[30], D. Gutierrez[31], P. Haugan[14], D. Hebert[32], J. Heiderich[33], S. Henson[28], K. Heywood[34], P. Hogan[35], L. Houpert[28, 36], S. Huh[37], M. E. Inall[36], M. Ishii[38], S. Ito[39], S. Itoh[39], S. Jan[40], J. Kaiser[34], J. Karstensen[41], B. Kirkpatrick[42], J. Klymak[43], J. Kohut[4], G. Krahmann[41], M. Krug[44], S. McClatchie[45], F. Marin[46], E. Mauri[47], A. Mehra[48], M. P. Meredith[16], T. Meunier [49], T. Miles[4], J. Morrel[50], L. Mortier[51], S. Nicholson[44], J. O'Callaghan[52], D. O'Conchubhair [53], P. Oke[544], E. Pallas Sanz[49], M. Palmer[28], J. Park[55], L. Perivoliotis[56], P.-M. Poulain[57], R. Perry[58], B. Queste[34], L. Rainville[6], E. Rehm[13], M. Roughan[59], N. Rome[25], T. Ross[32], S. Ruiz[60], G. Saba[4], A. Schaeffer[59], M. Schönau [61], K. Schroeder[19], Y. Shimizu[62], B. Sloyan[54], D. Smeed[28], D. Snowden[63], Y. Song[55], S. Swart[64, 65], M. Tenreiro [49], A. Thompson[66], J. Tintore[67], R. Todd[68], C. Toro[69], H. Venables[16], T. Wagawa[62], S. Waterman[70], R. Watlington [71], D Wilson[71]

(*Community White Paper, Frontiers Marine Sciences, OceanObs'19*)

OceanGliders Strategy and organization

- recommend the development of a global operational program to undertake **key ocean observing challenges addressing societal needs**.
- recommend that the global glider program first consider three key areas of ocean observation: **Ocean Boundary Currents, Storms, and Water Transformation**. We recommend that OceanGliders lead an assessment by the ocean observation community on how best to address these three areas of societal need for ocean data.
- recommend the development **of a global data management system to ensure the effective sharing and use of ocean data** from underwater gliders.
- recommend that OceanGliders develop **an implementation plan for a sustained Boundary Ocean Observing Network** to meet the societal needs of improving ocean observing in this key region of the global ocean.

Monitoring the Boundary regions

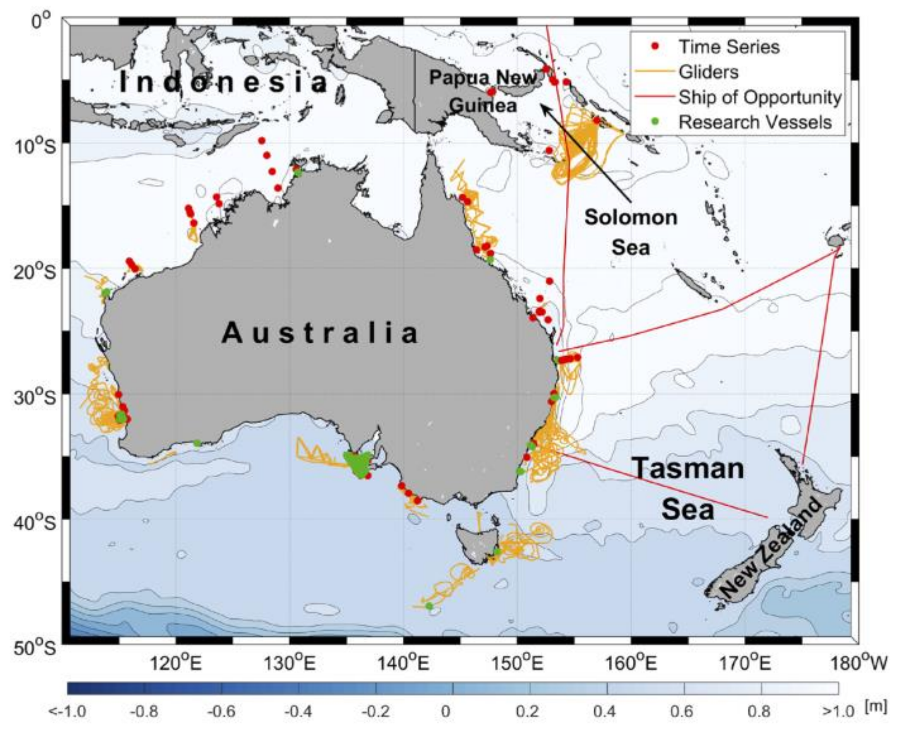


FIGURE 7 | Map of the boundary current observing efforts for the Leeuwin and South Australian Current Systems

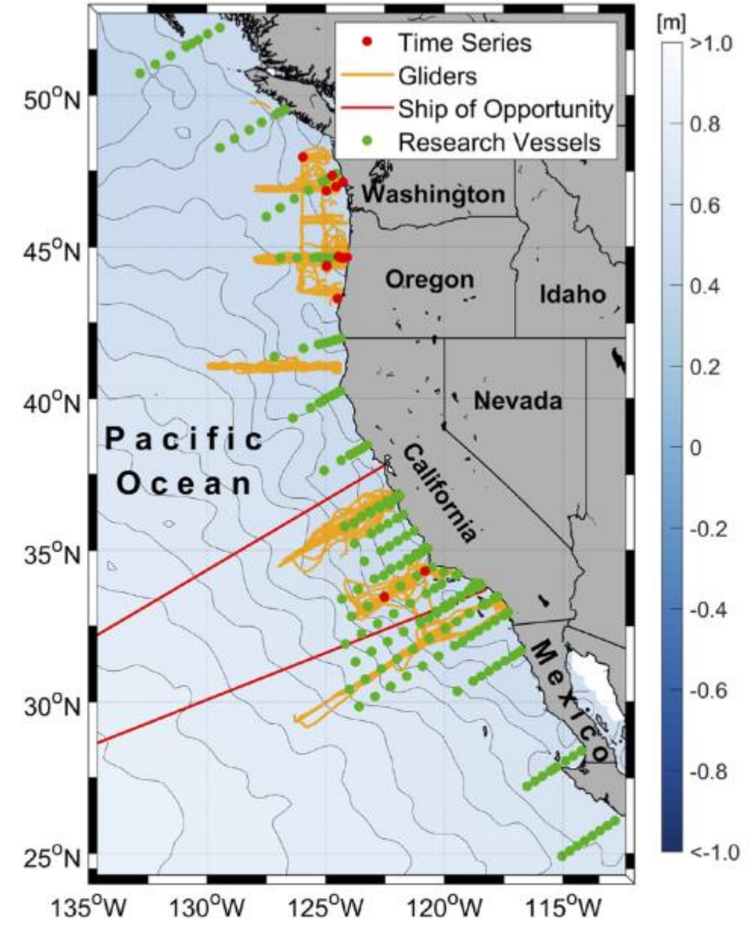


FIGURE 5 | Map of observing efforts extending more than 1 year during the past decade for the California Current System (see the section *California Current System*). Glider trajectories are shown in orange, SOOP/XBT lines are red, moorings are red dots, and stations routinely occupied by research vessels are green. Contours are mean sea surface height over the period 2009–2017 from AVISO.

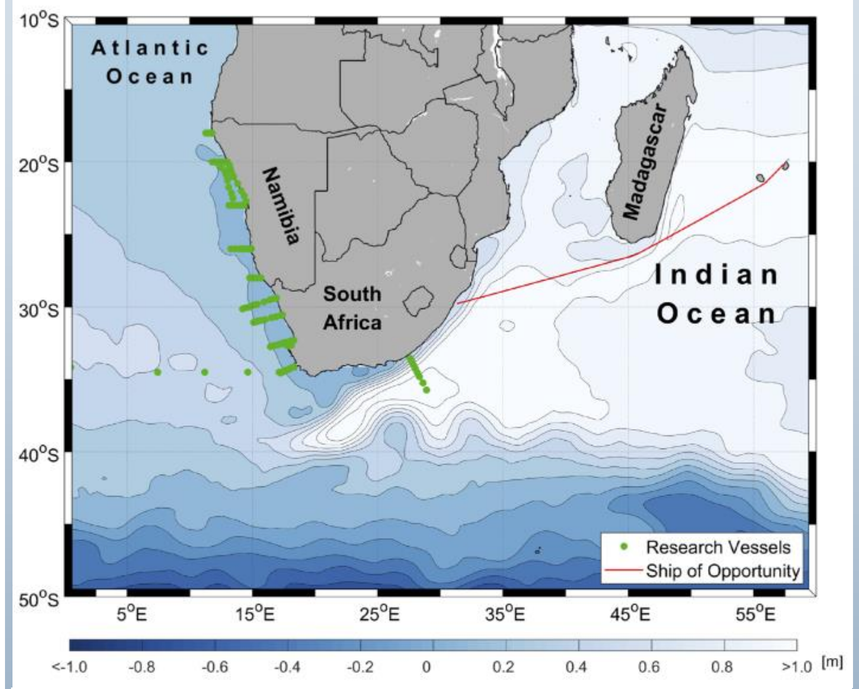


FIGURE 8 | Map of the boundary current observing effort for the Benguela Current System

Monitoring the Boundary regions

Why ocean boundaries?

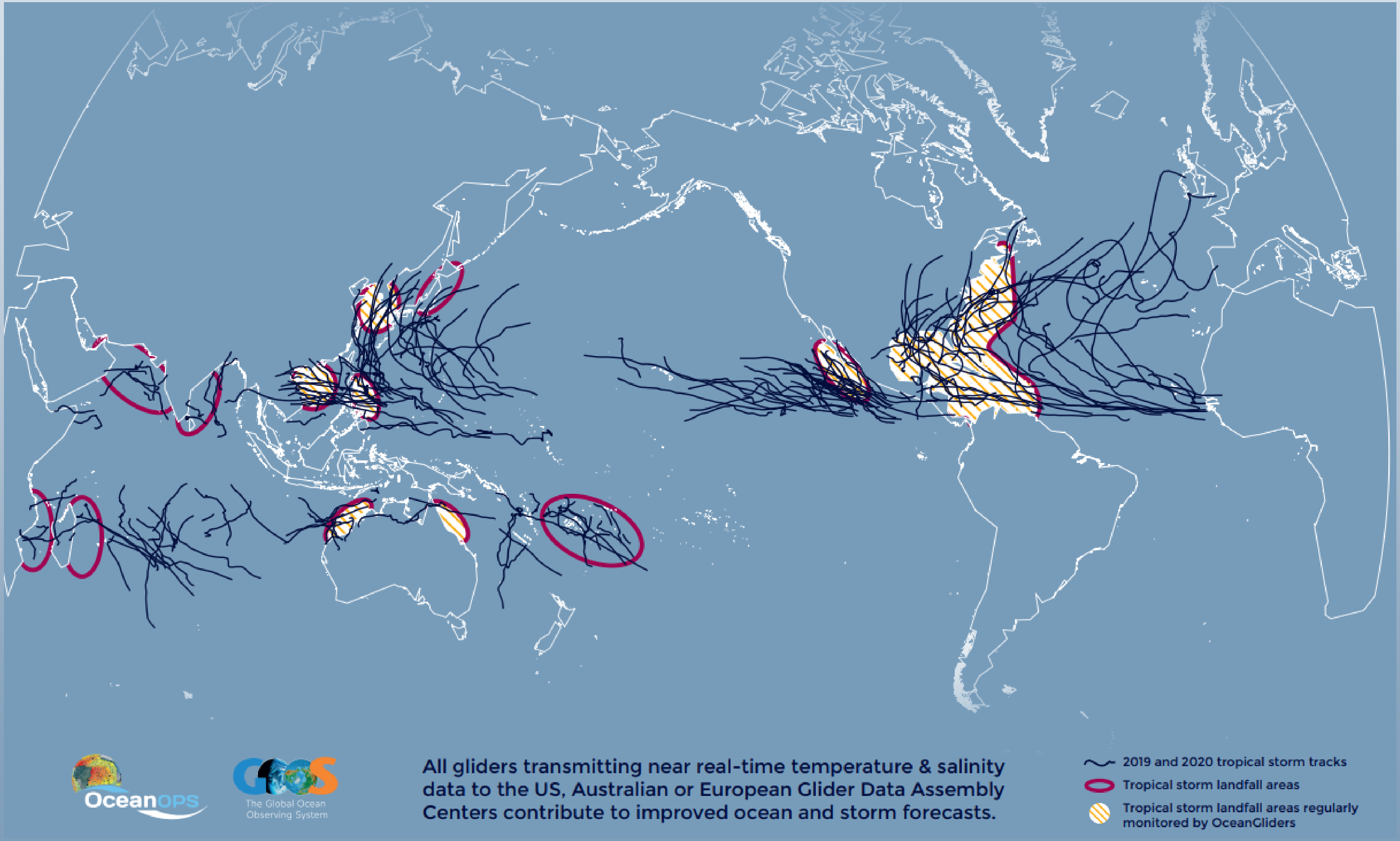
- Society feels the effects of ocean variability through boundaries
- Ecosystems are highly impacted by human activities in these zones
- Extreme weather and marine events affect billions of people who live and work near the coast
- Boundaries have high economic value for coastal communities

Climate, Weather, Fisheries, Pollutants, Transportation, Recreation

Why gliders & boundaries?

- Gliders connect the coast and open ocean
- Gliders capture physical, biogeochemical and biological variability
- Gliders sample across high gradients, along swift currents and in extreme weather conditions
- Gliders effectively integrate with other ocean boundary monitoring systems and ocean models

Measuring under the storms



Measuring under the storms

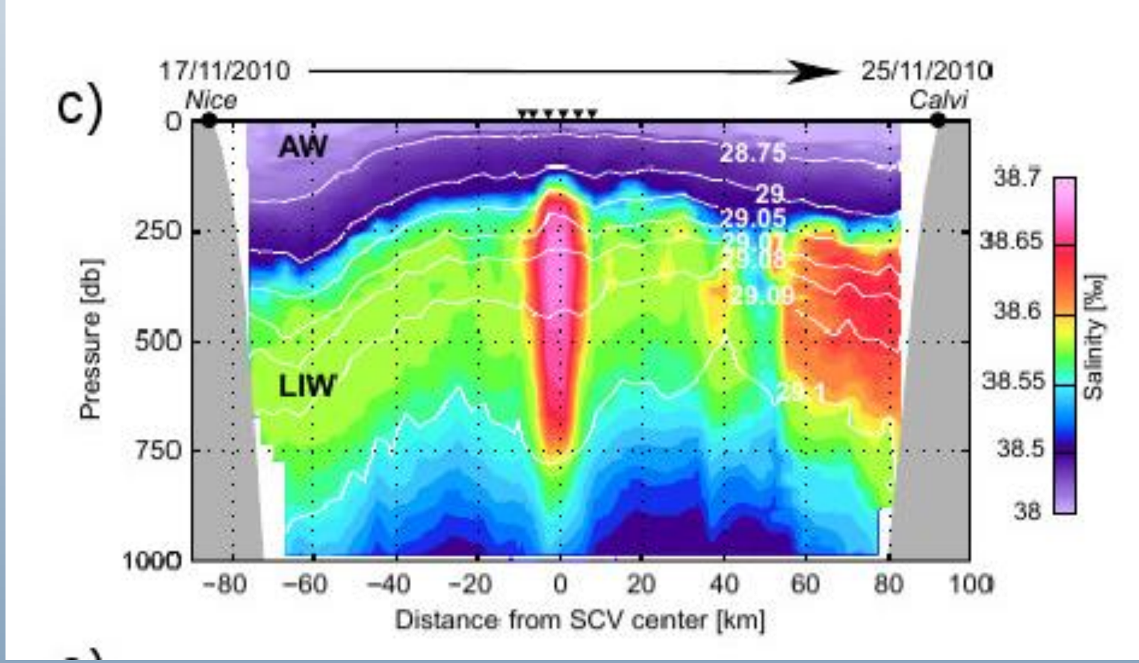
Why storm forecasts?

- Storms effect billions of people that live and work near the coast, causing 100's of billions of dollars in damage annually
- Many storms originate at sea, and are affected by specific Ocean Features such as boundary currents and eddies, subsurface thermal structure, and major river plumes
- Some of the world's best weather forecasts are produced by coupled atmosphere-ocean models that assimilate real-time data from a vast global observation network

How do gliders improve hurricane forecasts?

- OceanGliders operate unhindered by storms in a broad range of water depths
- All OceanGliders provide critical data for assimilation well ahead of the storms to better define Essential Ocean Features impacting storm intensity
- OceanGliders encountering storms improve scientific understanding of Essential Ocean Processes and their atmospheric feedbacks
- Uncertainties in forecast models provide guidance on where and when to deploy OceanGliders to maximize value

Observing water transformation



Water Transformation

Monitor shelf/open sea water formations & (sub)mesoscale variability

Chair : Pierre Testor, CNRS – LOCEAN

Mailing list : og-water-transformation@jcommops.org

Some highlights of (sub)mesoscale oceanic processes revealed by gliders that have been identified as important for the functioning of the physical, chemical and biological ocean (Community White Paper, OceanObs'19)

Understanding the Ocean Processes

<u>Physical domain:</u>

- Circulation
- Mixing
- Water transformation
- Transport
- Atmospheric and Oceanic exchanges
- Marine Heat Waves

…

<u>BioGeoChemical domain :</u>

- Eutrophisation
- Phytoplancton Bloom
- Nutrient cycle
- Acidification
- …

<u>Biological domain :</u>

- Passive acoustic
- Animal Tracking
- Behavioural studies
- …

<u>Numerical Ocean domain:</u>

- Regional to coastal model validation
- Regional forecasting (data assimilation)
- Reanalysis (data assimilation)
- …

The OceanGliders program

A component of the integrated GOOS

Best Practices

Chair : Pierre Testor, CNRS
Soeren Thomsen, CNRS?

Mailing list : pierre.testor@locean-ipsl.fr

Data Management

Chair : Dan Hayes, UC-UCY
Victor Turpin, JCOMMOPS

Mailing list : og-dm@jcommops.org

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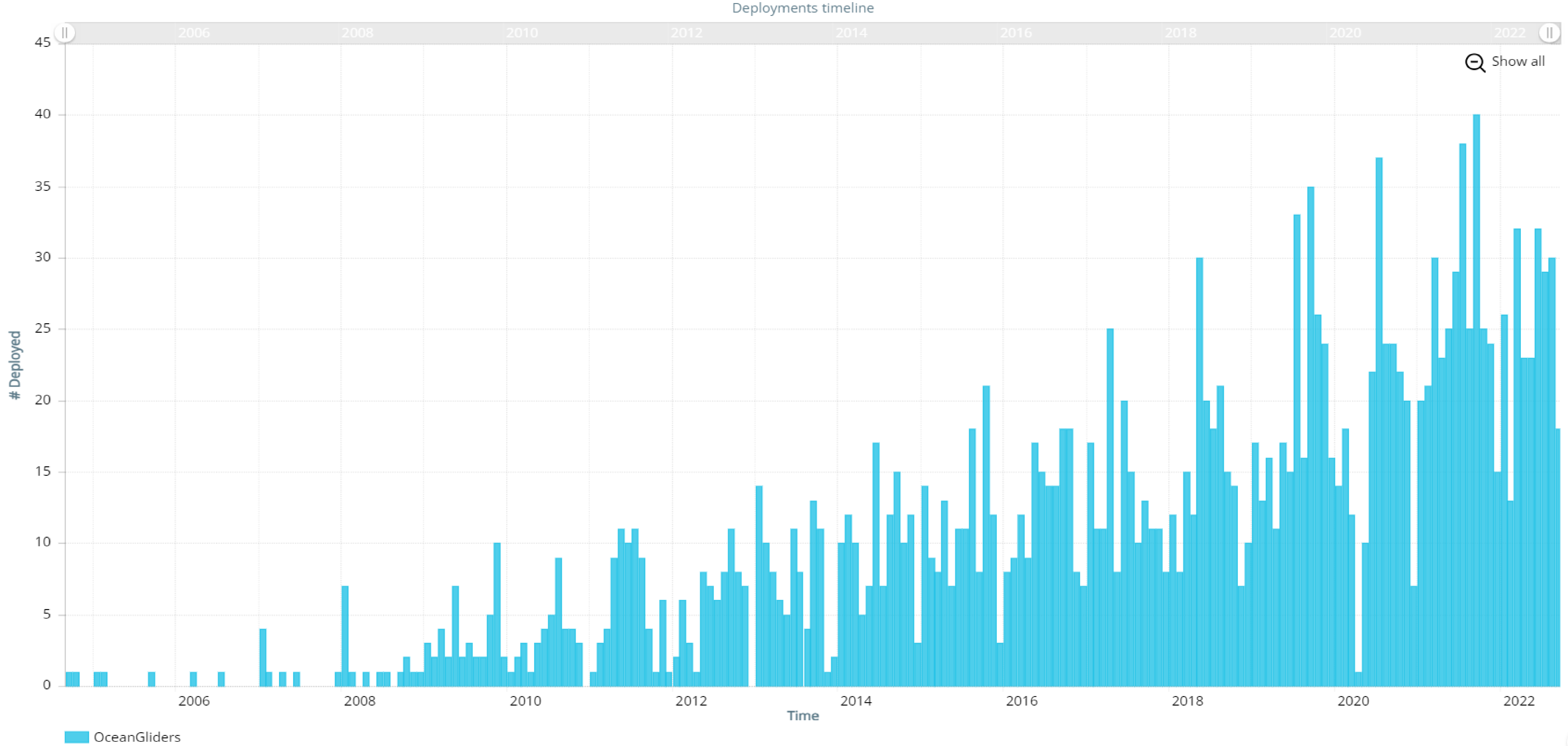
From an “emerging” to a “mature” OCG network



From an “emerging” to a “mature” OCG network

Following the GOOS-OCG (increasing level of) requirements…

GOOS-OCG report card 2018

Emerging networks and extending capabilities	Highlights	Readiness level
OceanGliders	Operational multidisciplinary systems exist in several different regions.	MATURE regionally; PILOT globally

GOOS-OCG report card 2020

GOOS *in situ* networks [1]	Implementation	Data & metadata			Best practices [6]	GOOS delivery areas [7]		
	Status [2]	Real time [3]	Archived high quality [4]	Meta-data [5]		Opera-tional services	Climate	Ocean health
OceanGliders	★☆☆ Emerging	★★☆	★☆☆	★★☆	★☆☆			

GOOS-OCG report card 2022

GOOS *in situ* networks [1]	Implementation	Data & metadata			Best practices [6]	GOOS delivery areas [7]		
	STATUS [2]	REAL TIME [3]	ARCHIVED DELAYED MODE [4]	META-DATA [5]		OPERATIONAL SERVICES	CLIMATE	OCEAN HEALTH
OceanGliders	½☆☆ Emerging	★★☆	★☆☆	★½☆	★★☆			

Loose monitoring
Loose governance
No community BP

Real Time monitoring
Active governance
Network targets

Community BP
Active Data Management Team
Improved monitoring (KPI, maps, statistics)

Target 2023

- **Unique format (Meta-data, Real time, status, BP)**
- **Network strategy for archived Delayed mode data**

From an “emerging” to a “mature” OCG network

<u>The example of OG1.0: The common format for gliders</u>

From 3 format to a unique one

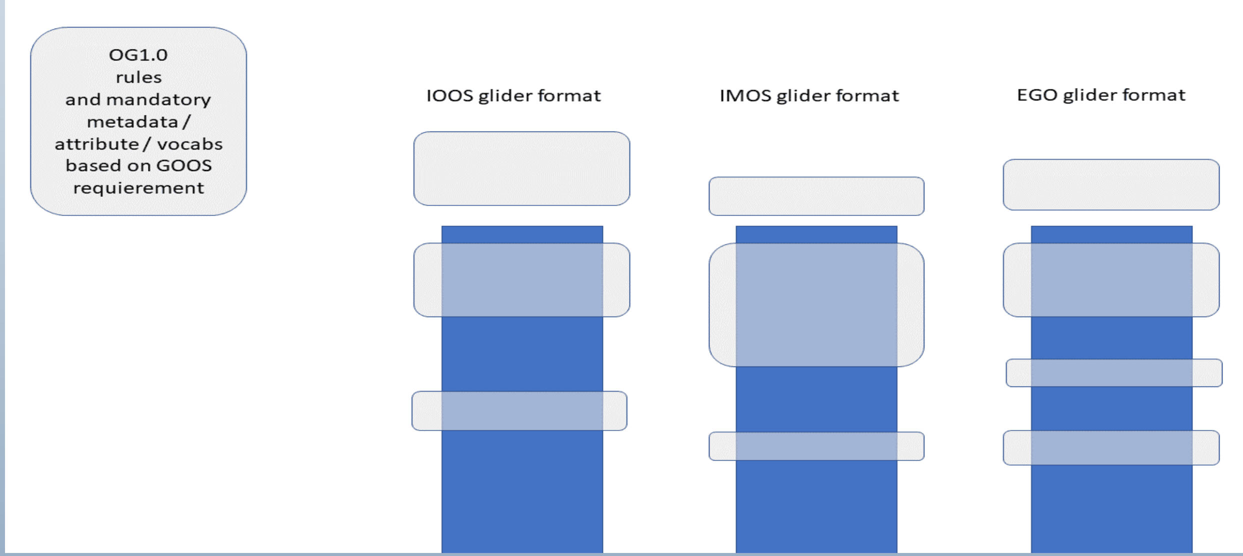


Figure 1: current OceanGliders data management scheme

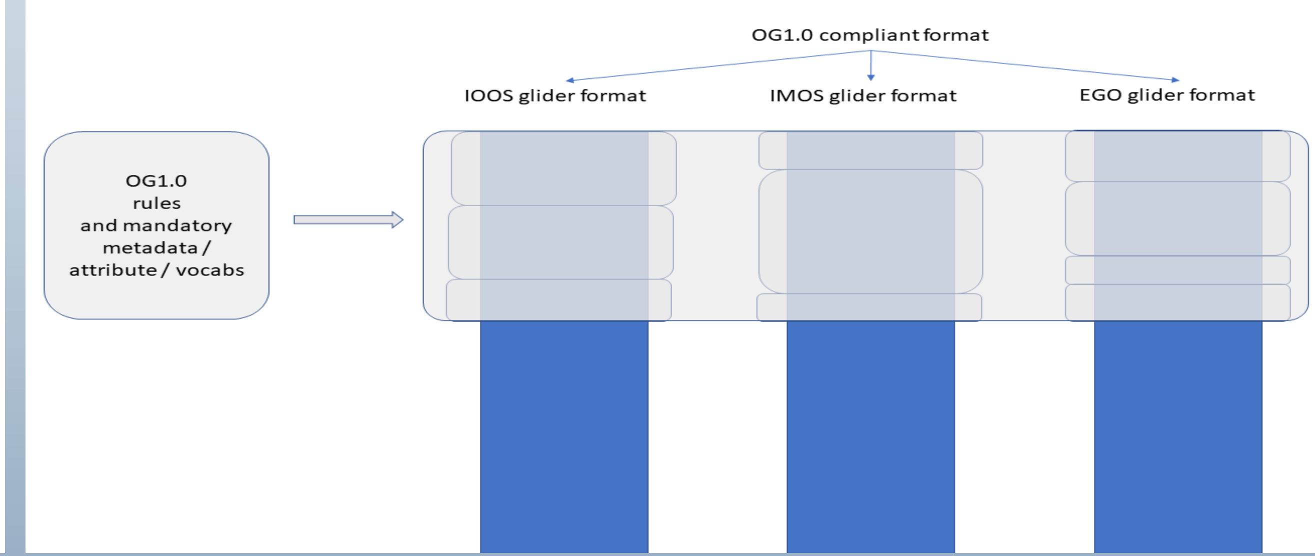


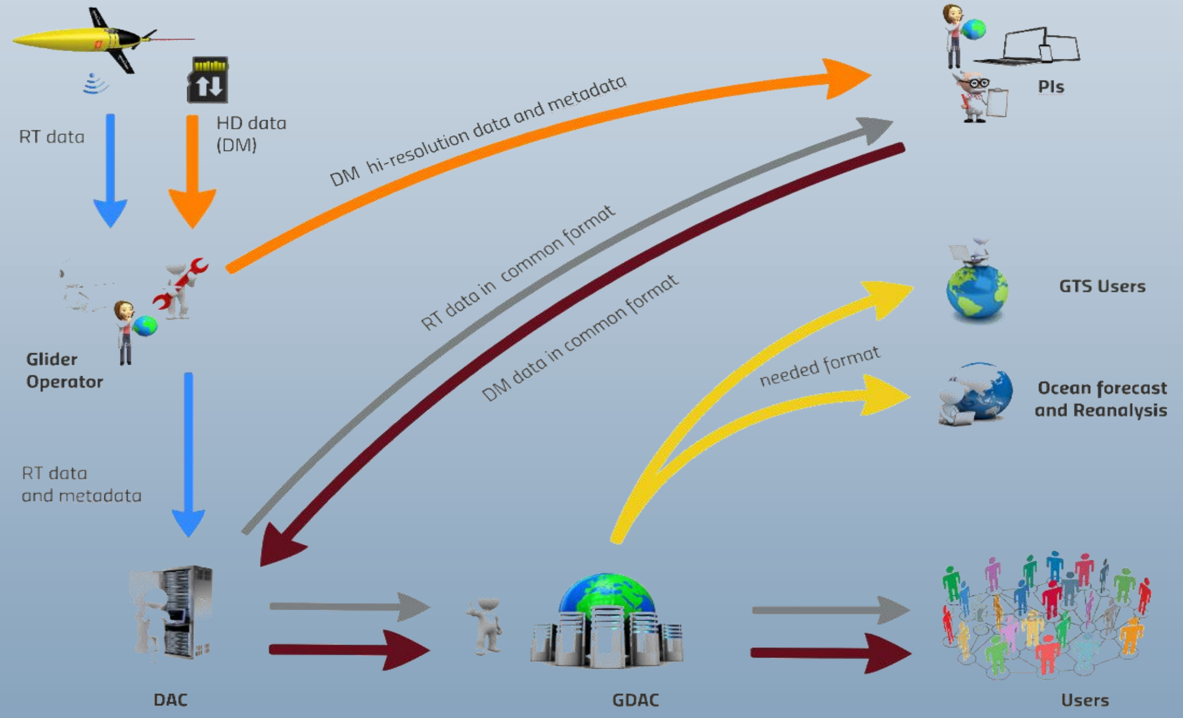
Figure 2: Gliders data management harmonization goal.

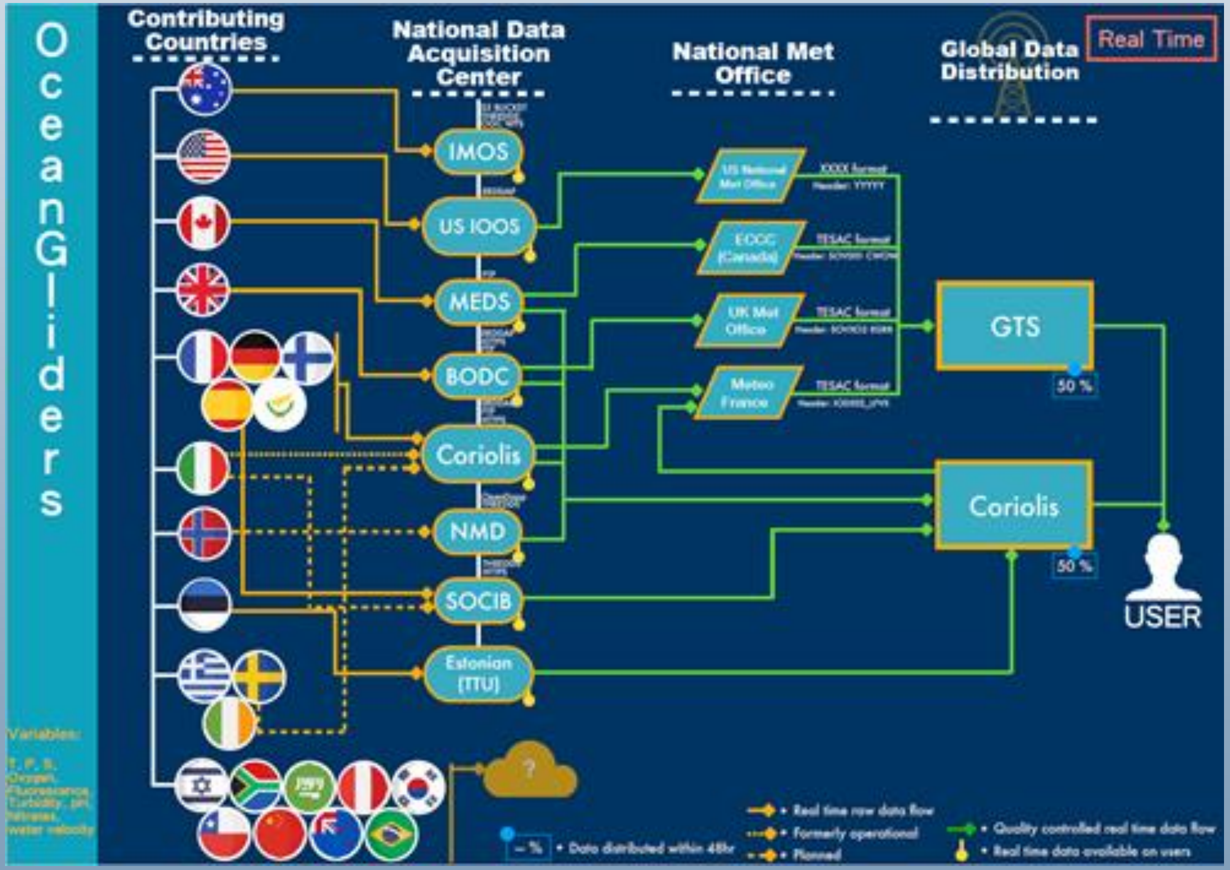
https://github.com/OceanGlidersCommunity

From an “emerging” to a “mature” OCG network

<u>The example of OG1.0: The common format for gliders</u>

A unique data flow





From an “emerging” to a “mature” OCG network

<u>The example of OG1.0: inspired by Argo success story</u>

- An active data team
- A unique format
- A unique data flow
- Common vocabularies

- Better RT monitoring
- Improved status
- Stronger BP
- Improve metadata management
- Impact on long-term archiving
- High impact on network status

Спасибо

Thank you

Gracias

Merci

谢谢

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Improving netwokd

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