

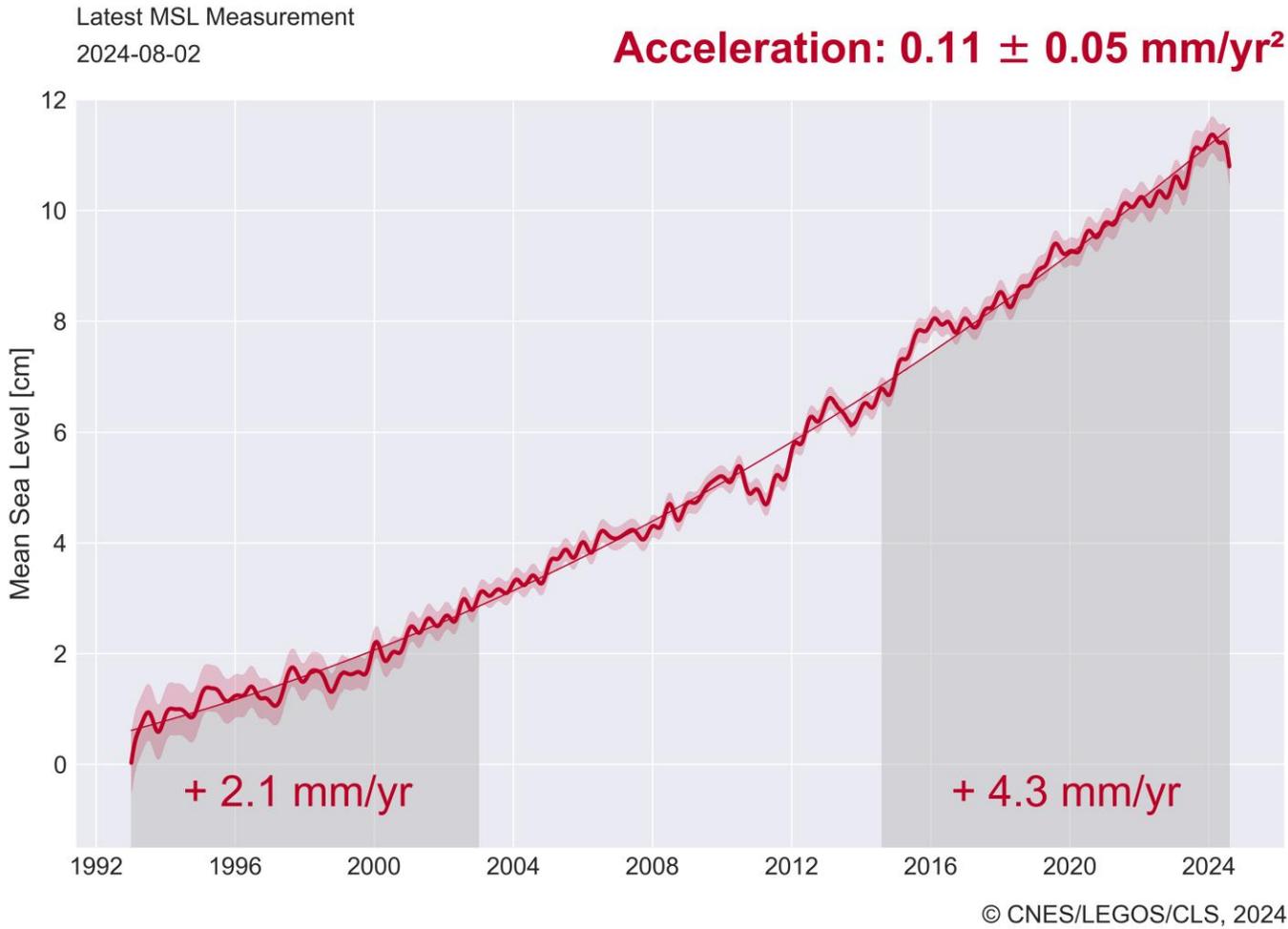
Sea Level Rise and Ocean Warming

William Llovel (William.Llovel@ifremer.fr)

LOPS/CNRS



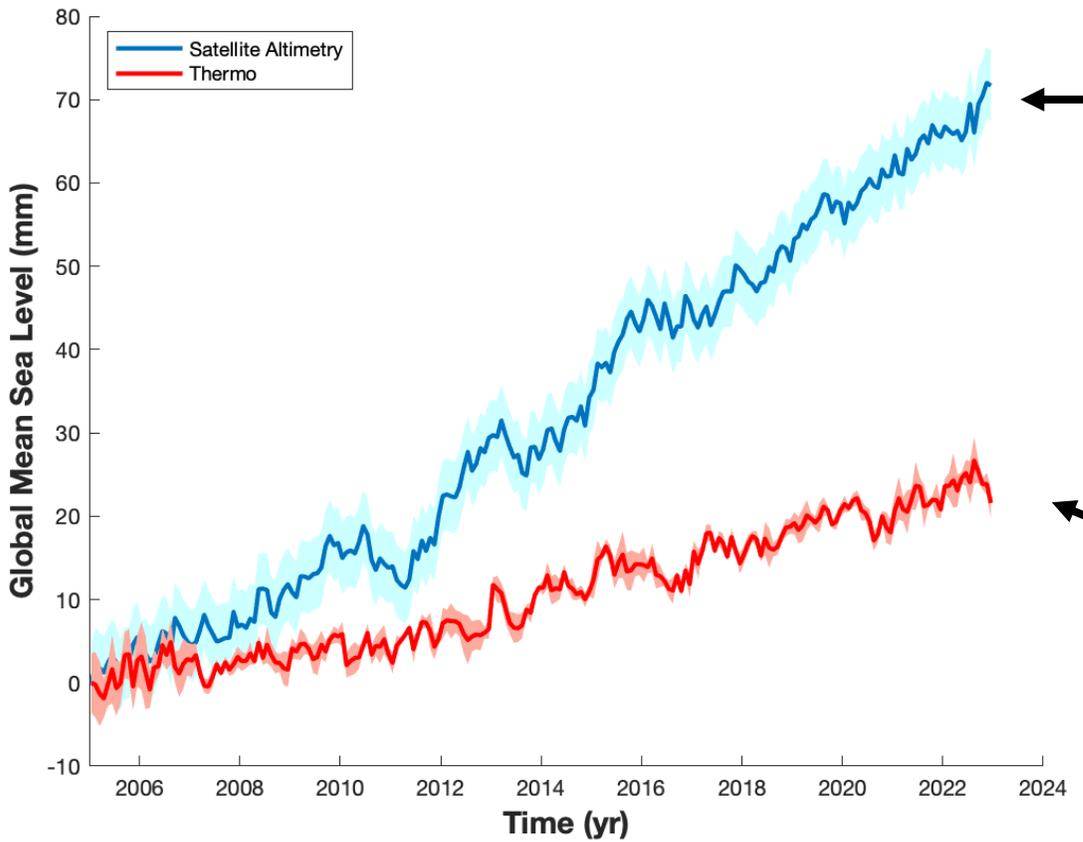
Global mean sea level rise since 1993



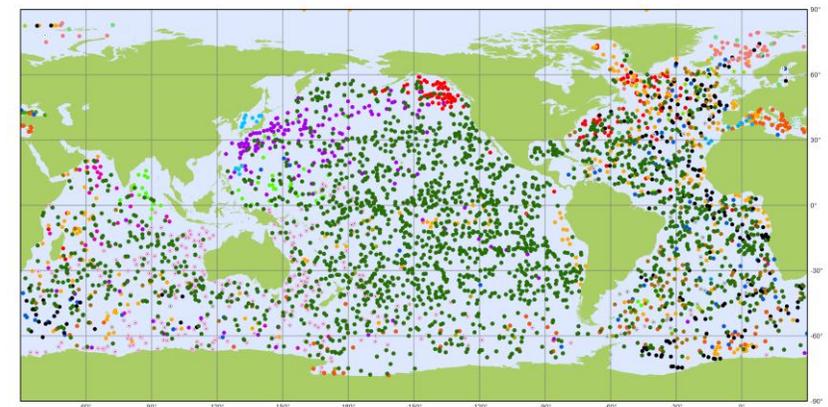
TOPEX/Poseidon (1992-2006)
Jason 1 (2001-2013)
Jason 2 (2008-2019)
Jason 3 (2016- ...)
S6-MF/Jason-CS (2020-...)

Linear trend (1993-2024): $3.3 \pm 0.4 \text{ mm/yr}$

Global mean sea level rise since 1993



Argo network



Argo National contributions - 3858 operational floats
Latest location of operational floats (data distributed within the last 30 days)

May 2023

AUSTRALIA (301)	FINLAND (7)	IRELAND (16)	NORWAY (48)	UK (140)
BULGARIA (8)	FRANCE (298)	ITALY (92)	PERU (1)	USA (2118)
CANADA (152)	GERMANY (225)	JAPAN (178)	POLAND (10)	
CHINA (56)	GREECE (5)	NETHERLANDS (38)	KOREA, REPUBLIC OF (16)	
EUROPE (88)	INDIA (31)	NEW ZEALAND (16)	SPAIN (14)	

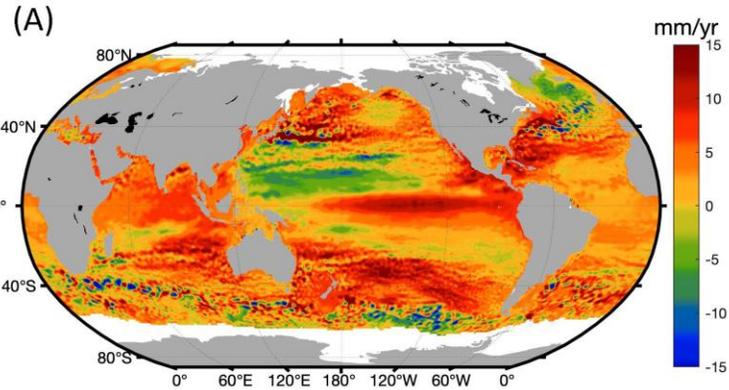
2005-2022 :

-> Global mean sea level rise 4.1 mm/yr

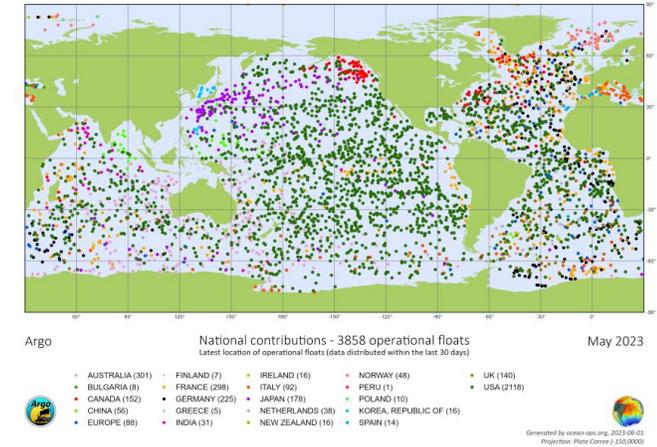
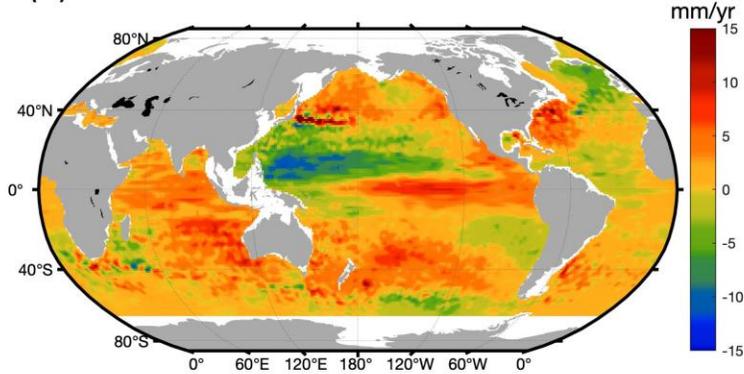
-> Global ocean warming explains 35%

Maps of regional sea level trends over 2005-2015

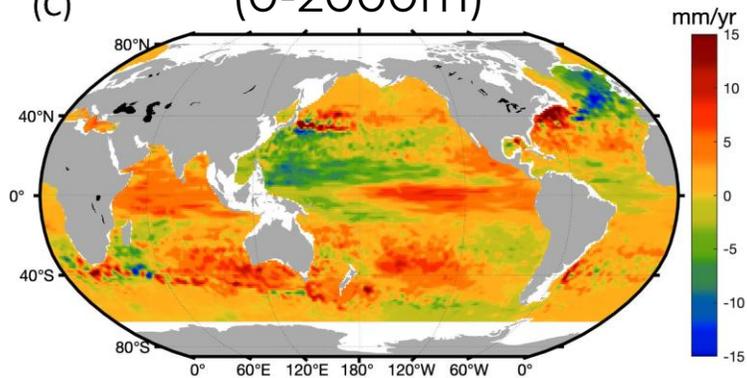
Satellite altimetry



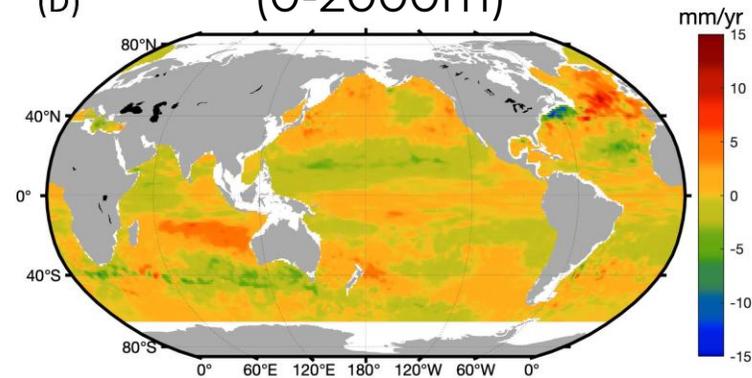
Argo-based steric sea level
(0-2000m)



Argo-based thermosteric sea level
(0-2000m)

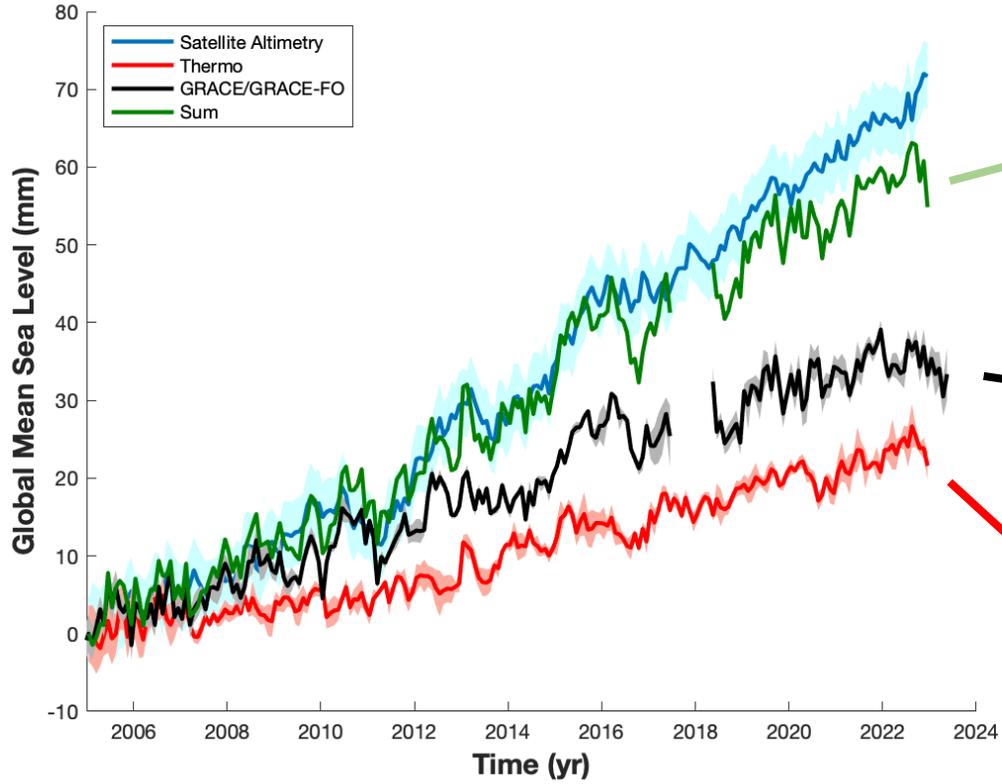


Argo-based halosteric sea level
(0-2000m)

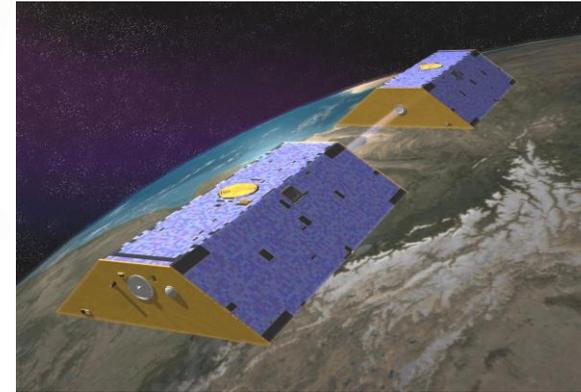


-> Regional variability in
observed sea level trends
-> Steric origin
-> Mainly explained by
temperature

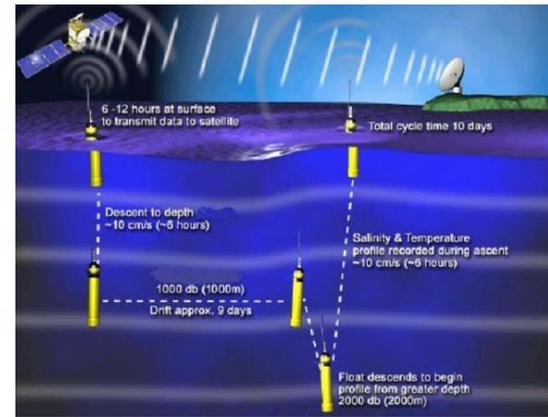
Global Mean Sea Level Budget over 2005-2020



Argo + GRACE/GRACE-FO



GRACE / GRACE-FO



Argo floats