Thoughts about a Deep-Argo strategy
Objectives

- Heat content monitoring and sea-level budgets
- Deep circulation and Meridional Overturning Cell
- Improve operational and climate models
- Data quality

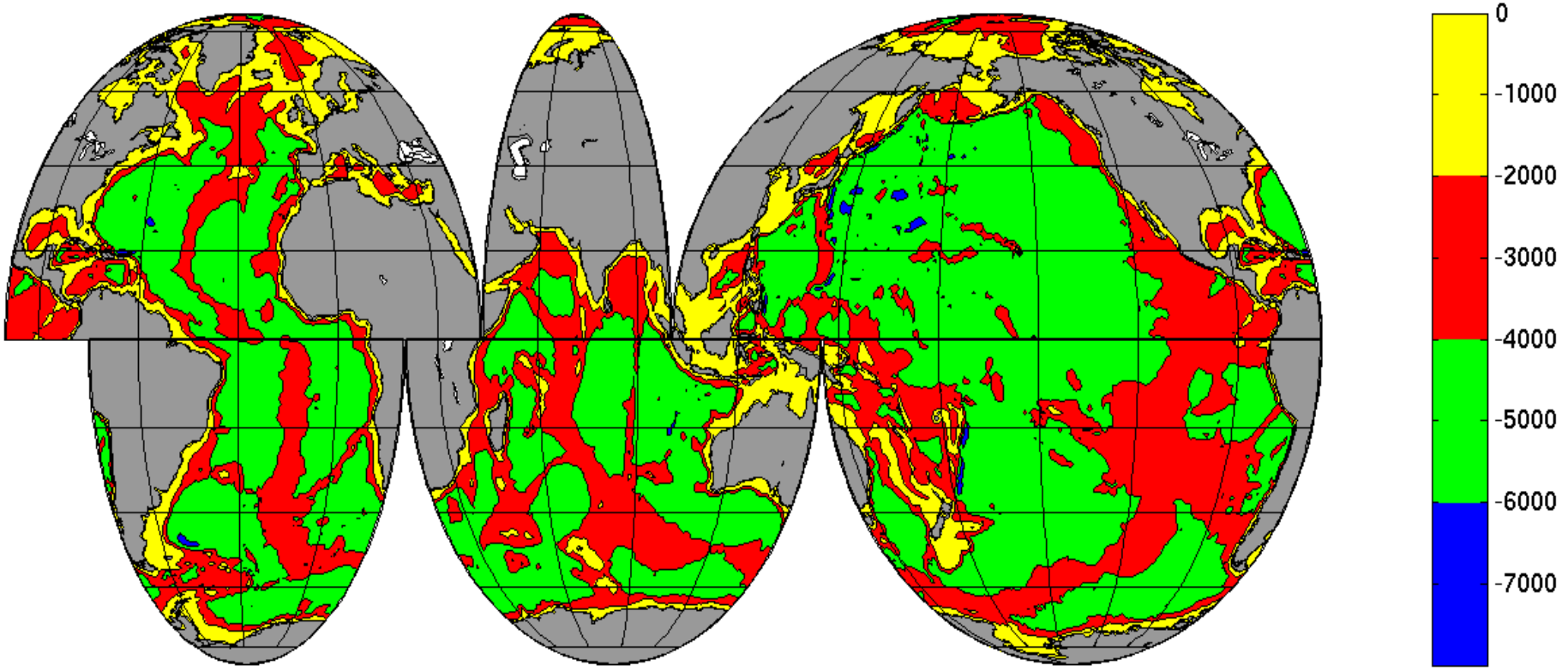
Thoughts about a Deep-Argo strategy

Deep Argo floats: Depth capability, cost and expected life time

	0-4000m floats	0-6000m floats
Total cost	~ 30k€	> 50k€
Cycles	~ 150	~ 50 ??
Sensor	SBE41CP	SBE61CP

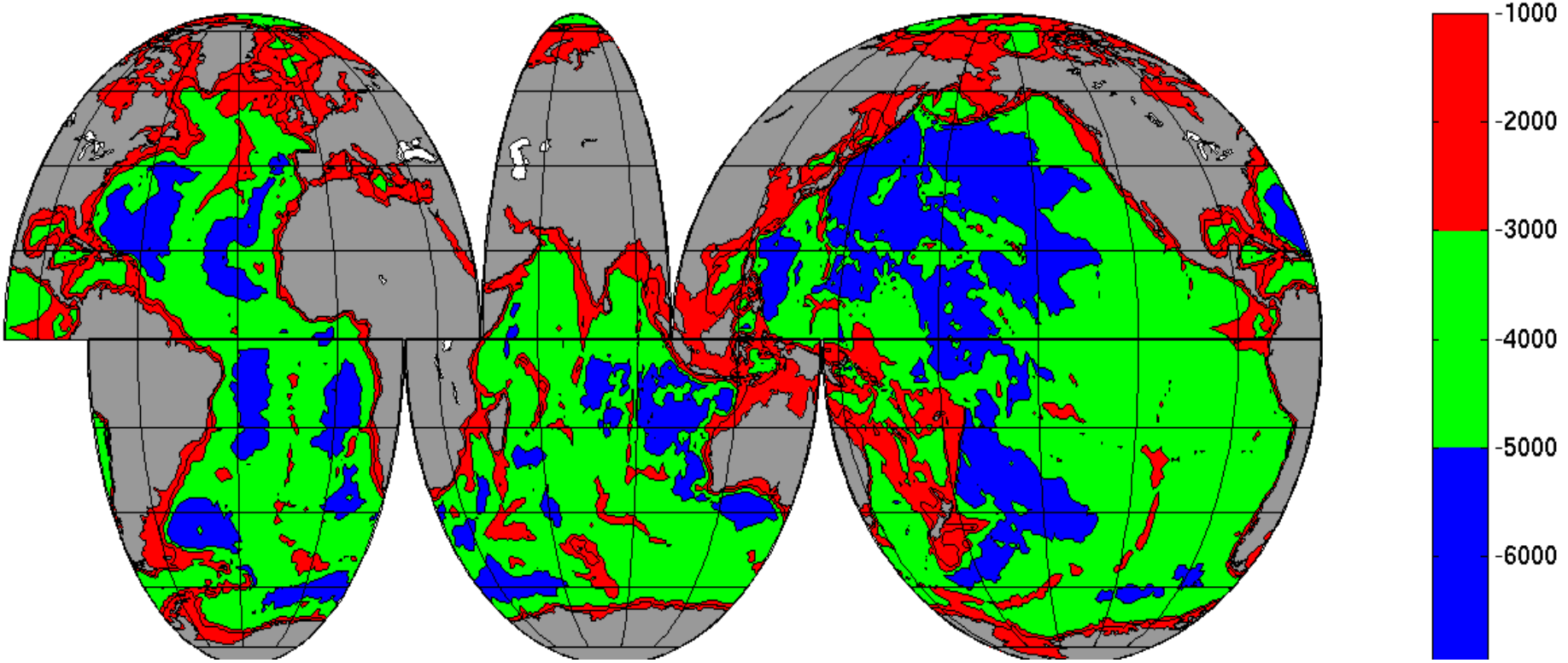
Thoughts about a Deep-Argo strategy

Some facts



Thoughts about a Deep-Argo strategy

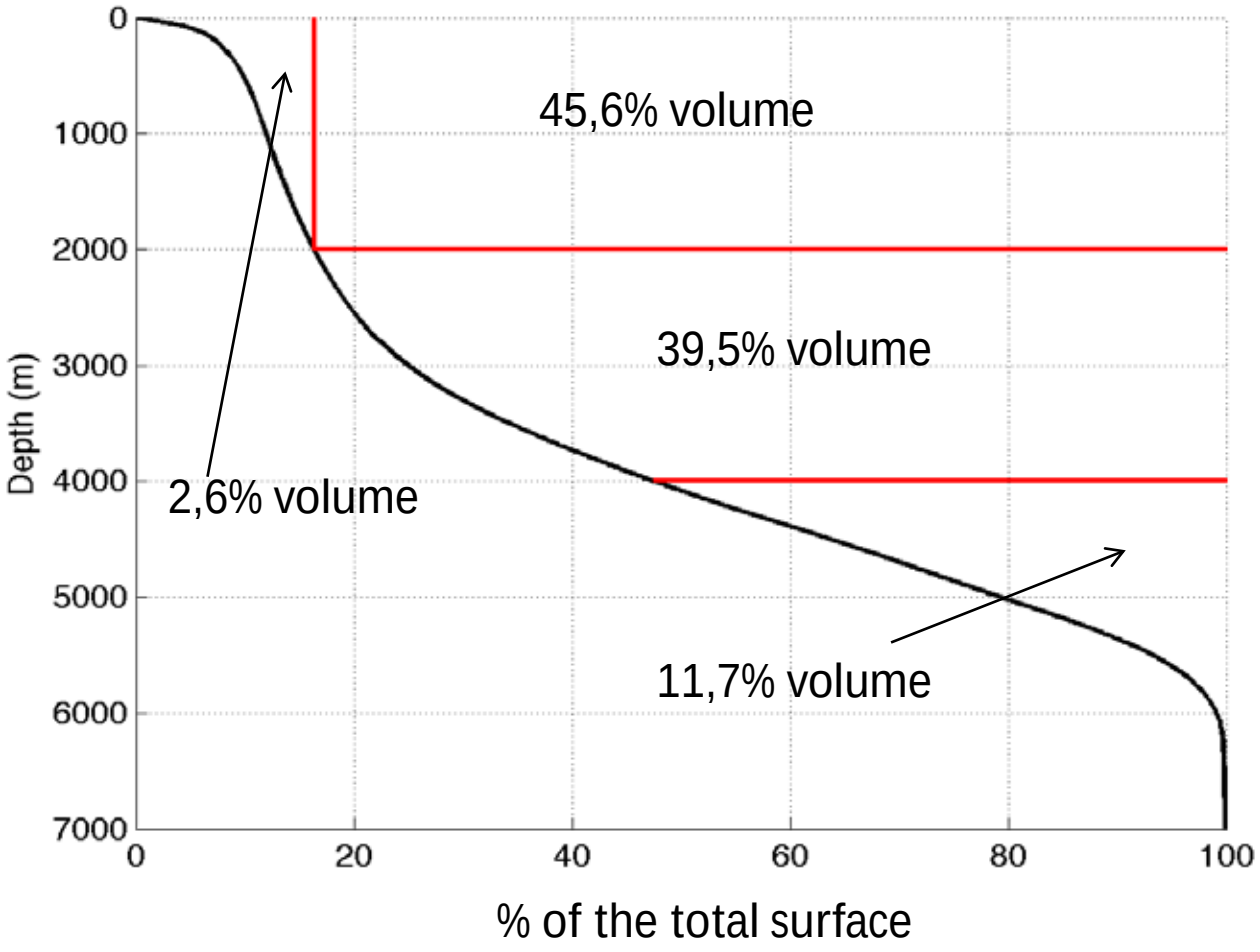
Some facts



Thoughts about a Deep-Argo strategy

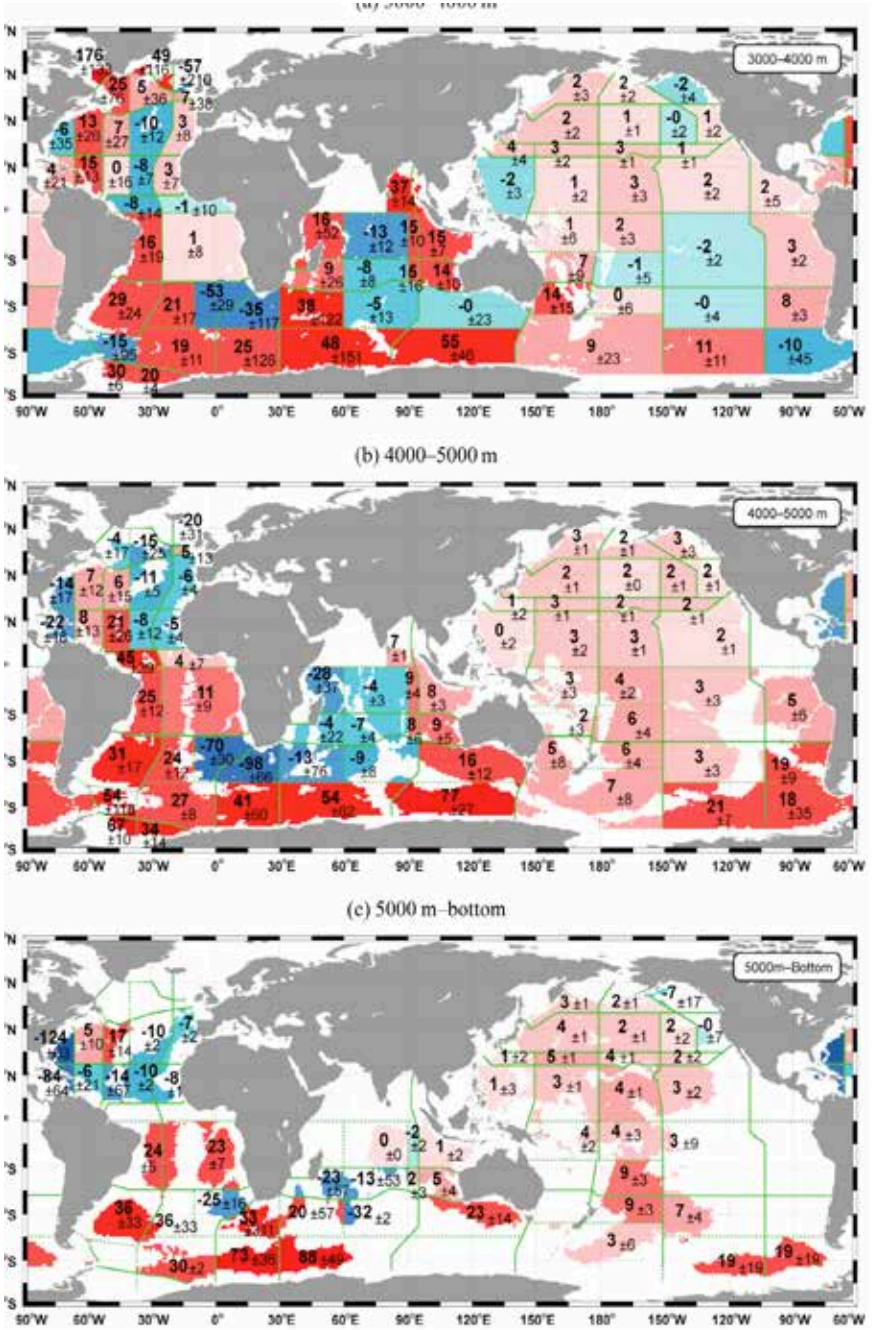
Some facts

Ocean surface as function of depth (%)



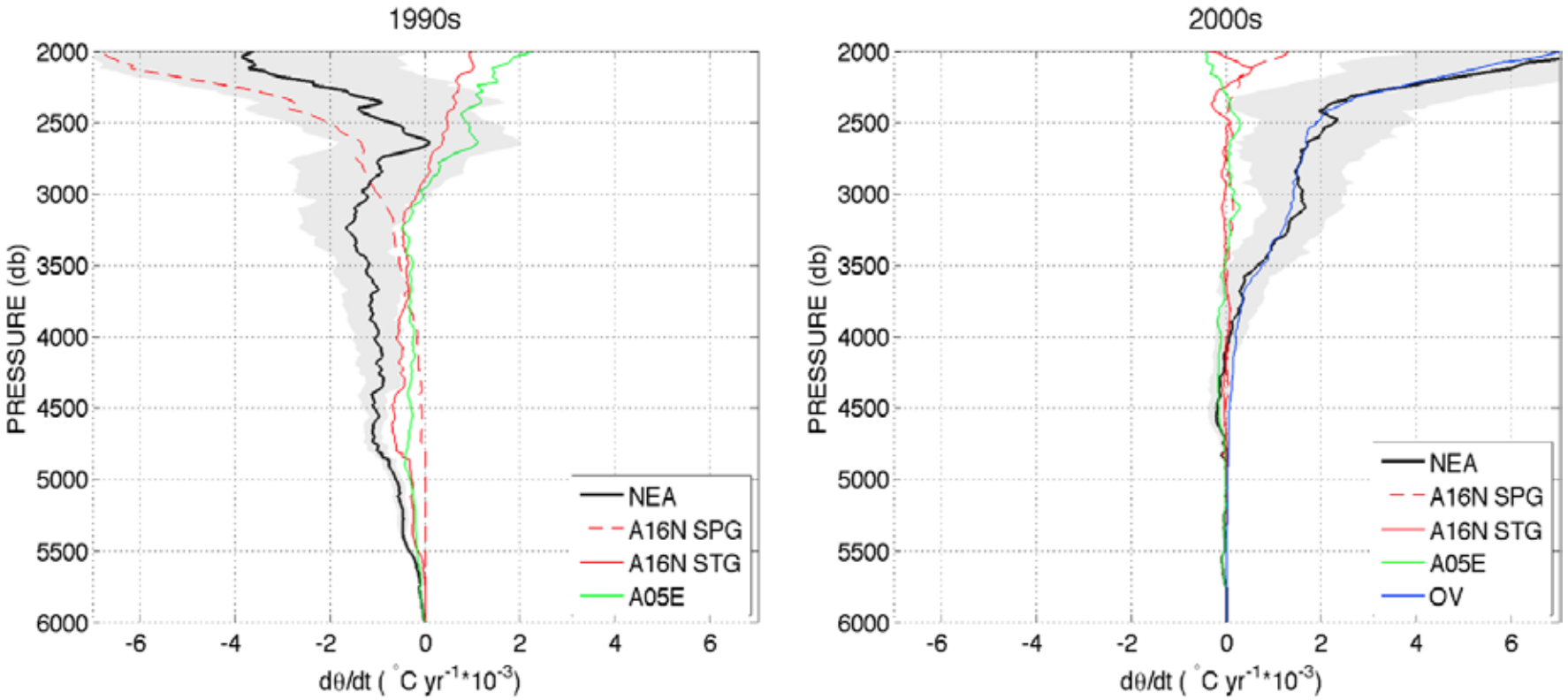
Temperature rate of change (x 10^{-3} ° C/decade) over 1990 - 2000 period

- Changes observed in all oceans below 3000m, with different amplitudes and signs (range from ±1 to ±125 x 10^{-3} ° C/decade)
- Large changes
  - Arouns antarctic (down to the bottom),
  - In the Pacific Ocean below 4000m
  - In the subpolar gyre of the the North-Atlantic Ocean between 3000 and 4000m



Kouketsu et al., 2011

Variability in the temperature rate of change



Desbruyères et al. (2014)

Large decadal variability might be observed in some areas like in the Northeast Atlantic were the cooling observed in the 90s was replaced by a warming in the 2000s of about the same amplitude (+/- 1 to 6 x 10^{-3} ° C/year).

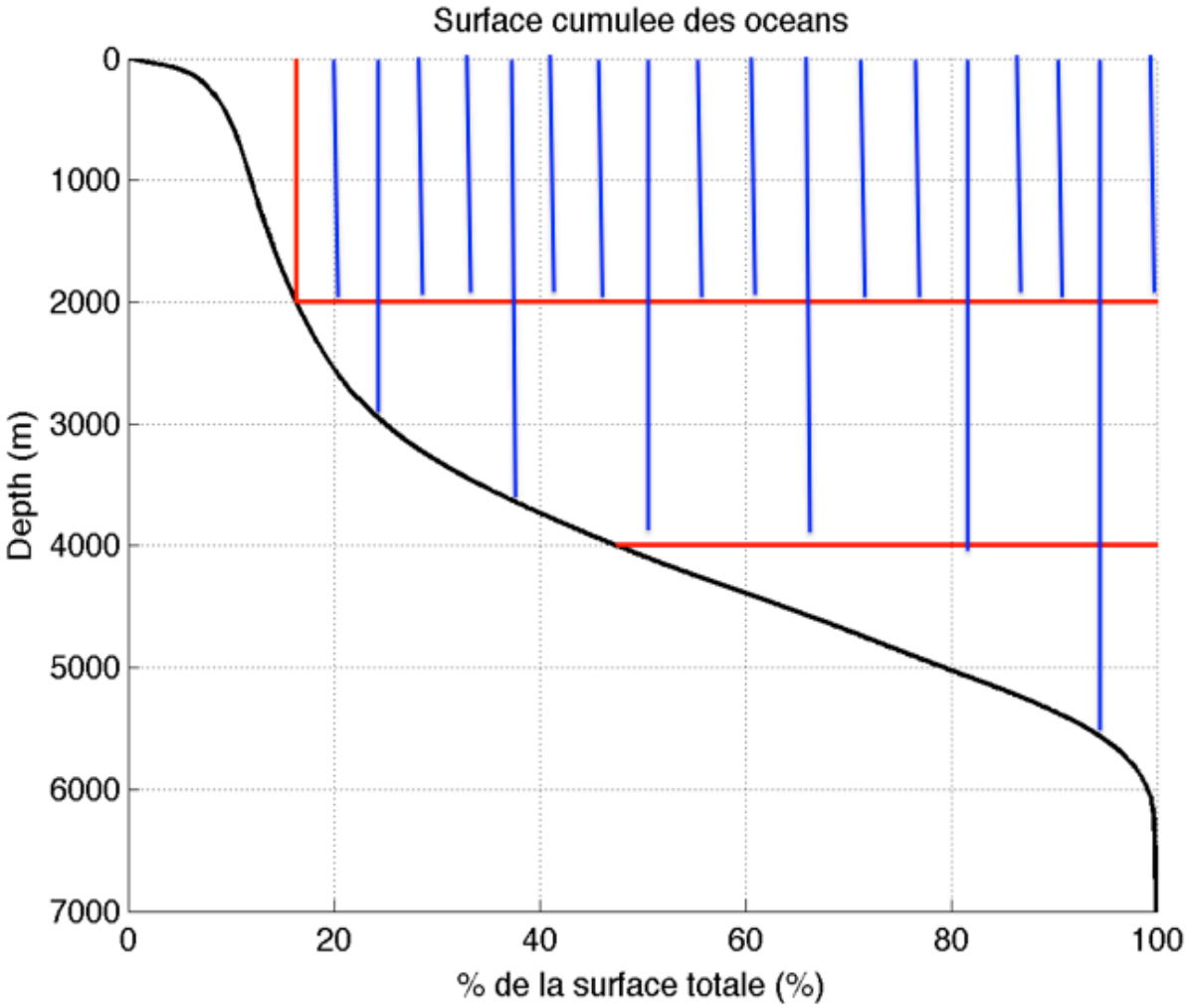
Thoughts about a Deep-Argo strategy
Synthesis

- Need to sample the 2000-4000 m layer globally
  - ~ 40 % of the ocean volume
  - Argo core + 2000-4000m = 85% of the ocean volume
  - Signal present in all basins with different amplitude and signs + decadal variability
  - Large impact on the heat content budget because it represents a large volume

- Need to sample the 4000-6000 m layer where the signal is (and where the very deep layers are)
  - Large signal in some areas (southern ocean, pacific ocean)
  - ~12 % of the ocean volume
  - One cannot afford a global Deep-Argo array with 0-6000m float

Thoughts about a Deep-Argo strategy

Synthesis

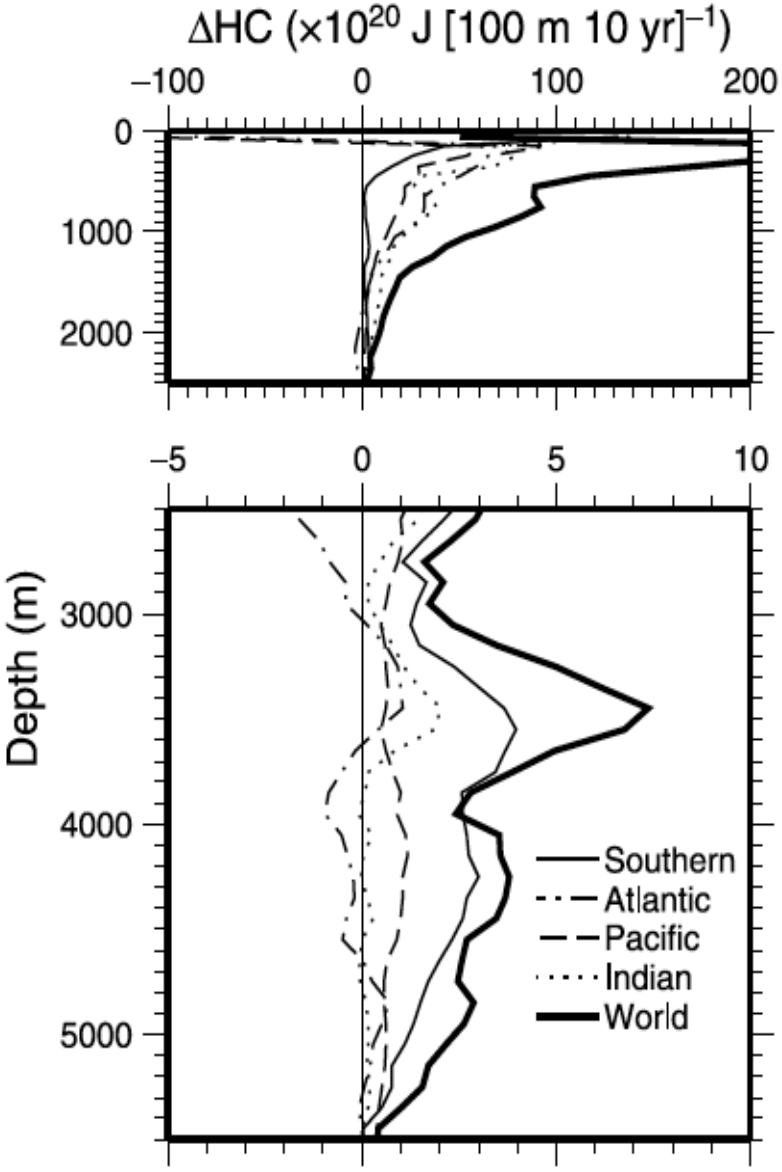


Thoughts about a Deep-Argo strategy
Synthesis

- Global sampling of the 2000-4000 m layer (Deep-Argo)
  - Insertion of the Deep-Argo floats (4000m) in the core Argo array
  - Same parking depth, same cycle
  - 1 / xx of the core Argo array is a Deep-Argo float (4000)
  - If 1/3: è 1000 floats in operation, 250 float/year to deploy
- Sampling the 4000-6000 layer (Abyss), where the signal is
  - First: in the Southern and Pacific Oceans
  - Then along the pathway of the deep water masses formed in the Southern Ocean (AABW)
  - Probably need to include hydrographic cruises in the array, because of the context (climate), the expected amplitude of the signal (~0.05 ° C/decade), and the need of an independent reference database to control and correct the whole Argo dataset and the corresponding HC/SL estimates

Heat content rate of change 1990-2000

- Focus on the deep layers (below 2000m)
- One order of magnitude less than in the upper layers (above 2000m)
- Large HC change near 2500m (Indian and Southern Oceans)
- Minimum at 3000m and increases below 3000 m (Southern Ocean)
- Below 4000m: large contribution of Southern and Pacific oceans
- Below 4000m: reduce contribution of Atlantic Ocean because of the small volume of AABW there



Kouketsu et al., 2011