Argo-Based Analyses Of Oceanic Water Masses

Gaël Forget

Caltech, Pasadena

2017/11/07

Gaël Forget	Presentation Outline	2017/11/07

Gaël Forget	Presentation Outline	2017/11/07

- Structural uncertainty associated with water mass analyses and interpolation methods.

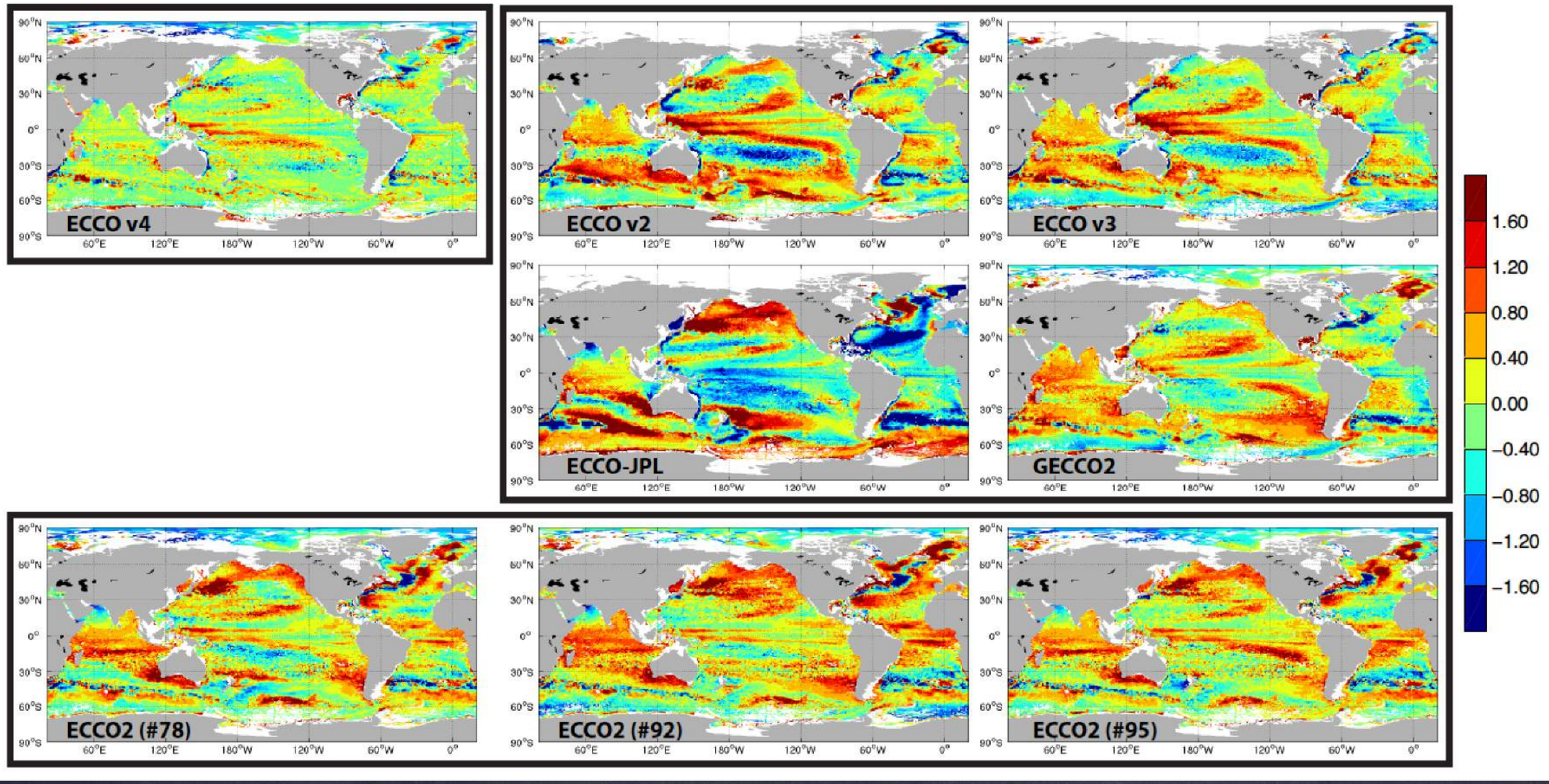
Gaël Forget	Presentation Outline	2017/11/07

- Structural uncertainty associated with water mass analyses and interpolation methods.
- Water mass census and budgets estimated from Argo profiles via interpolation-free methods.

Gaël Forget

Not All State Estimates Are Created Equal

2017/11/07



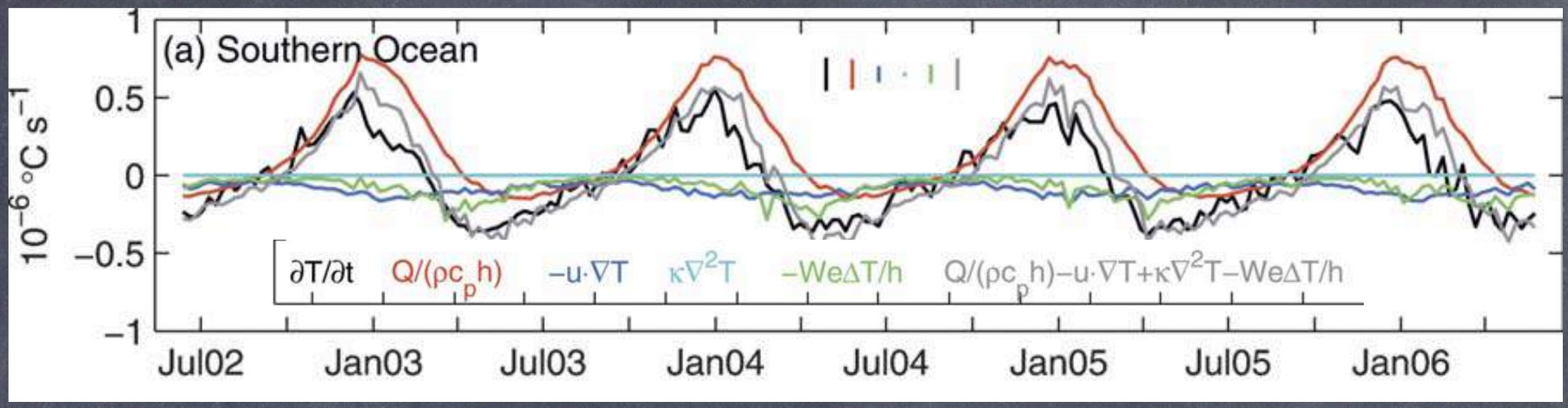
model-data misfits for temperature at 300m depth and various ECCO estimates

Forget, Ferreira, Liang 2015 (OS)

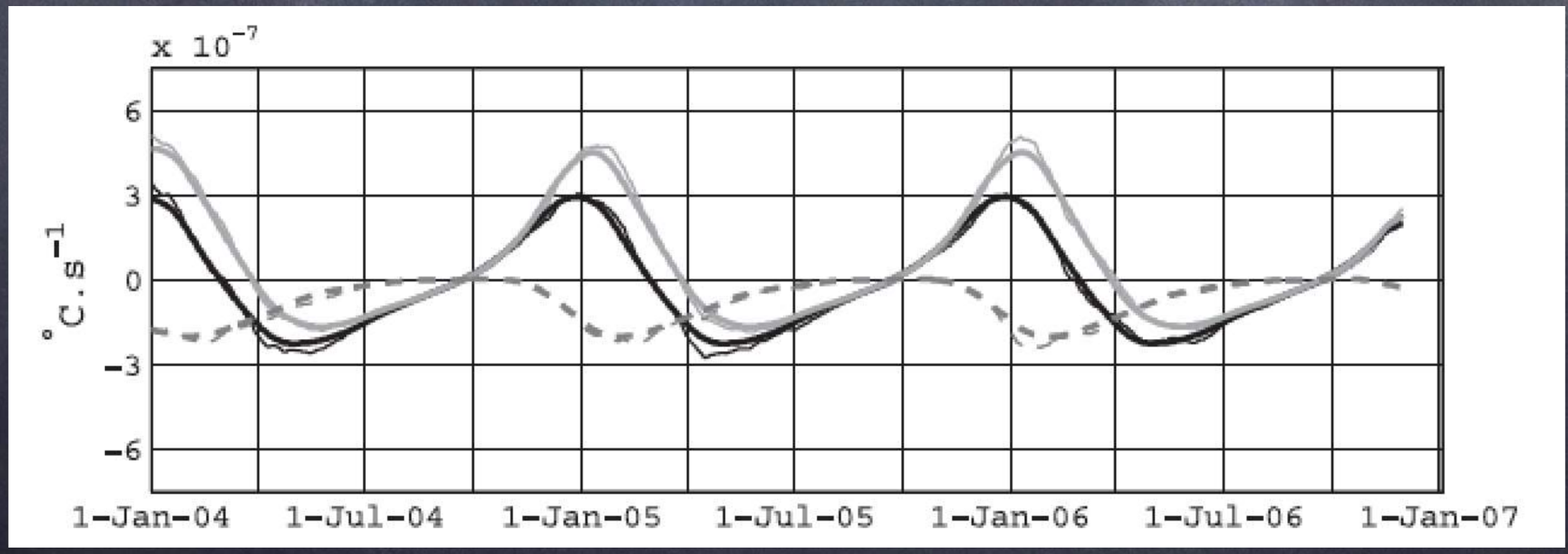
Gaël Forget

Mixed Layer Heat Budgets (relatively robust)

2017/11/07



Dong, Gille, Sprintall 2007 (DOI: 10.1175/JCLI4259.1)

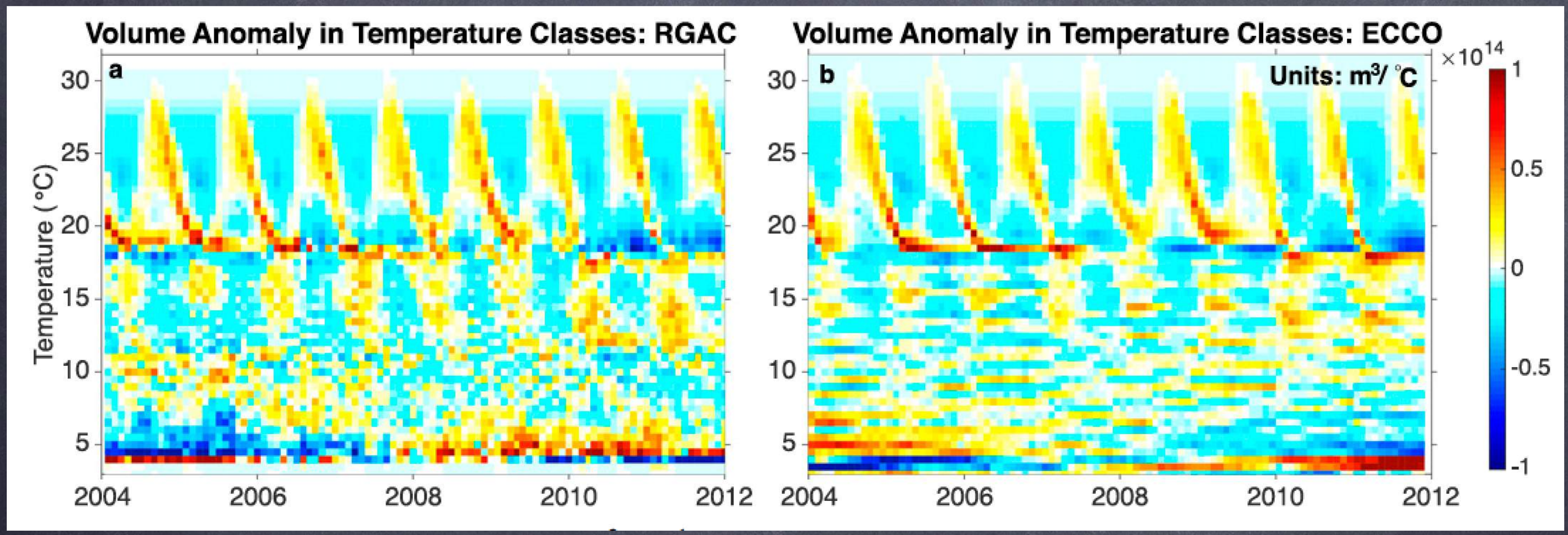


Forget 2010 (DOI: 10.1175/2009jpo4043.1)

Gaël Forget

$V_\theta(t)$ (relatively robust)

2017/11/07



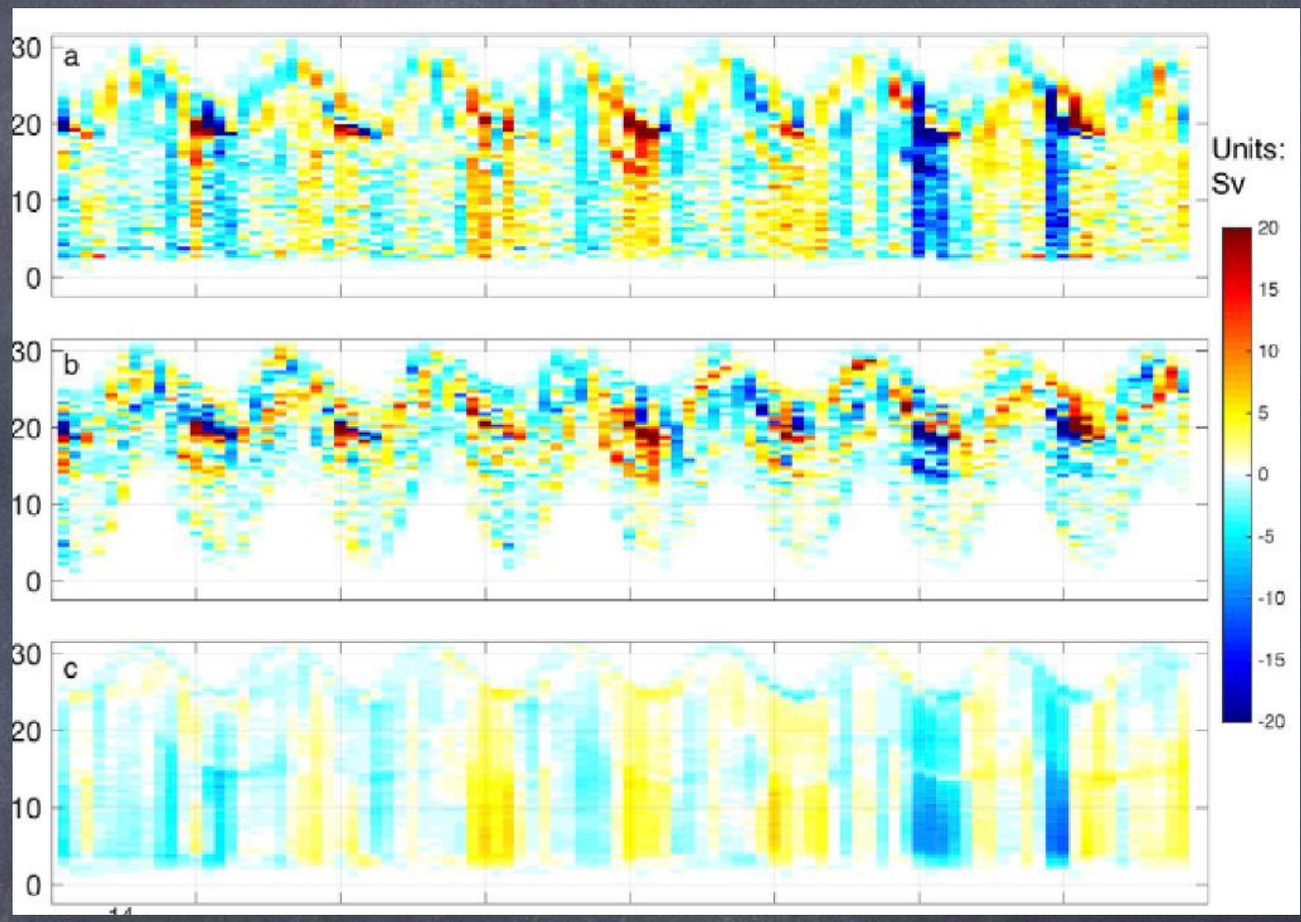
North Atlantic between 27N and 48N

Evans, Toole, Forget, Zika, Naveira Garabato, Nurser, Yu, 2017 (https://doi.org/10.1175/JPO-D-16-0089.1)

Gaël Forget

$dV_\theta(t) / dt$ (relatively sensitive)

2017/11/07

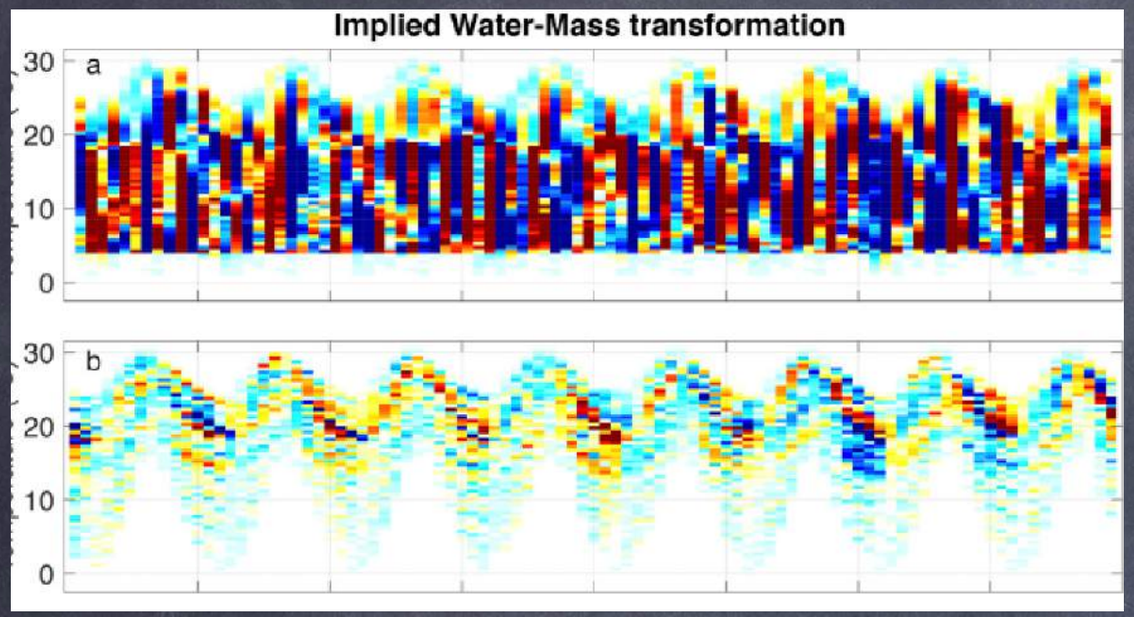


ECCO V4 R1 State Estimate
(incl. air-sea heat fluxes
and temperature advection)

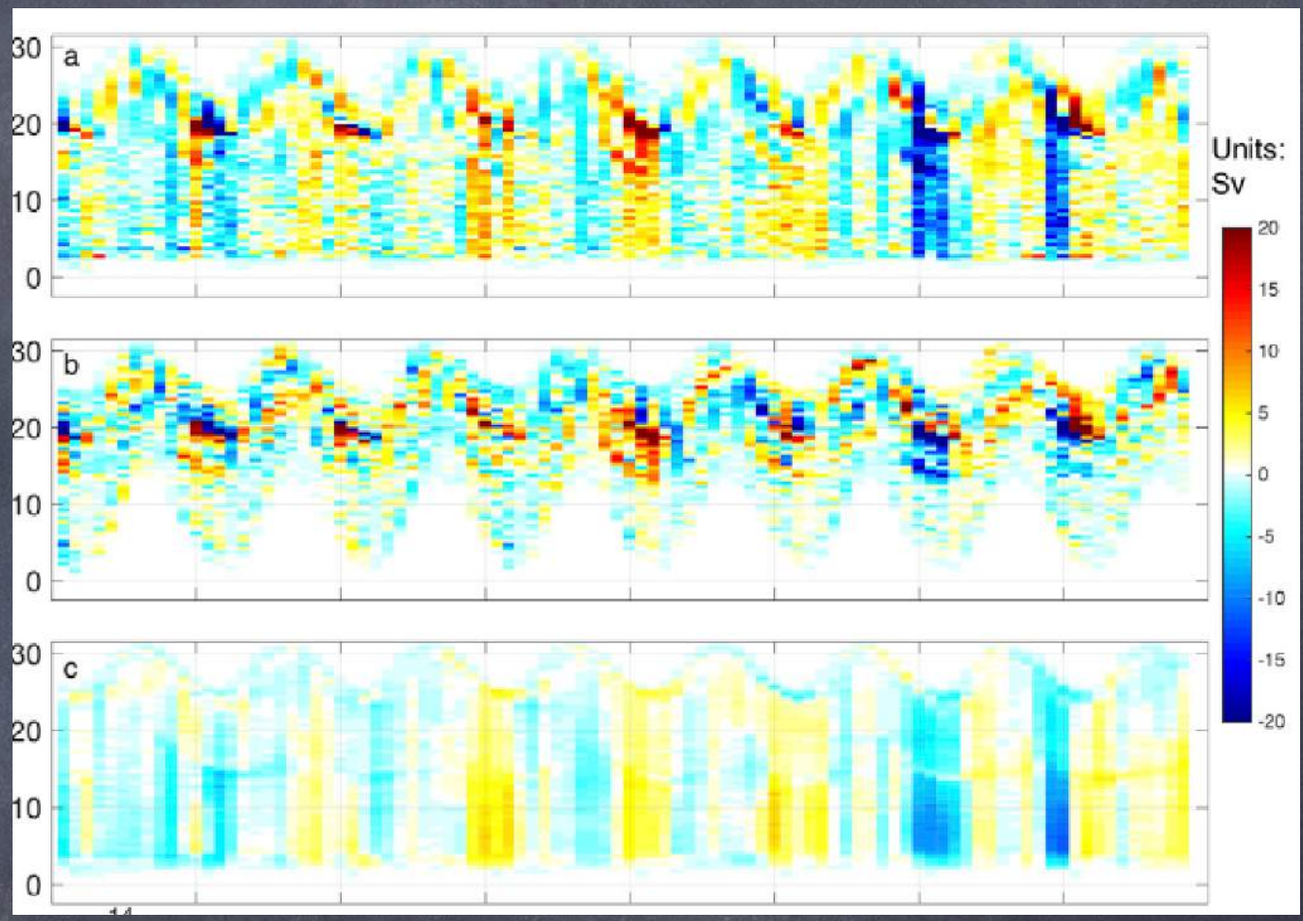
Gaël Forget

$dV_\theta(t) / dt$ (relatively sensitive)

2017/11/07



Roemmich And Gilson State Estimate + NCEP

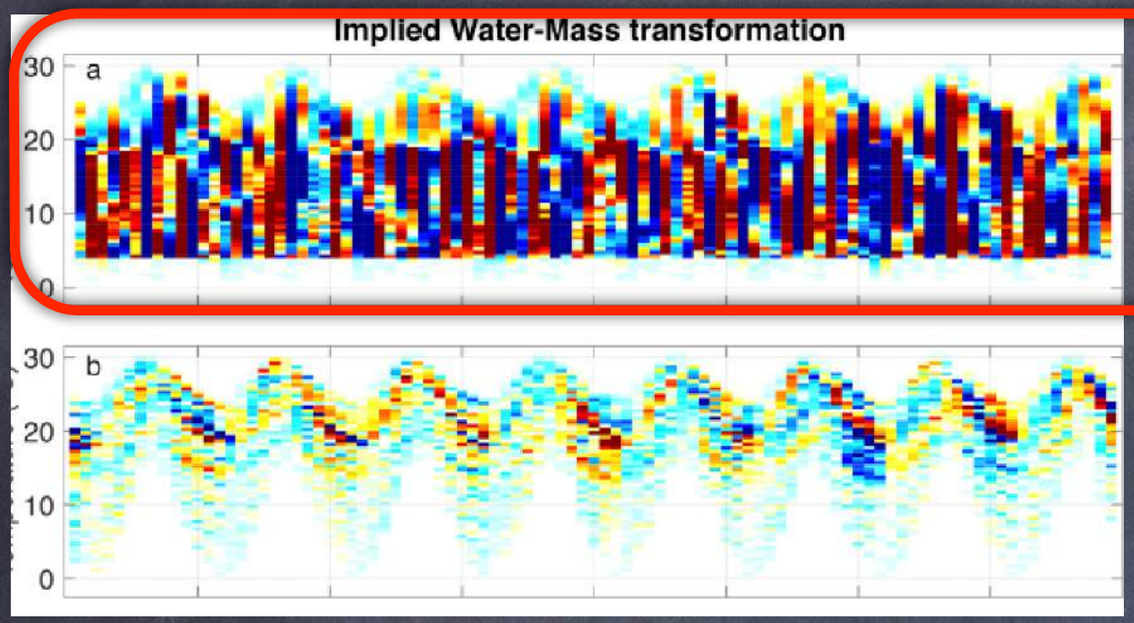


ECCO V4 R1 State Estimate (incl. air-sea heat fluxes and temperature advection)

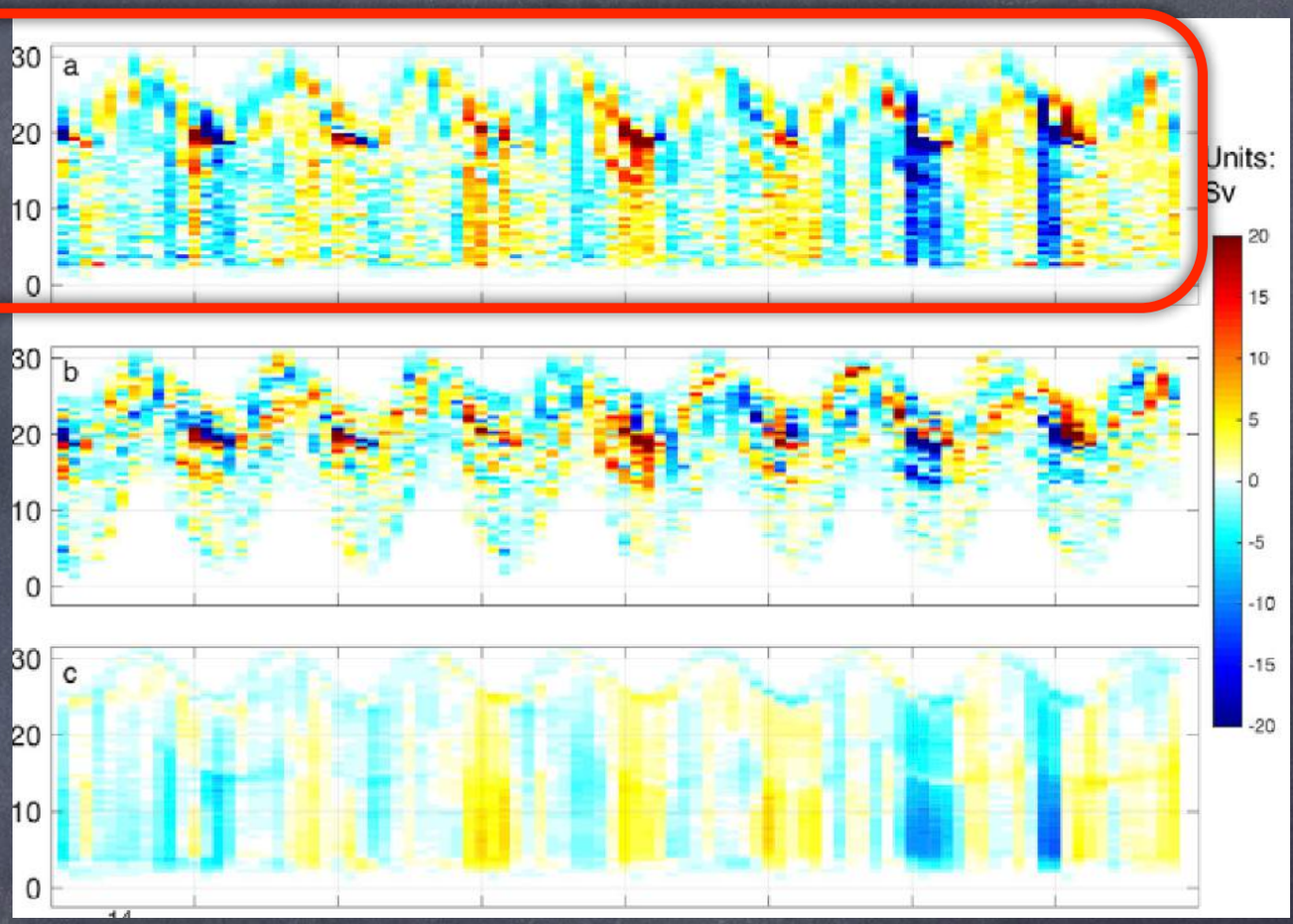
Gaël Forget

$dV_\theta(t) / dt$ (relatively sensitive)

2017/11/07



Roemmich And Gilson State Estimate + NCEP



ECCO V4 R1 State Estimate (incl. air-sea heat fluxes and temperature advection)

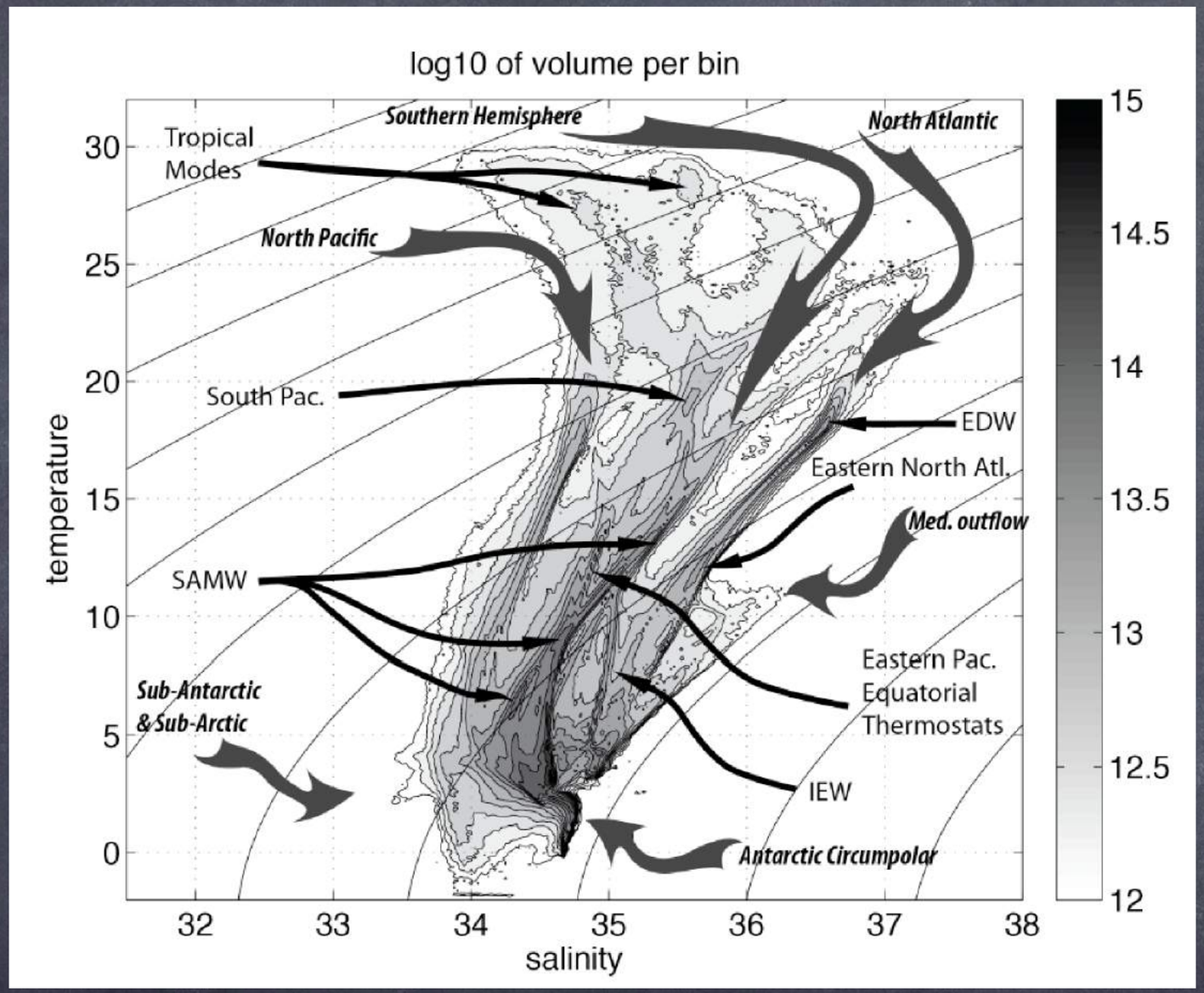
Gaël Forget	Presentation Outline	2017/11/06

- Structural uncertainty associated with water mass analyses and interpolation methods.
- Water mass census and budgets estimated from Argo profiles via interpolation-free methods.

Gaël Forget

Argo Volumetric Census (Worthington Framework)

2017/11/07

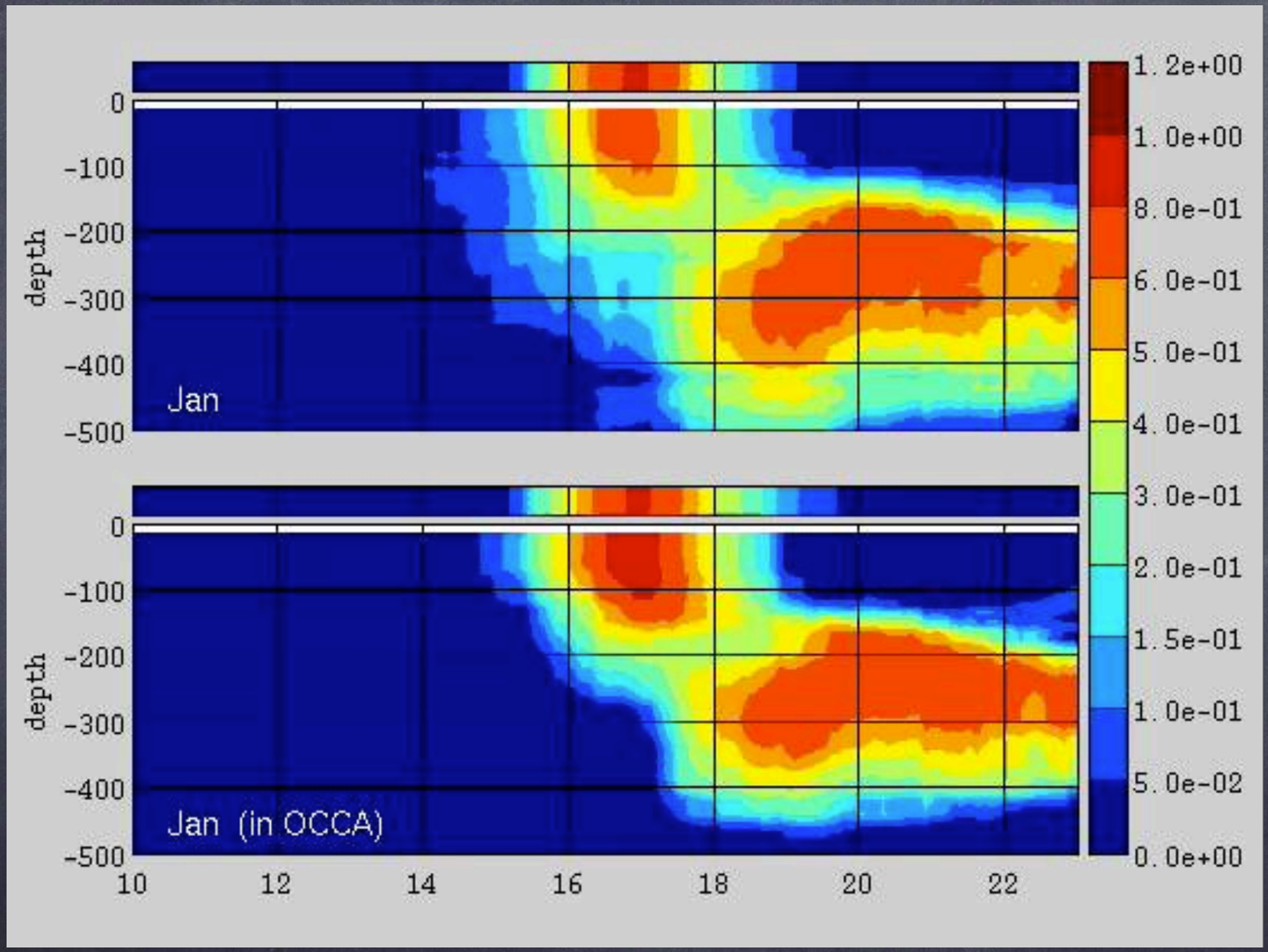


Speer and Forget 2013 (Global Distribution and Formation of Mode Waters; https://doi.org/10.1016/B978-0-12-391851-2.00009-X)

Gaël Forget

Monitoring North Atlantic Eighteen Degree Water

2017/11/07

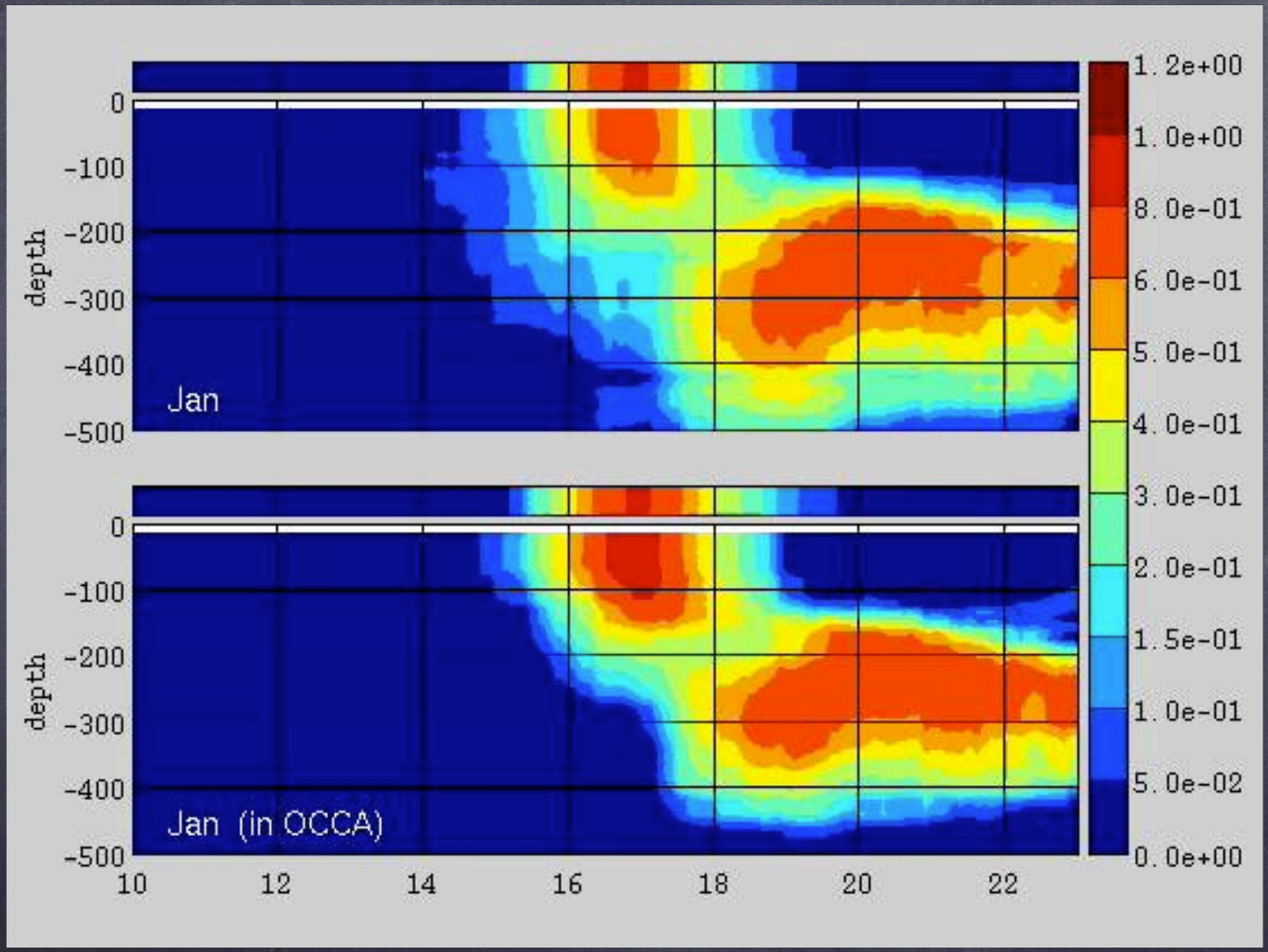


Forget, Maze, Buckley, Marshall, 2011
(https://doi.org/10.1175/2010JP04257.1)

Gaël Forget

Monitoring North Atlantic Eighteen Degree Water

2017/11/07

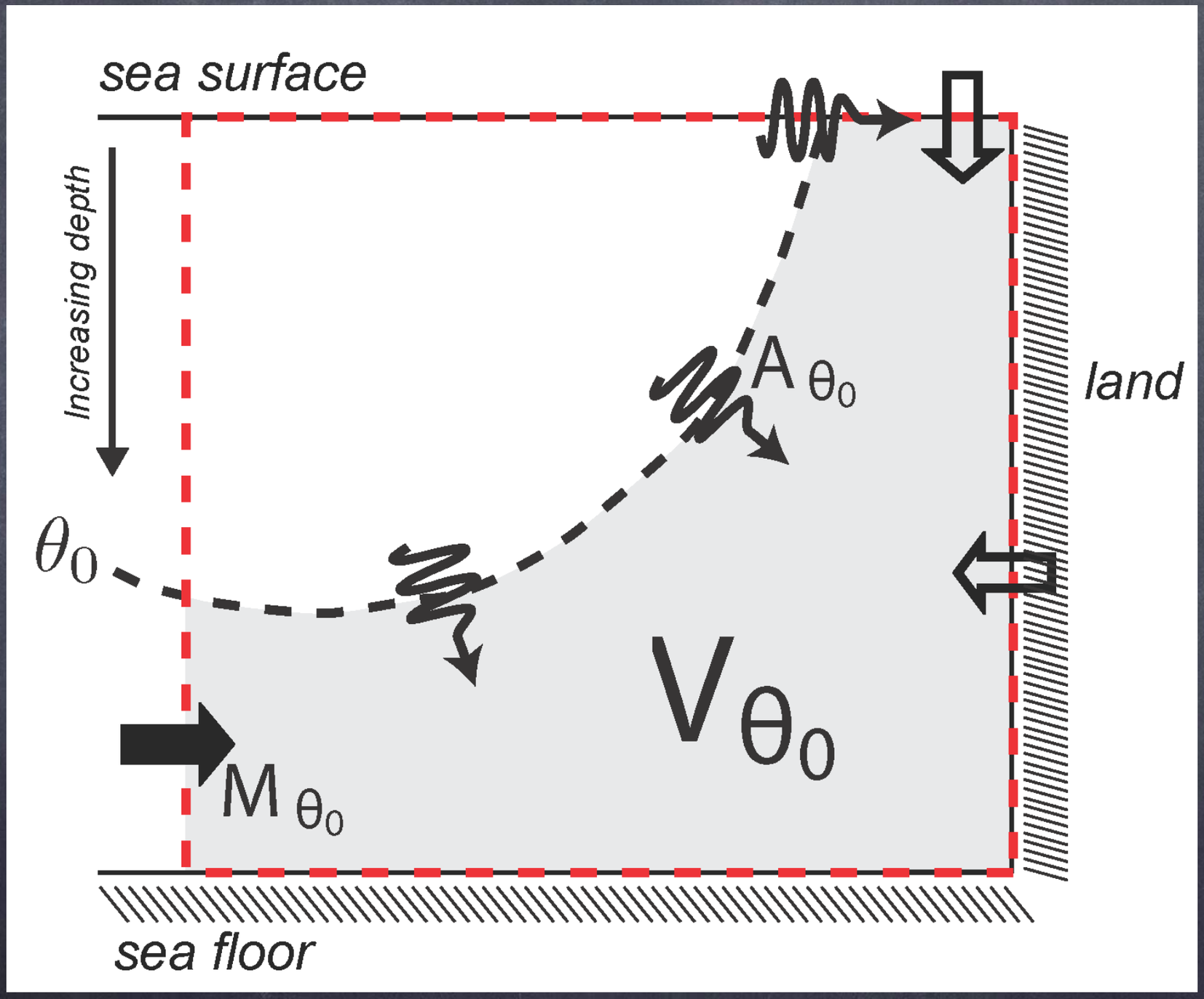


Forget, Maze, Buckley, Marshall, 2011
(https://doi.org/10.1175/2010JP04257.1)

Gaël Forget

Water Mass Budgets (Walin framework)

2017/11/07



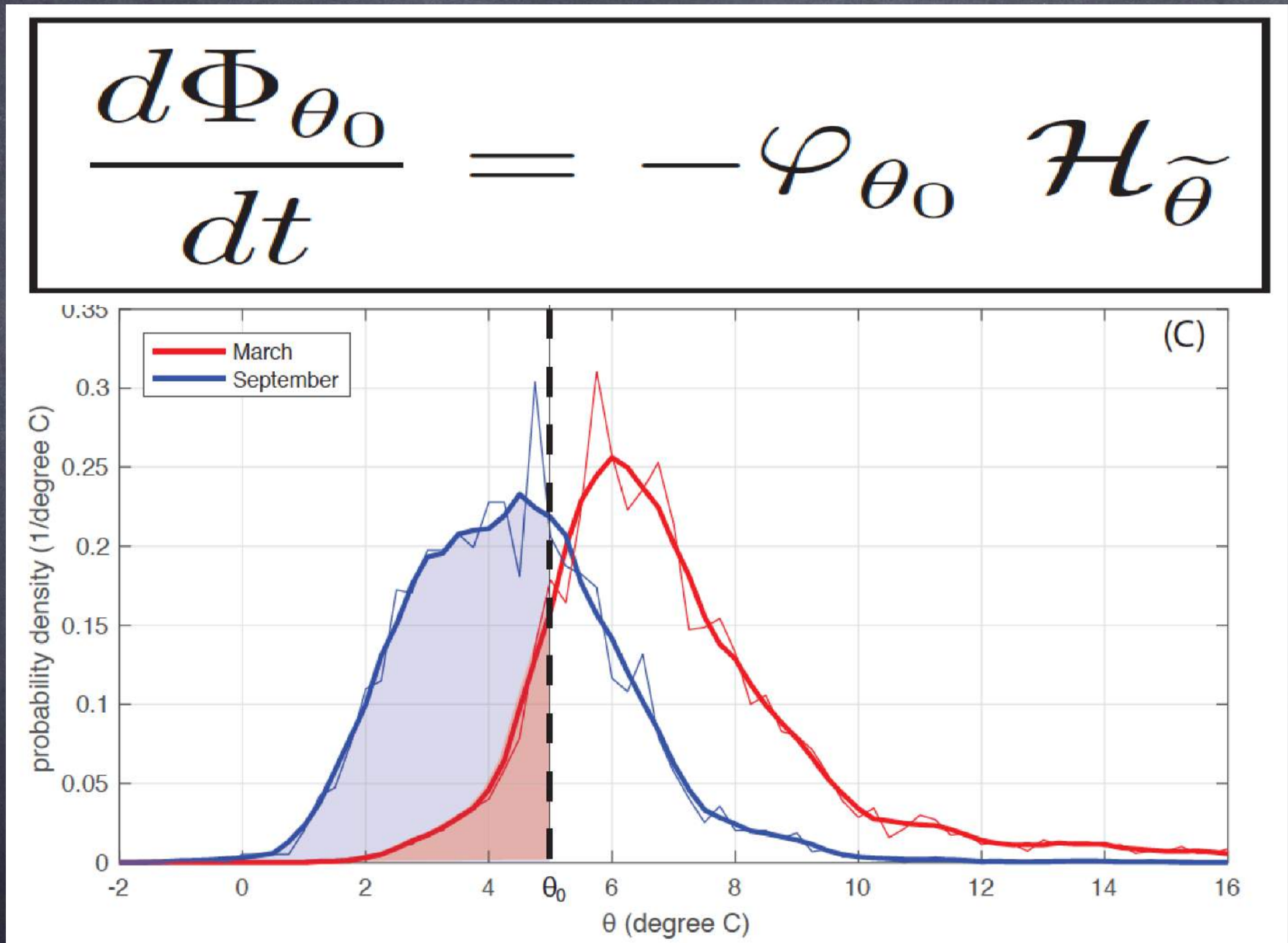
Adapted from Walin, 1982 (doi:10.1111/j.2153-3490.1982.tb01806.x)

Gaël Forget

Water Mass Budgets (Unified framework)

2017/11/07

$$\frac{d\Phi_{\theta_0}}{dt} = -\varphi_{\theta_0}\,\mathcal{H}_{\tilde{\theta}}$$

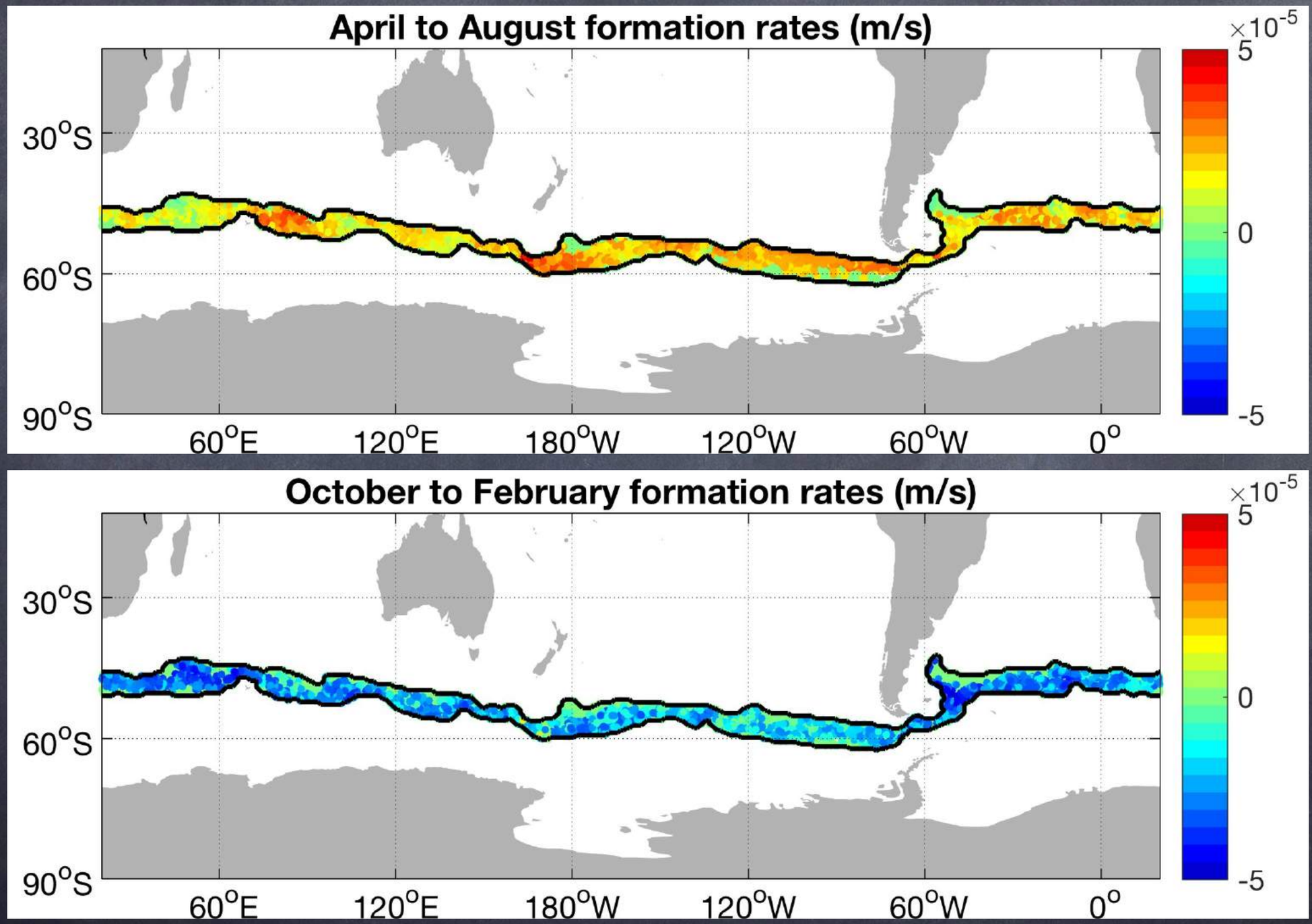


Forget, Maze, Marshall, Hill (in prep)

Gaël Forget

Local Transformation Rates (θ_0=5˚C, Argo θ, ECCO Qnet)

2017/11/07



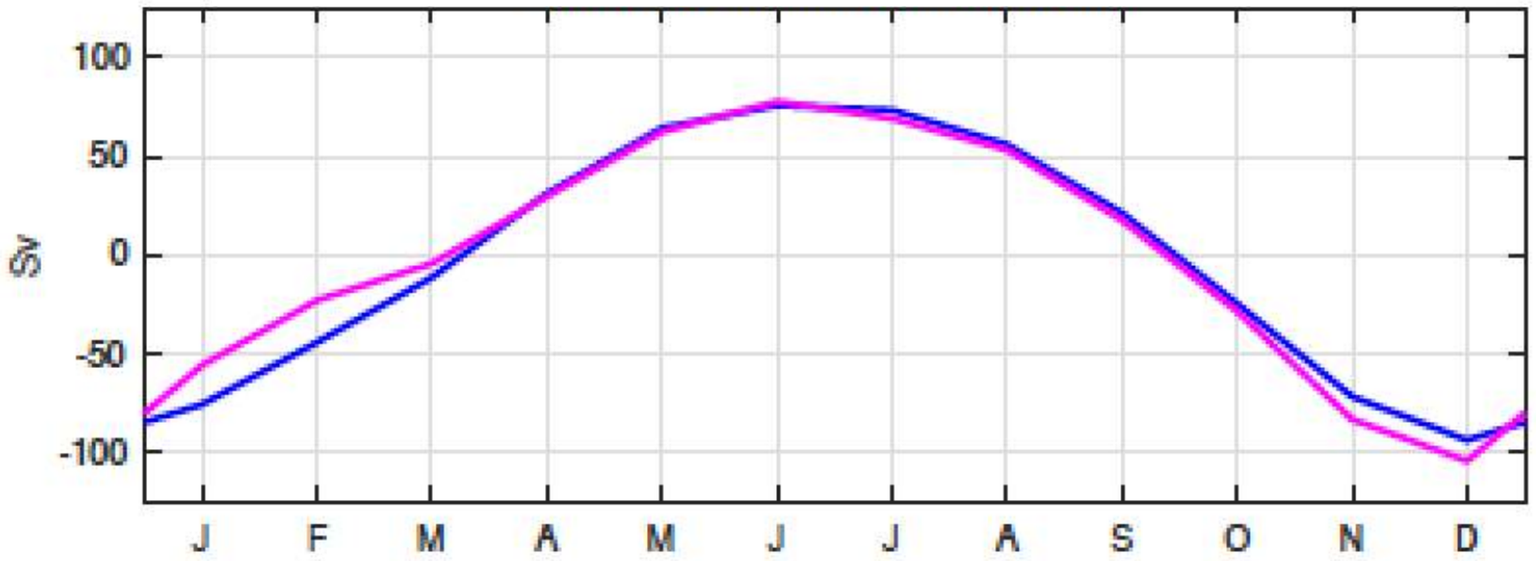
Forget, Maze, Marshall, Hill (in prep)

Gaël Forget

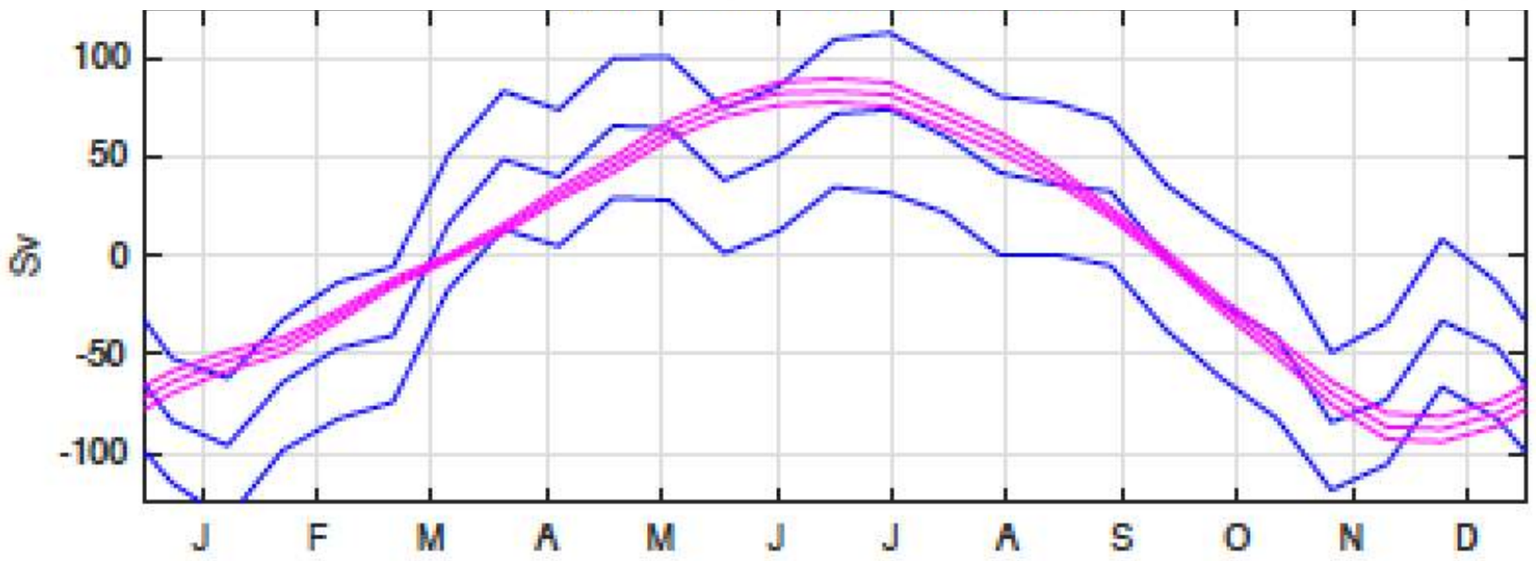
Water Mass Budgets (θ_0=5˚C, ACC, 0-700m)

2017/11/07

With Interpolation (ECCO v4 r2)



No Interpolation (95% bootstrap range)



Forget, Maze, Marshall, Hill (in prep)

Gaël Forget | **Summary & Discussion** | 2017/11/07

Gaël Forget	**Summary & Discussion**	2017/11/07

- Structural uncertainty associated with state estimation / interpolation methods should not be overlooked (see Forget et al. 2015, GMD, doi: 10.5194/gmd-8-3071-2015 for more on this).

Gaël Forget	**Summary & Discussion**	2017/11/07

- Structural uncertainty associated with state estimation / interpolation methods should not be overlooked (see Forget et al. 2015, GMD, doi: 10.5194/gmd-8-3071-2015 for more on this).

- Argo allows for interpolation-free water mass census and budget estimation. This approach readily yields uncertainty estimates associated with limited data coverage. It integrates Worthington & Walin.