

# **ECCO: Understanding Sea Level, Ice, and Earth's Climate**

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# **The effort aims to establish ECCO as a “community facility” for studying the ocean & climate**

1. Sustained production of the ECCO Central State Estimate,
2. Advance fidelity & capability of the ECCO analysis with a focus on improving understanding of sea level change,
  - include ocean-ice interaction (sea-ice, ice sheet/ice shelf)
  - eddy-permitting resolution
  - tides, SAL, surface pressure
3. Support and foster community utilization of ECCO products.

# 1. Sustained Production

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- ❑ Version 4 Release 3 (V4r3; 1992-2015) was released in July 2017,
  
- ❑ V4r3 is being extended to end of 2017 and will be released by EOY,
  - Updated data (altimetry, GRACE, TS profiles),
  - Updated model (e.g., sea-ice time-stepping scheme),
  - Optimization strategy: optimize 2014-2017 separately before optimizing the entire 26-year 1992-2017 estimate so as to minimize computational requirements,
  
- ❑ V4r3, along with other legacy products, are being served via a revamped ECCO website ([ecco.jpl.nasa.gov](http://ecco.jpl.nasa.gov) or [ecco-group.org](http://ecco-group.org)). V4r3 is also mirrored at UT Austin (<http://web.corral.tacc.utexas.edu/OceanProjects/ECCO/ECCOv4/Release3/>)

## 2a. Including Ice Shelf/Ice Sheet

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### ❑ Physics:

Merged MITgcm's shelf-ice and ice-front packages into a single "land ice" package, allowing ocean's interaction with ice shelf/ice sheet both vertically and horizontally,

### ❑ Model Configuration:

Revised V4's geometry (bathymetry) to include interfaces between ocean and ice shelf/ice sheet around Antarctica,

### ❑ Control:

Activated a bulk parameter in the ocean-land ice exchange so as to control the melt,

### ❑ Experiment:

Optimization over a 1-year period, constrained by ice shelf melt data.

## 2b. Eddy-Permitting Central Estimate

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- ❑ Version 5 pre-release (alpha) global llc270 solution (2001-2015) downloadable on ECCO ftp site
  - Based on the ECCO v4 R1 cost function formulation
  - 60S~60N: ~28km; high-latitude: ~12km
- ❑ Extension of time period to 1992-2017
  - The solution was extended to 2017 and then back from 1992 using updated data constraints (sea-ice, altimetry, GRACE, TS profiles).
- ❑ Optimization strategy:
  - First optimize 2001-2015.
  - Assume time-invariant mixing coefficients and ERA interim atmospheric reanalysis bias corrections
  - Use these optimized mixing coefficients and mean reanalysis bias corrections to extend solution over 1992-2017 window
  - Continue iterations

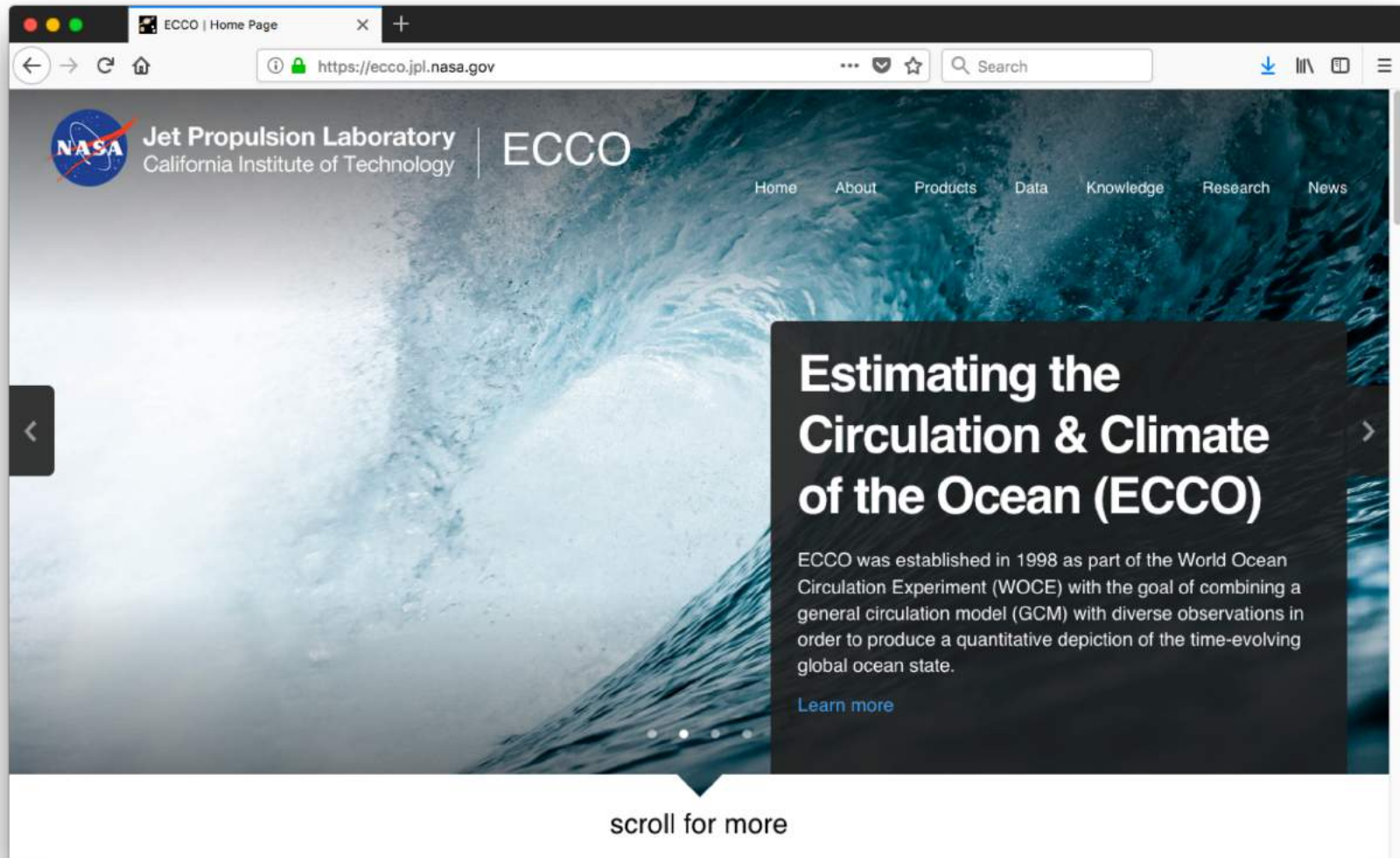
## 2b. Eddy-Permitting Central Estimate (cont.)

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- ❑ Transition to llc270 setup as Central Production in 2019
- ❑ Benefits:
  - Better representation of ice shelf cavities (marginally)
  - Solution is already well optimized and compares favorably to V4 R3 in terms of misfit
  - Can directly incorporate knowledge gained during ASTE optimization (both setups on same resolution) to improve representation of the Arctic Ocean circulation
- ❑ Challenges:
  - Far more computationally expensive, one complete iteration takes 5-8 days depending on queue.
  - 9X greater storage requirements
  - Next experimental resolution: llc540 [ $1/6^\circ$ ] or llc1080 [ $1/12^\circ$ ]?

# 3a. Revamped ECCO Website

<https://ecco.jpl.nasa.gov> (redirected from ecco-group.org)





# 3b. ECCO Publication List (Mendeley)

## Mendeley Desktop (User ID ecco.consortium@gmail.com)

The screenshot displays the Mendeley Desktop interface. The main window shows a list of documents under the 'All Documents' tab. The selected document is 'Hidden founders? Strong bottlenecks and fine-scale genetic structure in mangrove populations of the Cameroon Estuary complex' by Ngeve, Magdalene N; der Stocken, Tom; Menemenlis, Dimitris, published in 2017 in *Hydrobiologia*.

★	●	📄	Authors	Title	Year	Published In	Added
★	●	📄	Ngeve, Magdalene N; der Stocken, Tom; Menemenlis, Dimitris	Hidden founders? Strong bottlenecks and fine-scale genetic structure in mangrove populations of the Cameroon Estuary complex	2017	Hydrobiologia	Oct 22
★	●	📄	Triest, Ludwig; Sierens, Tim; Menemenlis, Dimitris	Inferring Connectivity Range in Submerged Aquatic Populations (Ruppia L.) Along European Coastal Lagoons	2018	Frontiers in Plant Science	Oct 22
★	●	📄	Van der Stocken, Tom; Menemenlis, Dimitris	Modelling mangrove propagule dispersal trajectories using high-resolution estimates of ocean surface wind	2017	Biotropica	Oct 22
★	●	📄	Zhang, Ying; Feng, Ming; Du, Yan; Phillips, Helen E.	Strengthened Indonesian Throughflow Drives Decadal Warming in the Southern Indian Ocean	2018	Geophysical Research Lett...	Aug 21
★	●	📄	Wilson, Nat; Straneo, Fiammetta; Heimbach, P.	Satellite-derived submarine melt rates and mass balance (2011–2015) for Greenland's largest remnant ice sheet	2017	The Cryosphere	Jul 30
★	●	📄	Fukumori, Ichiro; Heimbach, Patrick; Ponte, Rui	A Dynamically Consistent, Multi-Variable Ocean Climatology	2018	Bulletin of the American Meteorological Society	Jul 30
★	●	📄	Jordan, James R; Holland, Paul R; Goldberg, Dan; Smeets, Gert	Ocean-Forced Ice-Shelf Thinning in a Synchronously Coupled Ice-Ocean Model	2018	Journal of Geophysical Research	Jul 30
★	●	📄	Khatriwala, Samar; Graven, Heather; Payne, Sarah; Heimbach, Patrick	Changes to the Air-Sea Flux and Distribution of Radiocarbon in the Ocean Over the 21st Century	2018	Geophysical Research Lett...	Jul 30
★	●	📄	Clayton, Sophie; Dutkiewicz, Stephanie; Jochum, M	Biogeochemical versus ecological consequences of modeled ocean physics	2017	Biogeosciences	Jul 30
★	●	📄	Sonnenwald, Maik; Wunsch, Carl; Heimbach, Patrick	Linear Predictability: A Sea Surface Height Case Study	2018	Journal of Climate	Jul 30
★	●	📄	Nicholson, D P; Khatriwala, S; Heimbach, P	Noble gas tracers of ventilation during deep-water formation in the Weddell Sea	2016	Journal of Geophysical Research	Jul 30
★	●	📄	Wunsch, Carl	Towards determining uncertainties in global oceanic mean values of heat, salt, and surface elevation	2018	Tellus A: Dynamic Meteorology	Jul 30
★	●	📄	Goldberg, D N; Snow, K; Holland, P; Jordan, J R; Smeets, G	Representing grounding line migration in synchronous coupling between a marine ice sheet model and a z-coupled ice-ocean model	2018	Ocean Modelling	Jul 30
★	●	📄	Nguyen, An; Ocaña, Victor; Garg, Vikram; Heimbach, Patrick	On the Benefit of Current and Future ALPS Data for Improving Arctic Coupled Ocean-Sea Ice State Estimation	2017	Oceanography	Jul 30
★	●	📄	Ferreira, David; Cessi, Paola; Coxall, Helen K; d'Arrigo, G	Atlantic-Pacific Asymmetry in Deep Water Formation	2018	Annual Review of Earth and Planetary Sciences	Jul 24
★	●	📄	Vinogradova, Nadya; Lee, Tong; Durack, Paul; Boutin, M	Ocean Salinity and the Water Cycle: Recent Progress and Future Challenges	2016	GEWEX News	Jul 17
★	●	📄	Vinogradova, Nadya; Ponte, Rui; Stammer, Detlef	Relation between sea level and bottom pressure and the vertical dependence of oceanic variability	2007	Geophysical Research Lett...	Jul 17
★	●	📄	Vinogradova, Nadya; Ponte, Rui; Tamisieva, Marina	Self-attraction and loading effects on ocean mass redistribution at monthly and longer time scales	2011	Journal of Geophysical Research	Jul 17
★	●	📄	Davis, James; Vinogradova, Nadya	Causes of accelerating sea level on the East Coast of North America	2017	Geophysical Research Lett...	Jul 17
★	●	📄	The ATOC Consortium	Ocean Climate Change: Comparison of Acoustic Tomography, Satellite Altimetry, and Modeling	1998	Science	Jul 17
★	●	📄	Hirose, Naoki; Fukumori, Ichiro; Kim, Cheol-Ho; Yoshida, T	Numerical simulation and satellite altimeter data assimilation of the Japan Sea circulation	2005	Deep Sea Research Part B: Oceanographic Observations	Jul 17
★	●	📄	Cheng, B. N.	A duality between forward and adjoint MPI communication routines	2006	Comput. Methods Sci. Technol.	Jul 17
★	●	📄	Lee, Tong; Liu, Timothy W.	Effects of high-frequency wind sampling on simulated mixed layer depth and upper ocean temperature	2005	Journal of Geophysical Research	Jul 17

The right-hand pane shows the details for the selected article:

- Type: Journal Article
- Title: Hidden founders? Strong bottlenecks and fine-scale genetic structure in mangrove populations of the Cameroon Estuary complex
- Authors: M. Ngeve, T. der Stocken, D. Menemenlis et al.
- Journal: *Hydrobiologia*
- Year: 2017
- Volume: 803
- Issue: 1
- Pages: 189-207
- Abstract: Fine-scale genetic structure (FSGS) is common in plants, driven by several ecological and evolutionary processes, among which is gene flow. Mangrove trees rely on ocean surface currents to spread their hydrochorous propagules through space. Since pollen dispersal is generally restricted to local scales, high level of short-distance propagule dispersal is expected to result in FSGS in *Rhizophora* spp. We investigated FSGS, recent bottleneck events, as well as historical and contemporary expansion patterns in *Rhizophora racemosa* populations from the entire coast of Cameroon, using 11 polymorphic microsatellite markers. Populations of the Cameroon Estuary complex (CEC) showed significant FSGS and significant reduction in effective population sizes (recent bottlenecks), compared to the other areas. Additionally, our results indicate stark differences between historical and contemporary expansion models. T...
- Tags:
- Author Keywords:
- Citation Key: Ngeve2017
- Month: November
- Type of Work: article
- URL: <https://doi.org/10.1007/s10750-017-3369-y>

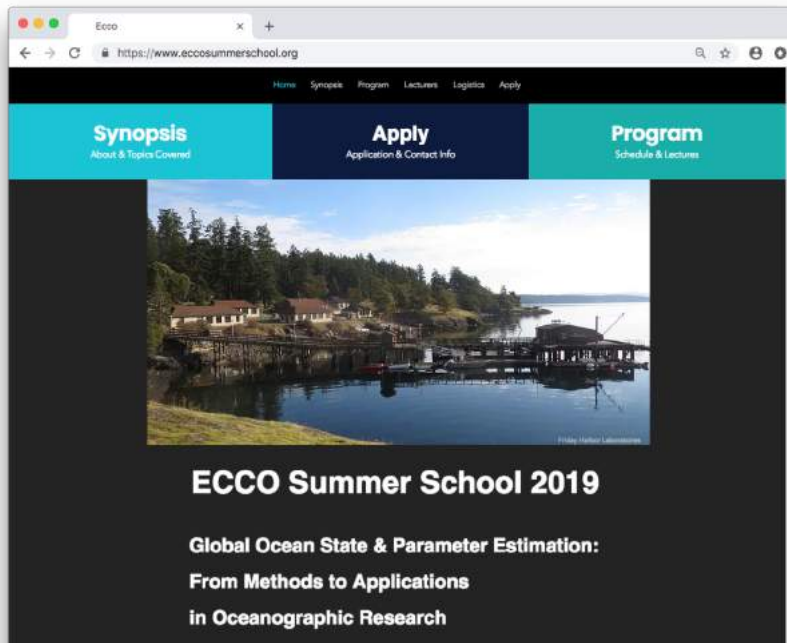


## 3c. Workshops and Summer School

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Informing the community of what ECCO offers and how to use them.

- ❑ ECCO Workshop at 2018 Ocean Sciences Meeting (Portland, OR),
- ❑ ECCO Townhall Meeting at 2018 AGU (Washington, DC),
- ❑ ECCO Summer School, 19-31 May 2019, Friday Harbor Labs,



<https://www.eccosummerschool.org/>

- ~30 students
- ~20 lecturers, half from outside ECCO
- Introduce state estimation and its application through lectures, tutorials, and hands-on projects.

## 3d. ECCO Symposium

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Symposium to mark the 20<sup>th</sup> anniversary of ECCO

- 11-12 September 2019,
- Seaside Forum, Scripps Institution of Oceanography,
- Looking back on progress and looking ahead into the future.

