SWOT Data Inversion and Assimilation Working Group

Status and Plans
September 2021

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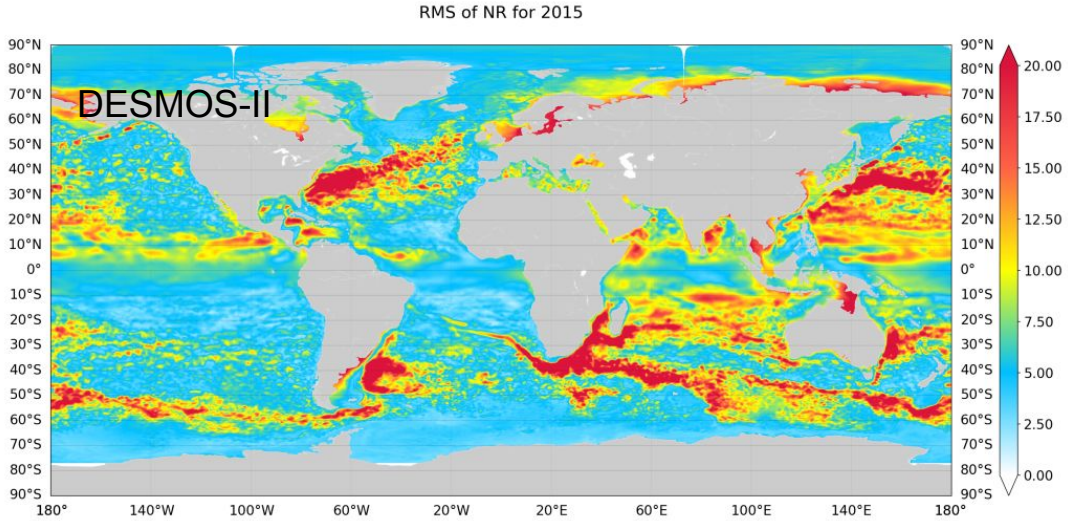
Goals and approach

- Facilitate collaboration across science team for mapping and assimilation problems
- (Bi)monthly thematic meetings, open to anyone
- Themes chosen from both domain and method perspectives
- Share announcements for other relevant events (e.g. SIO webinars)



OSSEs in the global high resolution Mercator Ocean data assimilation system (1/12°) (the "truth run" is derived from a different 1/12° model): three nadir altimeters (OSSE1), SWOT (OSSE2) and SWOT combined with the three nadir altimeters (OSSE3)

Le Traon, Benkiran, B. Tchonang, Y. Faugère (Benkiran et al 2021; Tchonang et al 2021)

Meeting themes

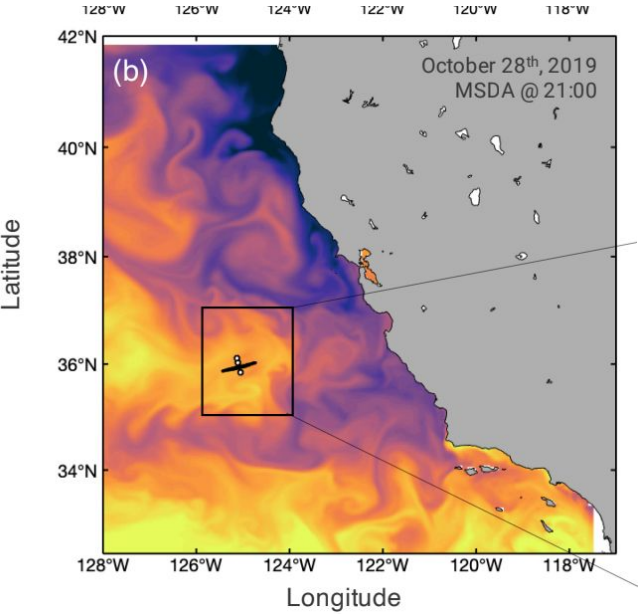
Regions

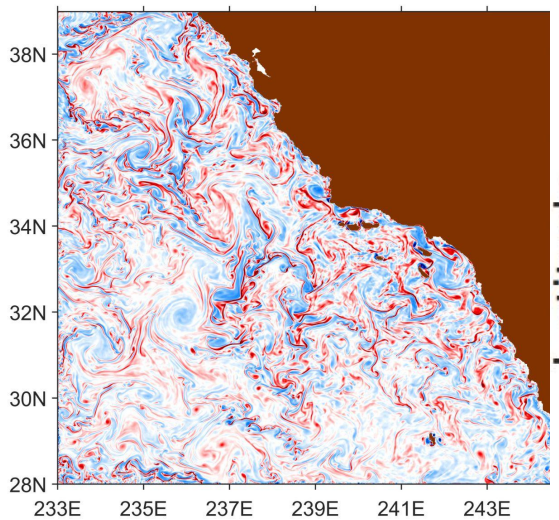
- California Current high-resolution mapping for pre-CalVal and CalVal domain (held on April 26)
- Inversion and assimilation in the Mediterranean Sea (planned October 13)

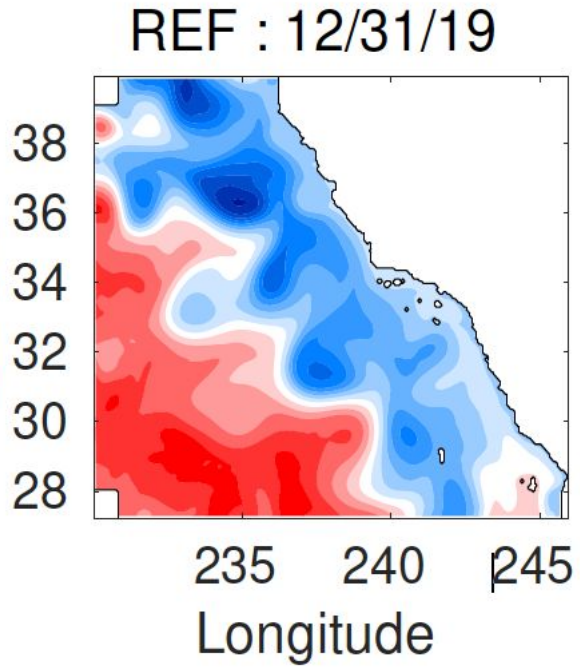
Methods

- Eddy/wave separation (co-organized with the tides WG, held on June 1)
- Metrics for assessing assimilation (Fall 2021)

California Current assimilation (April meeting)







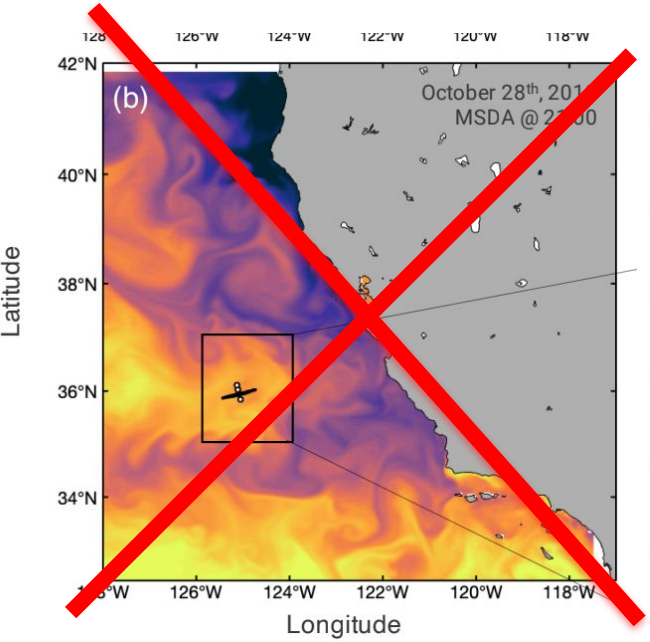
JPL: multi-scale 3-D Var using ROMS

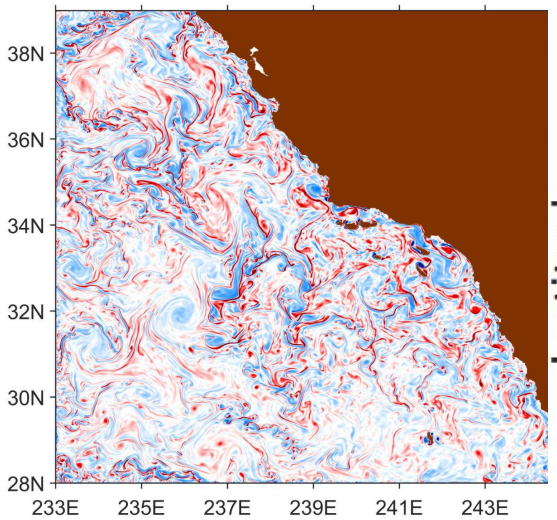
NRL: NCOM-3DVAR (1 km)

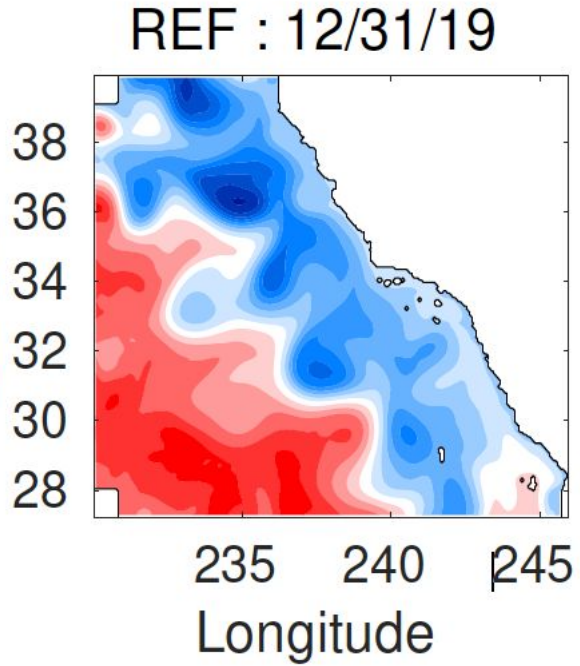
SIO: 4-D Var using MITgcm

Goals: (1) pre-CalVal (Autumn 2019) assimilation AND (2) preparation for SWOT assimilation (e.g. OSSEs)

California Current assimilation (now)







JPL: multi-scale 3-D Var using ROMS

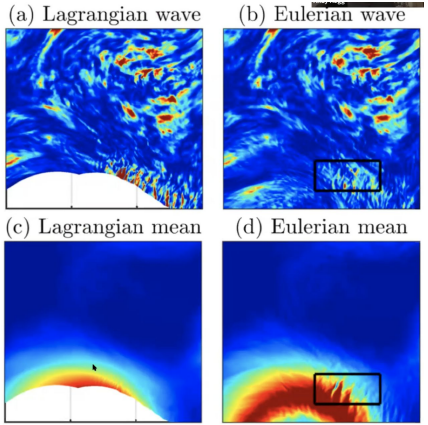
NRL: NCOM-3DVAR (1 km)

SIO and JPL: 4-D Var using MITgcm

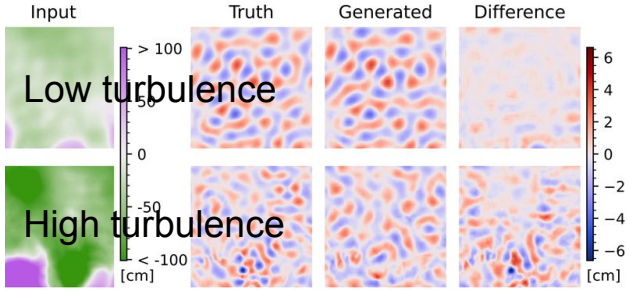
Focus on California Current for CalVal; intercomparisons not limited to groups listed here

Separating internal waves from balanced motions in SWOT
Joint workshop with Tides/IGW WG - June 2021

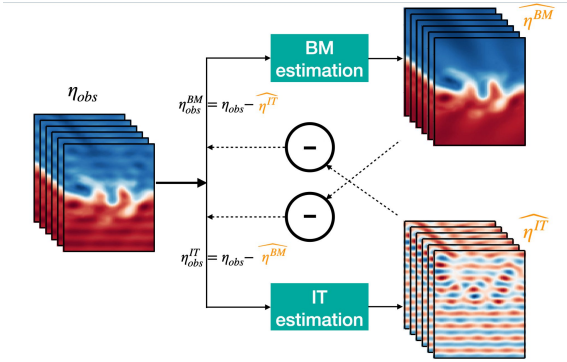
Lagrangian filtering (Andy Hogg/Spencer Jones)
- provides rigorous benchmark to test separation methods



Deep learning (Han Wang, Nicholas Grisourd) - First steps with simple setup are encouraging. High turbulence makes internal tides incoherent and separation difficult.



Iterative back-and-forth nudging + 4DVar (Florian Le Guillou et al.) - First steps with simple setup are encouraging. High turbulence makes internal tides incoherent and separation difficult.



Diversity of approaches with good results in idealized setups - but none yet ready for real SWOT data…

“Med Sea” meeting: plans

- Will take place on Oct 13, 4 pm-5 pm CET (7 am-8 am PDT).
- Focus on how to implement and coordinate inversion/assimilation activities for the CalVal campaign
- presentation of the scientific challenges, field campaigns, already planned I/A activities, relevant scientific results
- Open discussion
- Colleagues ready to propose tools, data or workforce are welcome!

SWOT Data Inversion and Assimilation Working Group
Discussion on Metrics

How to quantify the contribution of SWOT for ocean analysis and forecasting ?

Various metrics (RMSE, spectra, coherence analysis, lagrangian diagnostics…) have been used in different articles (See D'Addezio et al., 2019; Le Guillou et al., 2021; Jacobs et al, 2021; Tchonang et al., 2021…)

Can we define useful/common metrics to facilitate the intercomparison of results between SWOT science teams both for simulated data (eg OSSEs) and real data (OSEs) ?

A 2 h workshop to review present/future OSE/OSSE activities in the different SWOT teams focusing on metrics. Tentatively Autumn 2021.

Contributing teams: NRL, IGE, Scripps, CLS, Met Office, Mercator Ocean, etc

Next steps:

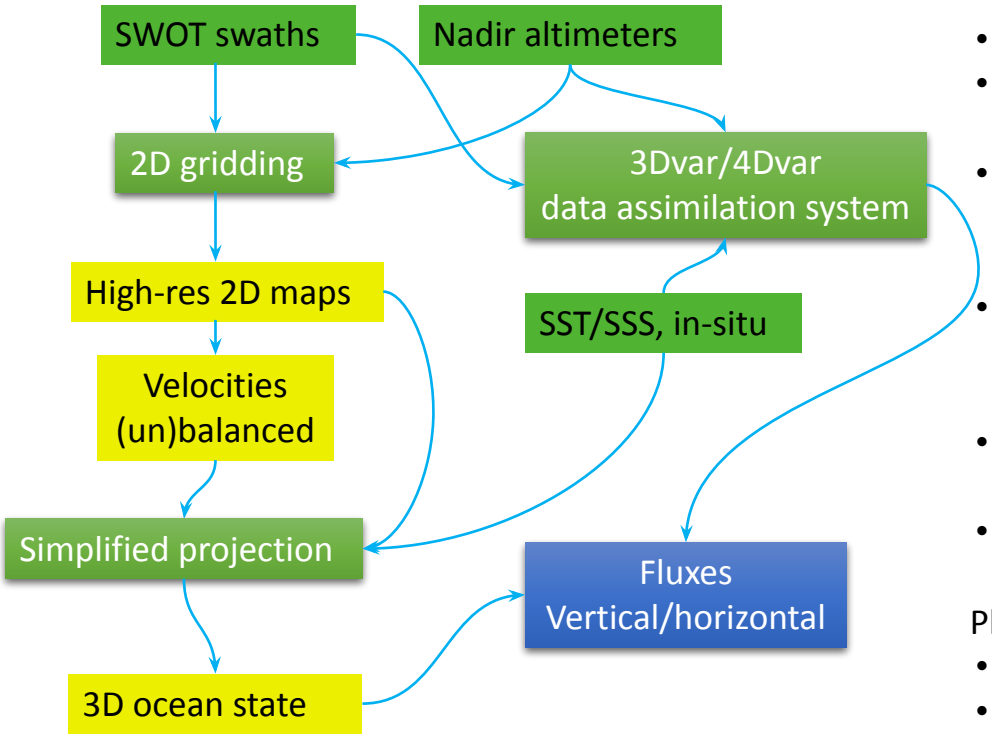
Continue working group discussions (Contact Sarah at sgille@ucsd.edu to join list.)

Include global as well as regional perspectives

Data Challenge (*Any interest in participating?)*

- Idea initiated last year, reactivated in e-mail discussions following the separation meeting
- A written document has been initiated
- Obstacles:
  - Identify problem(s) relevant for a wide community: could focus on a region, on metrics, on a common input data set
  - Identify model fields to use as “truth”
  - Removal of barotropic tide from a simulation
  - Time availability. Identify people to design, set up, and play.

Potential roadmap to post-calval SWOT data products with cross-team collaborations



Phase 1, Pre-calval (now – June 2023)

- prepare nature runs (modelling group)
- Synthetic swot (algorithm team, simulator)
- Provide a common cloud-based working environment, host the synthetic data in the cloud (PO.DAAC/AVISO)
- Experiment/select algorithms for 2D gridding, 3D inversion based on the results with the synthetic swot data (data inversion (this) group)
- Define L3 products with a lower resolution, reduced noise, and smaller data volume (algorithm team, mission)
- Xover locations (SWOT Cal/Val, AdAC working group), provide the prototype of the 2D/3D products
- Establish cloud-based data production pipeline (PO.DAAC/AVISO)

Phase 2, post-calval (June, 2023 --)

- Apply the selected algorithm for L3 and L4 products
- Apply algorithm in the cloud for data production.
- Extended cal/val by combining mission calval, AdAC, global drifters, Argo networks etc.