

Toward budget-conserving ocean-atmosphere-cryosphere-land reanalyses

POS Panel term of reference #5:

In consultation with other groups, assess and prioritize plans, and coordinate activities that lead to syntheses of observations and models in order to develop **consistent four dimensional climate products** (i.e., climate reanalyses).

What does this mean?

How far along are we?

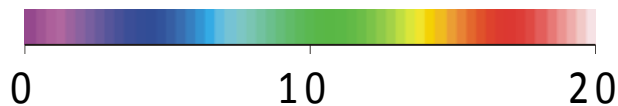
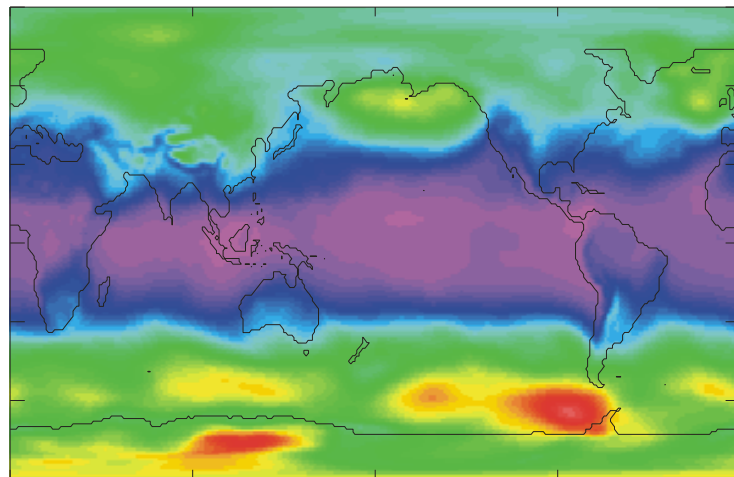
How do we move forward?

Importance of a physically consistent solution

Atmospheric reanalyses contain large air-sea flux imbalances. For example, the NCEP/NCAR reanalysis has an ocean freshwater flux imbalance of **6.2 cm/yr**, about 20 times larger than the observed **3 mm/yr** sea level rise.

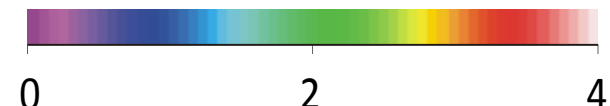
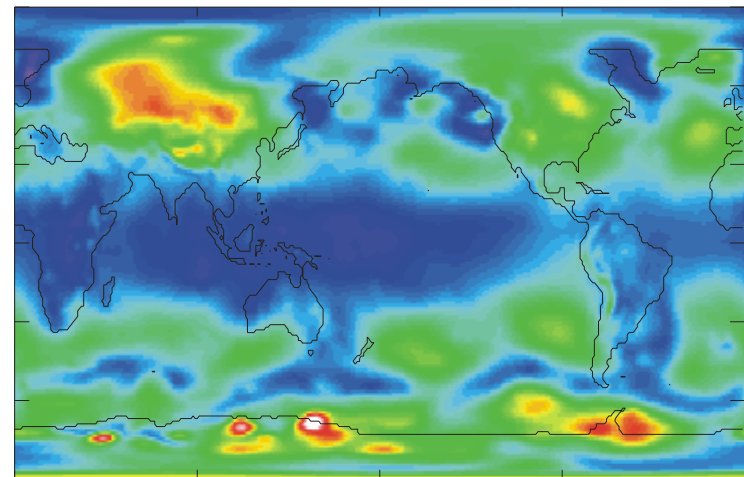
They also contain discontinuities during “assimilation” updates. For example, standard deviation of NCEP **surface pressure** analysis shows that **24%** of the atmosphere’s mass change is physically **unaccounted for** (I. Fukumori, JPL).

Change over 6-hours



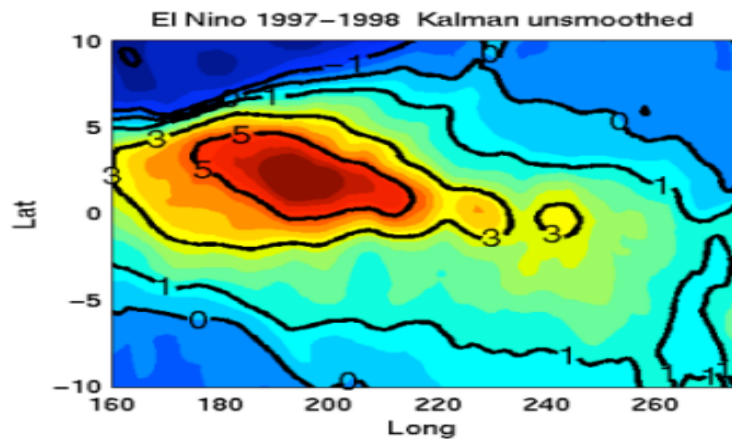
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Data Increment

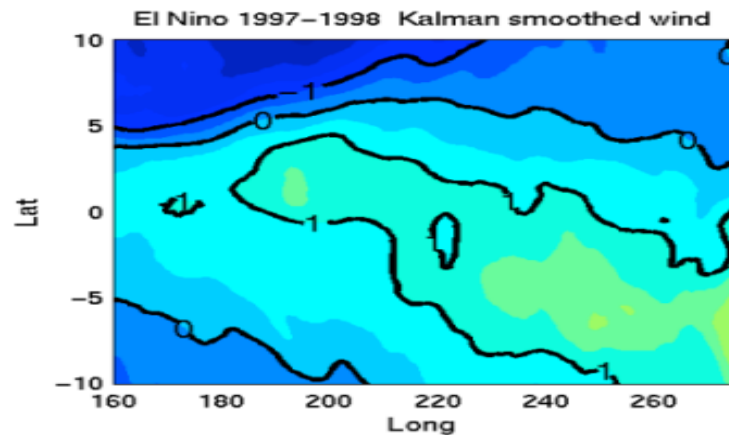


Example tracer application: CO₂ Sea Air Flux

Estimate of CO₂ flux during 97-98 El Niño (mol/m²/yr) based on Kalman filter solution

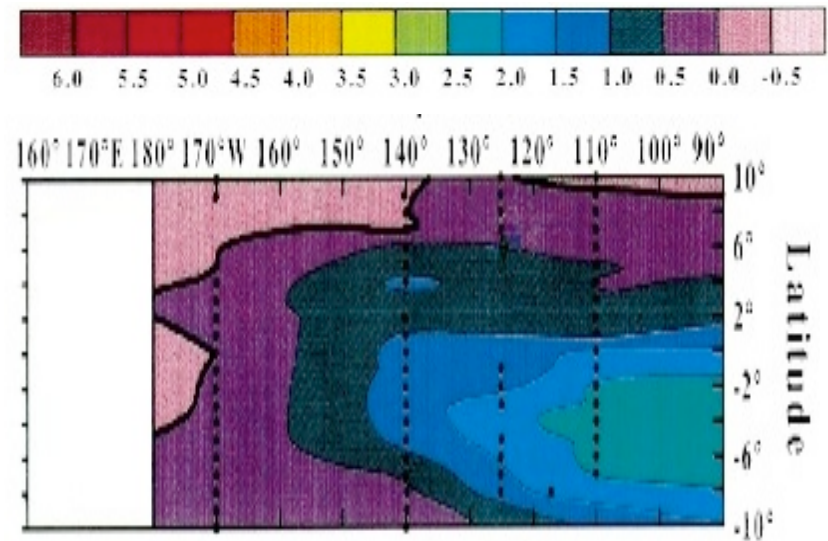


Estimate based on smoothed solution



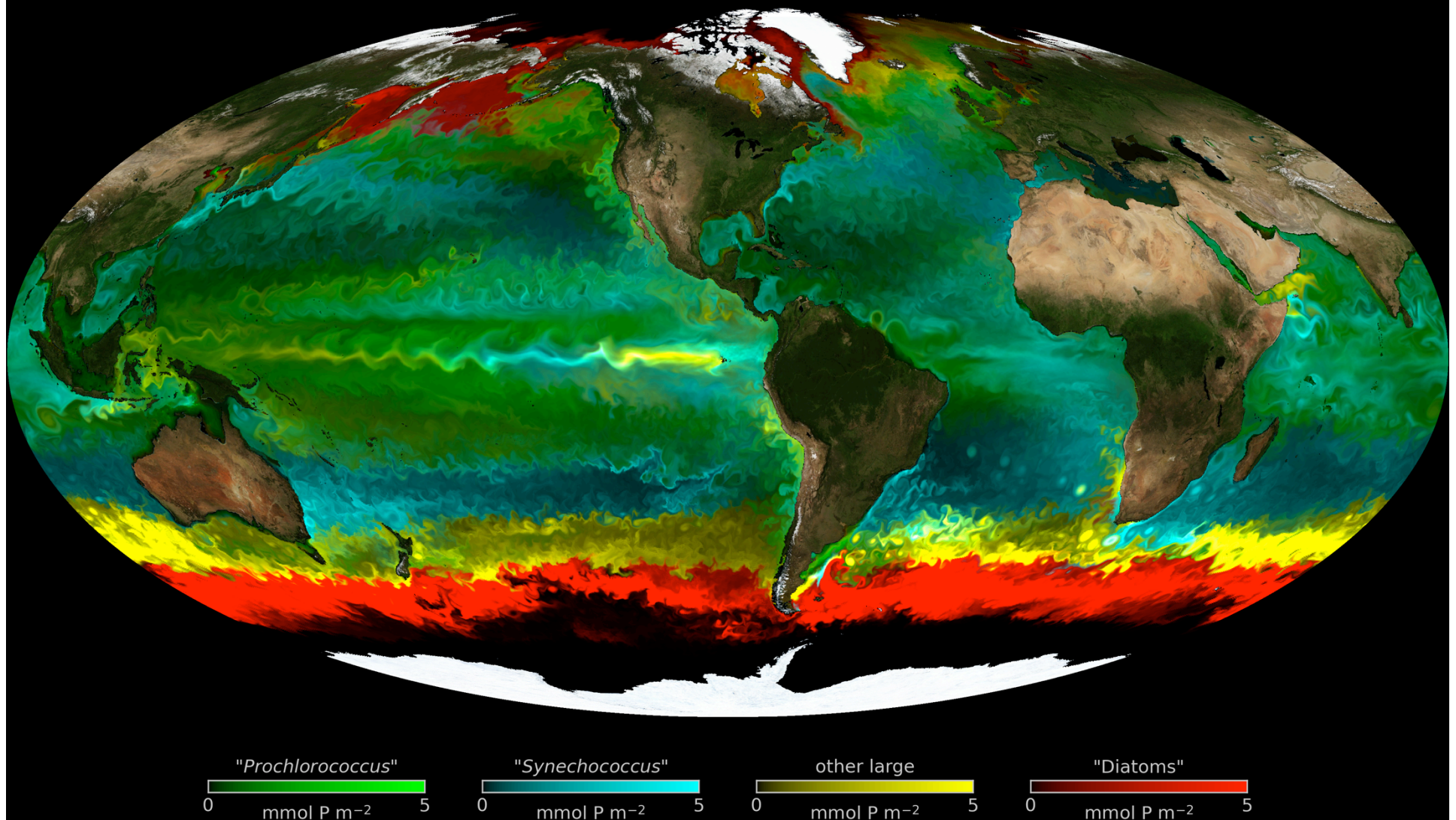
McKinley, 2002

Observed estimate of CO₂ flux during 92-93 El Niño (mol/m²/yr)



Feely et al., 1999

Example of a budget-conserving ocean and sea ice reanalysis used to drive an ocean ecology model (Follows et al.)

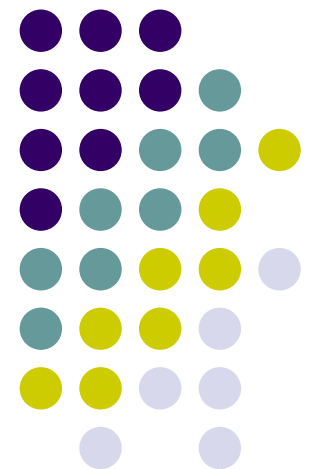


LAS 6.5.2.1/Ferret 5.81 -- NOAA/PMEL
LATITUDE : 0.5S
DEPTH (m) : 5
DATA SET: Cda_1996_1998_monthly_full

A global 4D-Var data assimilation experiment with a fully coupled GCM

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<http://www.jamstec.go.jp/frcgc/k7-dbase2/>