

Observations assimilated

R-factor to adjust model error variances and K-Factor to adjust observation error variances. ETKF employs SST and SLA bias correction via AR(1) model fit.

TABLE Summary of ocean observations assimilated into the Global Climate Model

SST	RADS altimetry	SSS	In-situ T/S (WMO GTS)
NAVO-AVHRR	JASON	AQUARIUS	Argo
AMSR-E	CryoSat2	SMOS	CTD
AMSR-2	EnviSat2		XBT
WindSat	Altika		RAMA
PATHFINDER	SARAL		PIRATA
VIIRS	Sentinel3		TAO-TRITON

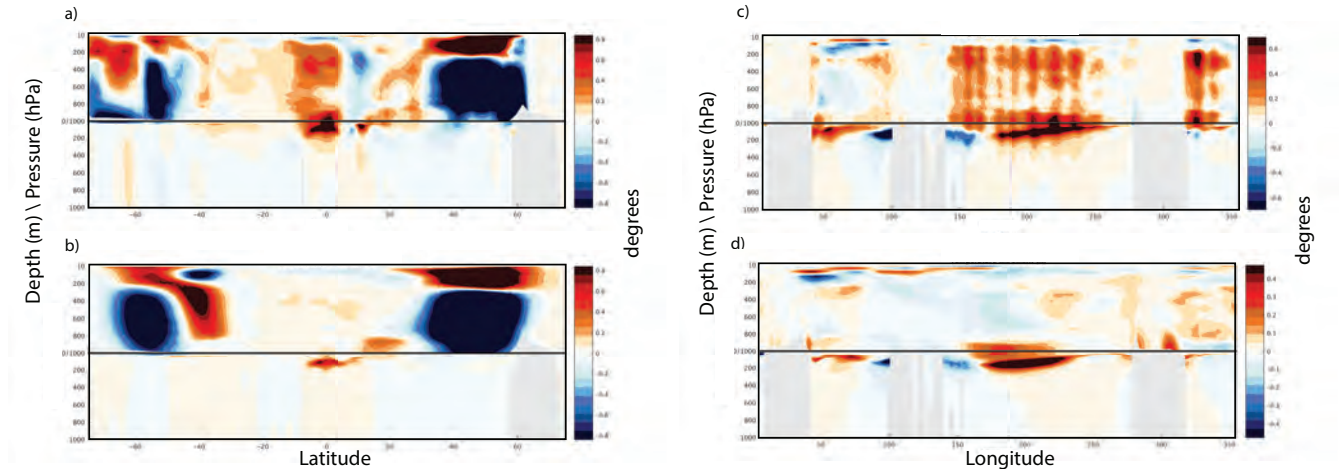
TABLE Number of ocean observations and superobs assimilated on 03/2012 & 12/2017

Date	03/2012		
type	# used	# discarded	# superobs
SLA	2249101	122202	245742
SST	19147820	250250	478420
TEM	1341154	14956	298345
SAL	1253298	15470	269894
SSS	2163235	96132	828292
Total	26154608	499010	2120693
Date	12/2017		
type	# used	# discarded	# superobs
SLA	2836923	175817	290120
SST	121295481	1026776	1059509
TEM	10432222	211906	363541
SAL	9452414	285884	337366
SSS	0	0	0
Total	144017040	1700383	2050536

Tropics-Extra-tropics (seasonal increments)

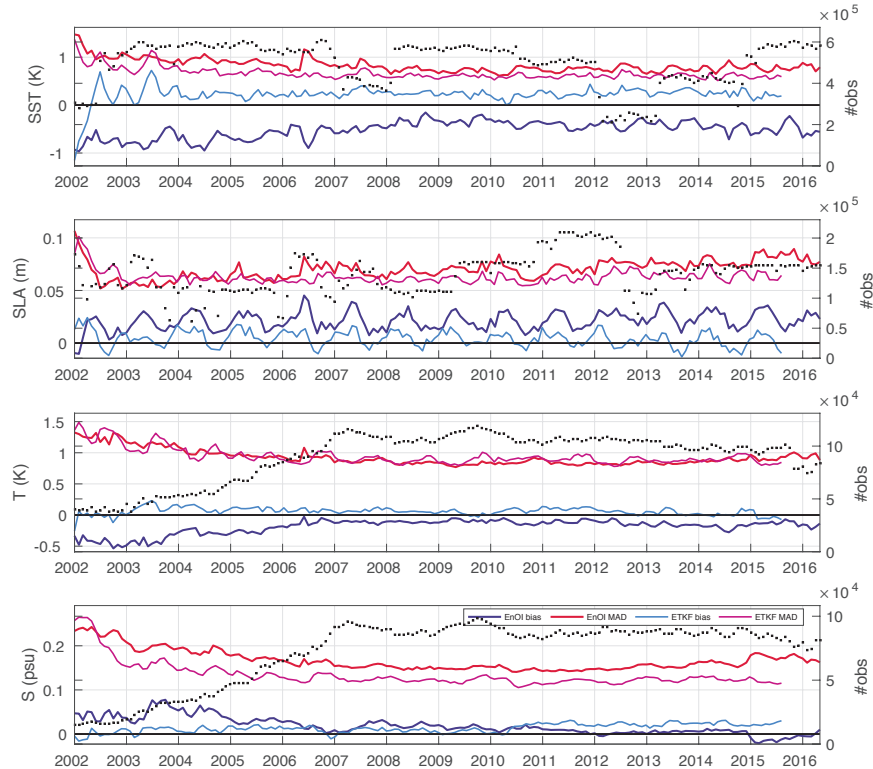
Comparison of ocean and atmosphere increments averaged over the boreal winter (DJF) along 140°W (ETKF a); EnOI b) and 2°S (ETKF c); EnOI d)

Temperature increments (DJF)



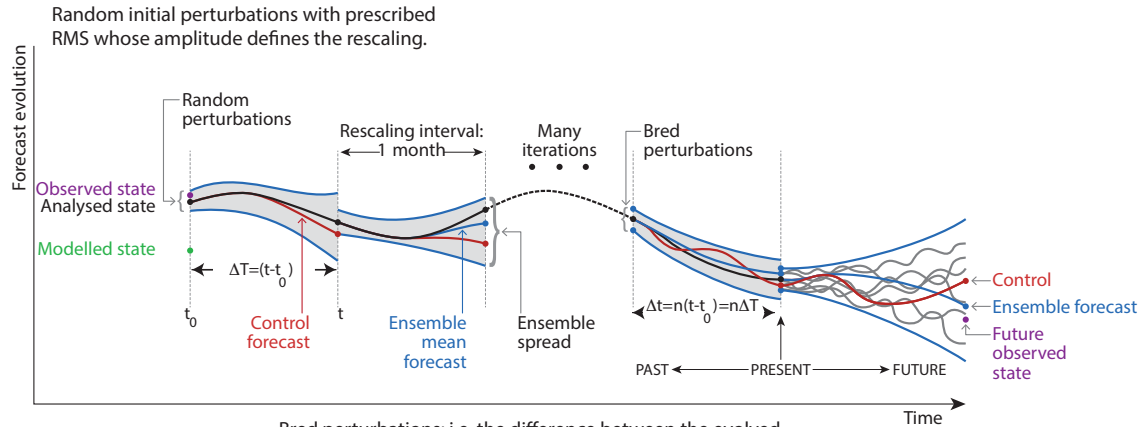
3: Assimilation statistics (20°S-20°N)

EnOI (1 analysis, static cov) versus ETKF (96 analyses, flow dependent + SST bias correction)



Ensemble Prediction System

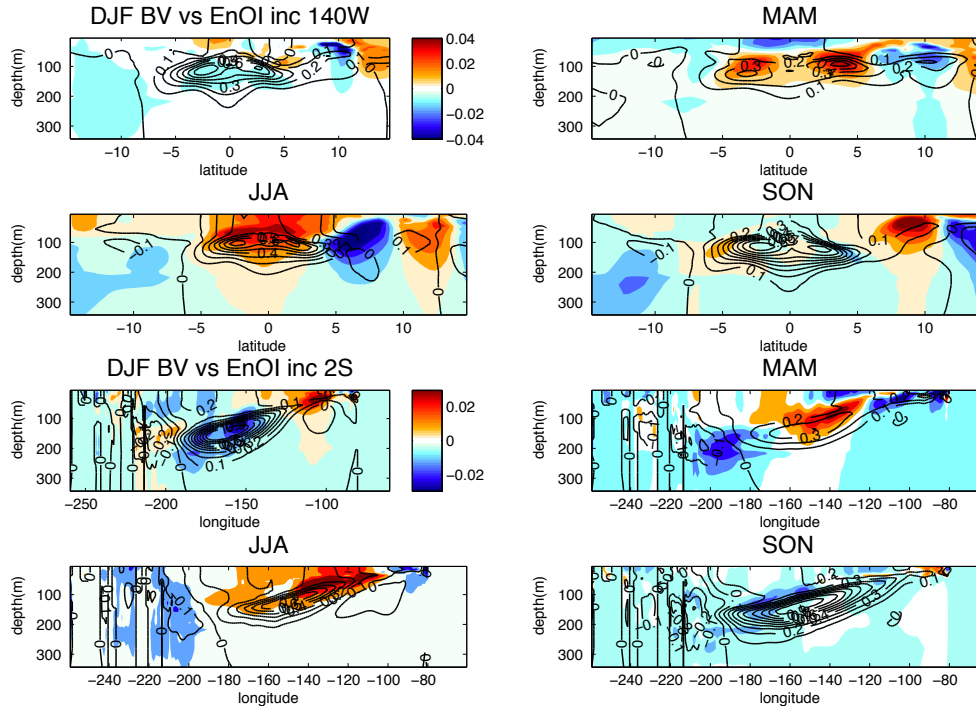
Bred vector generation



Bred perturbations: i.e. the difference between the evolved perturbed forecasts and the control, renormalised via the norm defined by the RMS of the initial perturbations and the length of the rescaling interval.

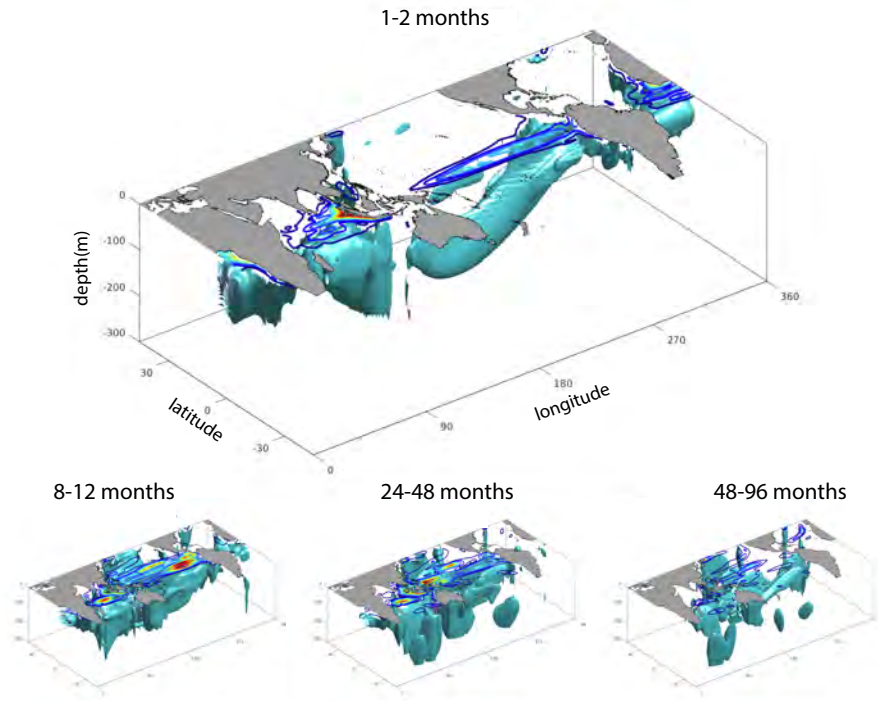
BV's versus 28 day forecast errors

Comparison of ensemble averaged BV's (shaded) and EnOI/ETKF analysis increment (contour) along sections at 140°W and 2°S.



Scale selection

- localisation length scales and adjustment of observation impact factors to "tune" increments to select spatio-temporal scales of relevance to given forecast lead times.
- mask regions of variance relevant to those chosen spatio-temporal scales such as the in band variance for temperature with an appropriate threshold (0.5 RMSE calculated from 500 years of control simulation).



Error growth rates

isosurface BV growth rates 3 times larger than 20°S-20°N BVs

