ACCESSG and ocean surface fluxes for OceanMAPS

aps1 $\rightarrow$ aps2

Andy Taylor, Gary Brassington, Prasanth Divakaran. Thanks Yi Xiao

May 18, 2015

Intro

Contrast OceanMAPS forecasts to seasonal/climate:

- new 7 day forecast daily
- practical matter of responding to operational changes to NWP
- data assimilation cycle regularly push model state back towards obs

OceanMAPS dependancy on ACCESSG:

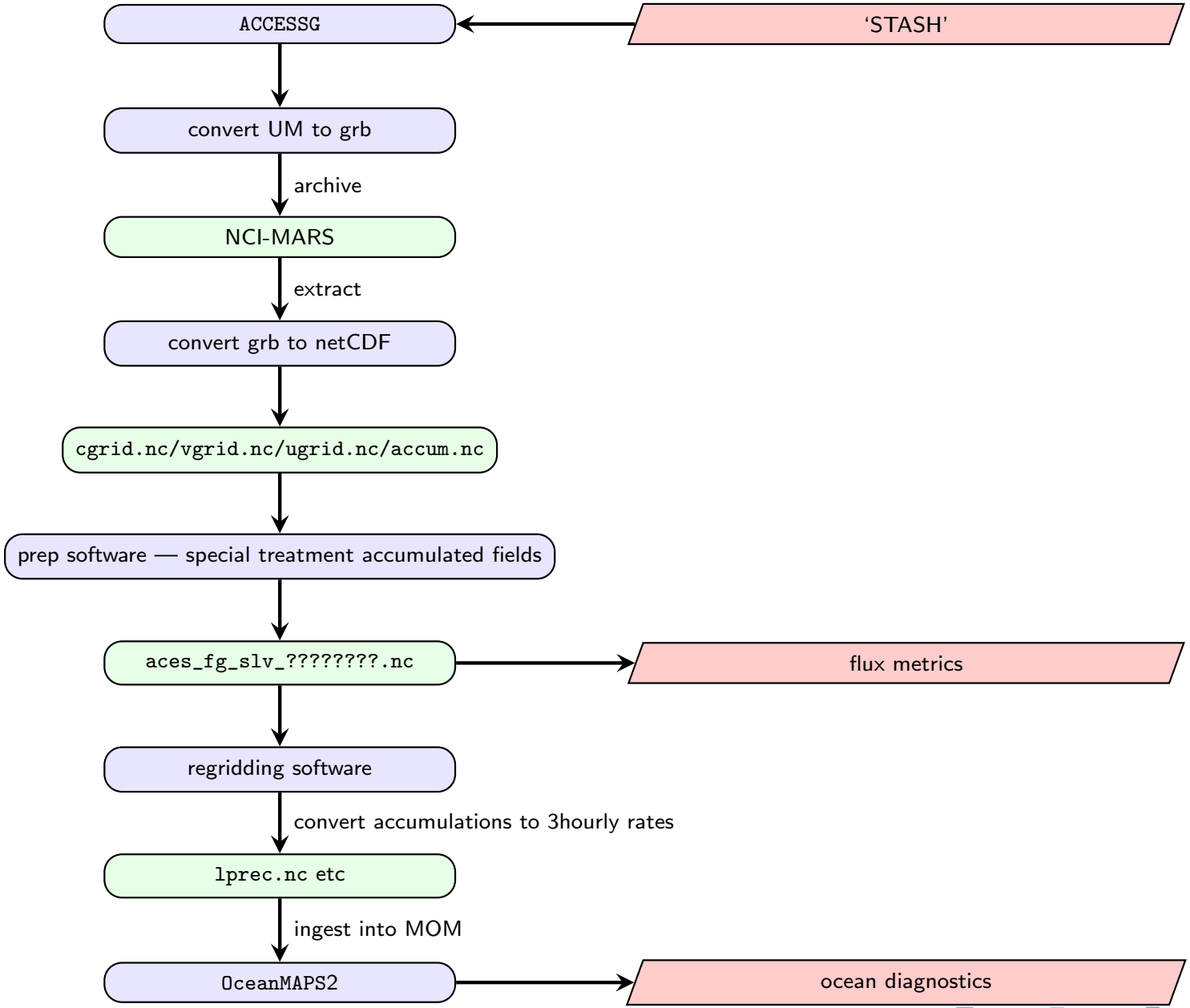
- unidirectional surface flux fields
- operations upgrade sequence
- ...ACCESSG-aps1 to ACCESSG-aps2 soon
- ...OceanMAPS2.2 to OceanMAPS3.0 later 2015
- ...hence requirement for intermediate OceanMAPS2.3
- short ocean hindcast parallel runs to check for impact of NWP change

Summary:

- ACCESSG-aps2 candidate is '00pl'
- short ocean hindcasts indicate:
- ...00pl less precip into ocean (good - but not discussed here)
- ...00pl more net heat into ocean (not good - focus of this talk)
- operational transitions:
- ...at 1 year NWP reanalysis would be very valuable

Schematic flow of data

Compare parallel runs at two points: (1) processed inputs (2) ocean output



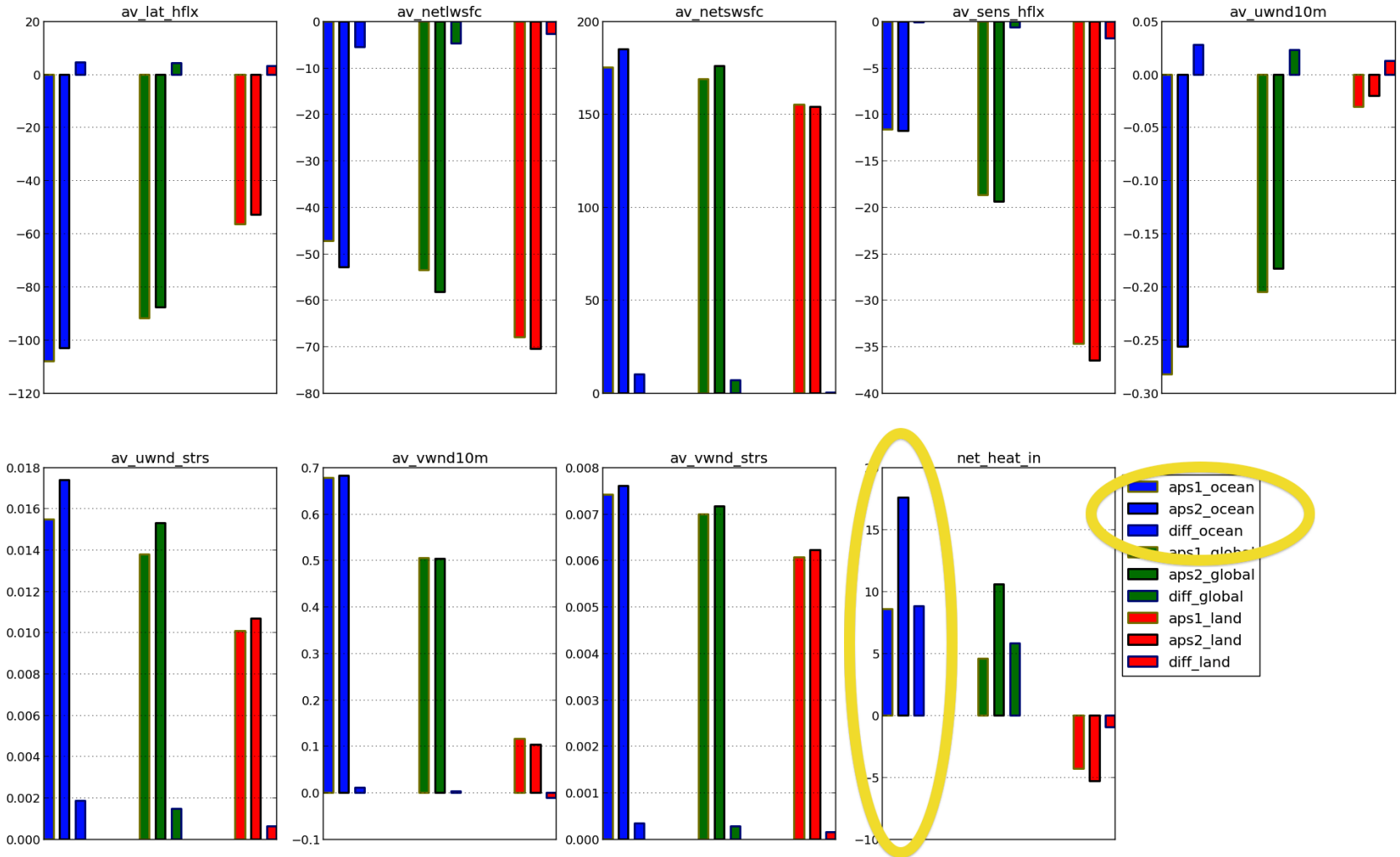
Method to derive flux budget metrics from pre-processed inputs

Period is much less than 1 year ... full seasonal cycle not represented.

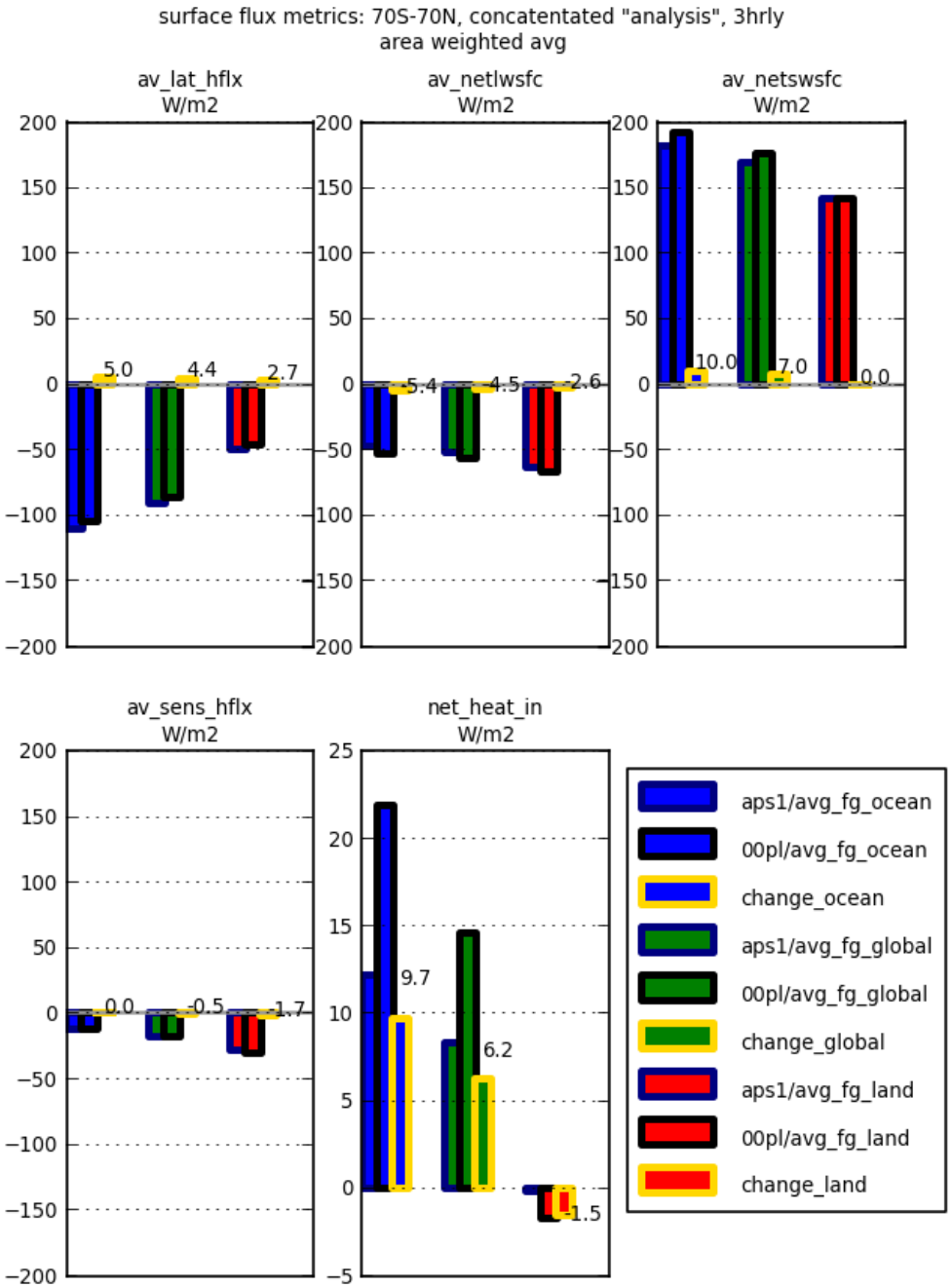
- prepare 3hourly fields as per flow chart
- period averages using NCO tool ncra
- derive metrics from averaged field with python code
- - land/sea masking
- - clip between lats 70S to 70N
- - surface area weighting
- - harmonise radiation directions: positive down
- - masked area weighted average $= \frac{\Sigma var[:,:]area[:,:]}{\Sigma area}$

aps1 00pl 'hindcast' 20140722-20141030

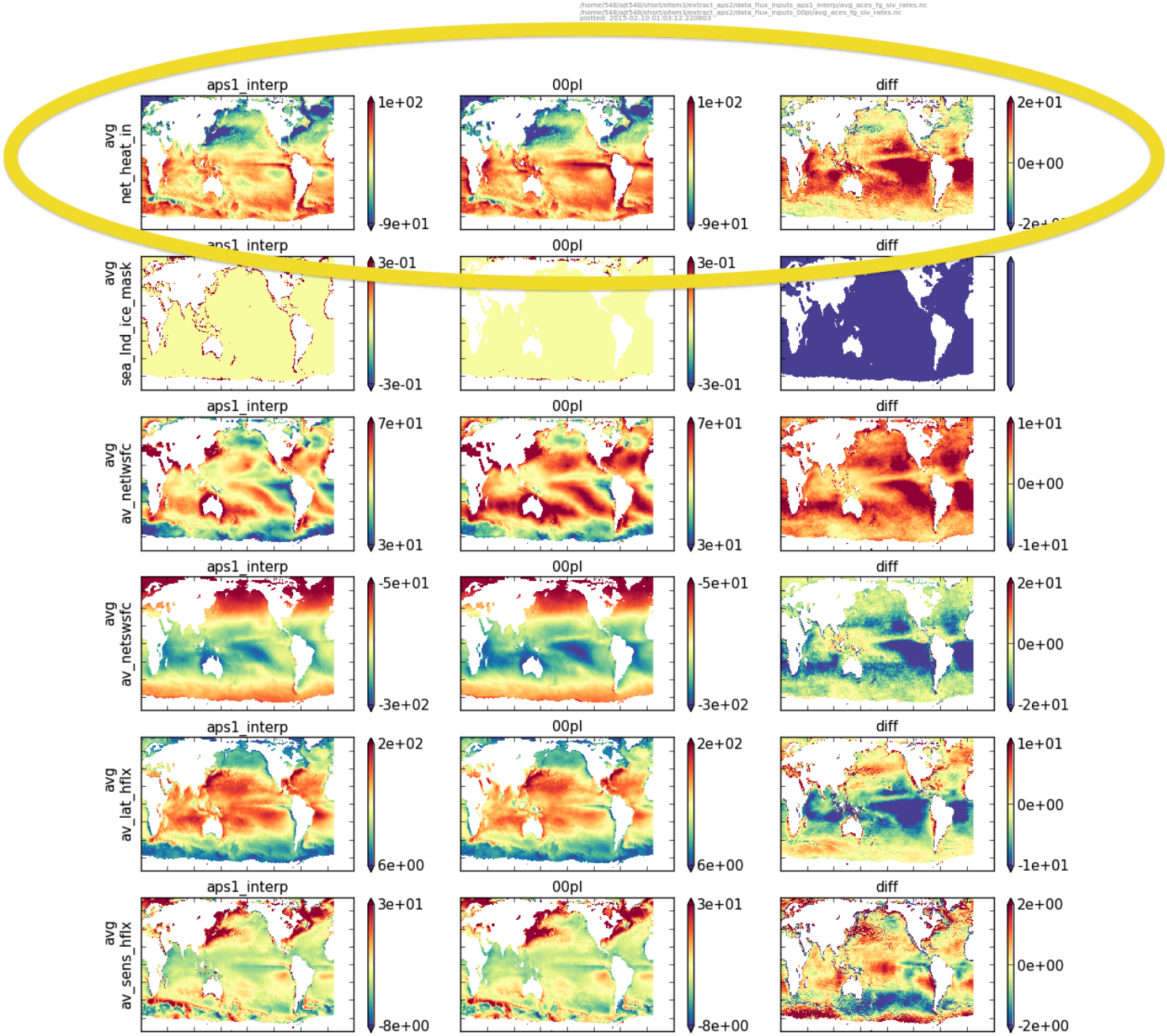
Net heat flux is a small difference between large values



aps1 00pl 'hindcast' 20140722-20141030 ...focus on flux breakdown



aps1 00pl 'hindcast' 20140722-20141030 ...spatial map



interpreting flux comparison

Pre-processed input files:

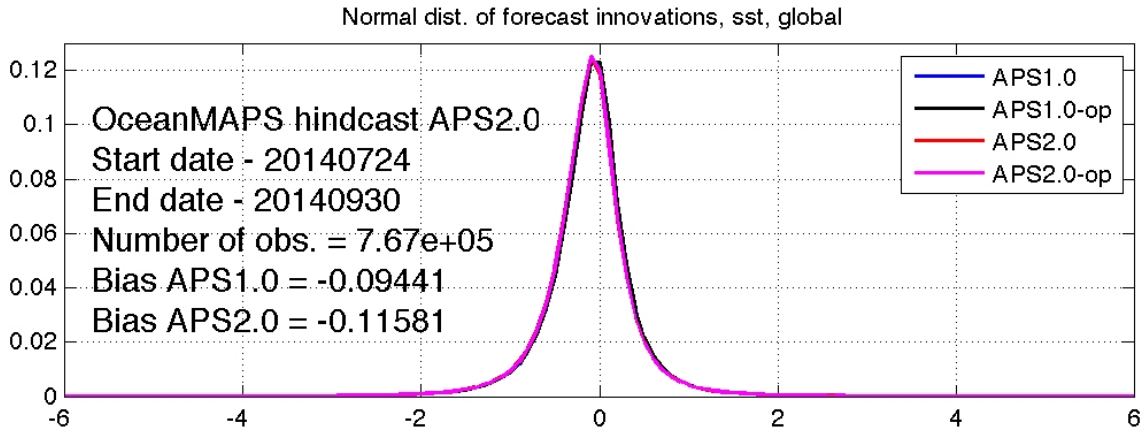
- 00pl has relatively large increase in net heat flux into the ocean.
- ...from $\sim 12 \frac{W}{m^2}$ to $\sim 22 \frac{W}{m^2}$
- Global net heat flux into the ocean is not directly observed.
- Literature estimates of net heat flux rate are quite uncertain.

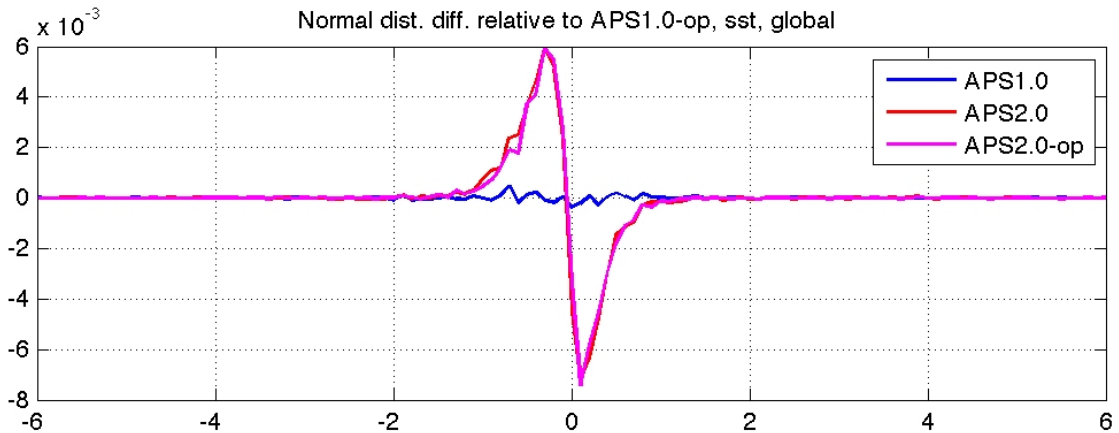
So next consider resulting ocean model diagnostics.

- DA statistics
- Comparison of ocean state to observations

OceanMAPS hindcast trials - impact on DA

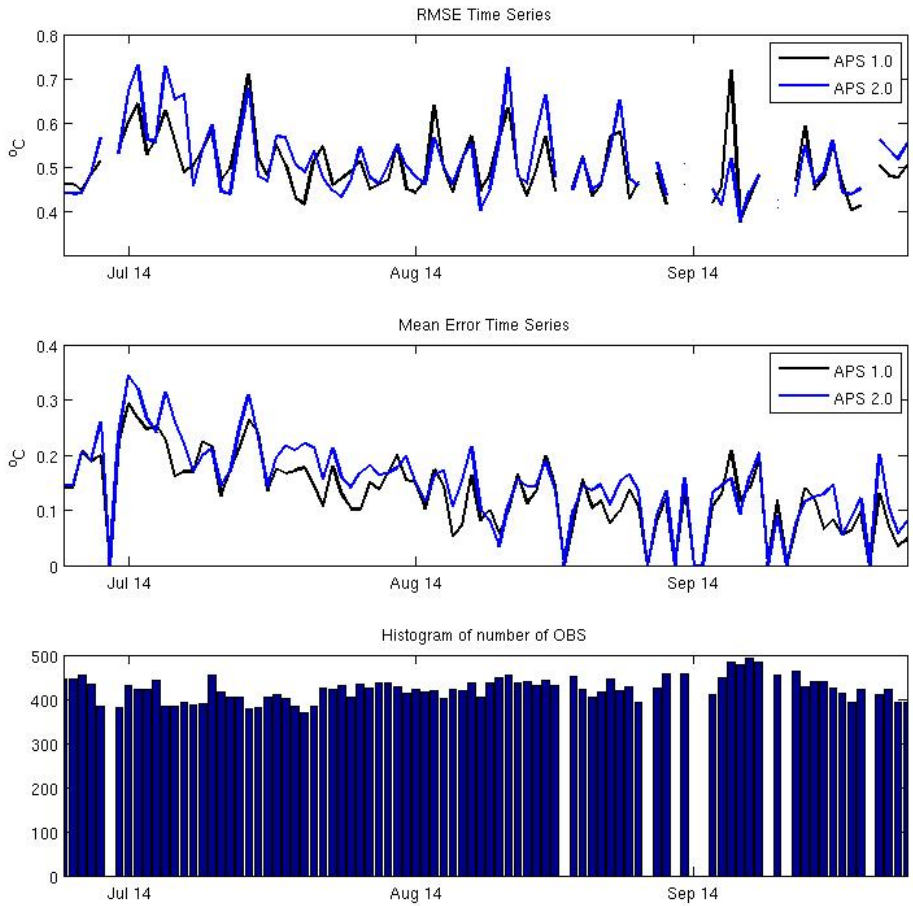
robust bias in the innovations between APS2 and APS1 consistent with increase in net heat flux





OceanMAPS hindcast trials - impact on ocean state (SST)

Australia region, independent drifting buoys, observation space
timeseries gaps due to 3rd party supply
general increase in RMSE error and positive bias
again consistent with increase in net heat flux



conclusions and comments

candidate aps2 degradation of net oceanic heat flux

- indications from NWP group of issue related to radiation scheme code
- `OceanMAPS` DA has limited ability to correct for systematic flux bias
- ...projection of surface obs designed for dynamics not bias
- ...likely accumulation of errors at depth
- ...possible implications for important services

- operational transitions
- ...advocate for 1 year hindcast (routine at other centres)
- updates to STASH will enable bulk flux formulations
- growing suite of shelf and coastal ocean systems