SATELLITE CHANNEL SELECTION WITH A DATA ASSIMILATION ADJOINT

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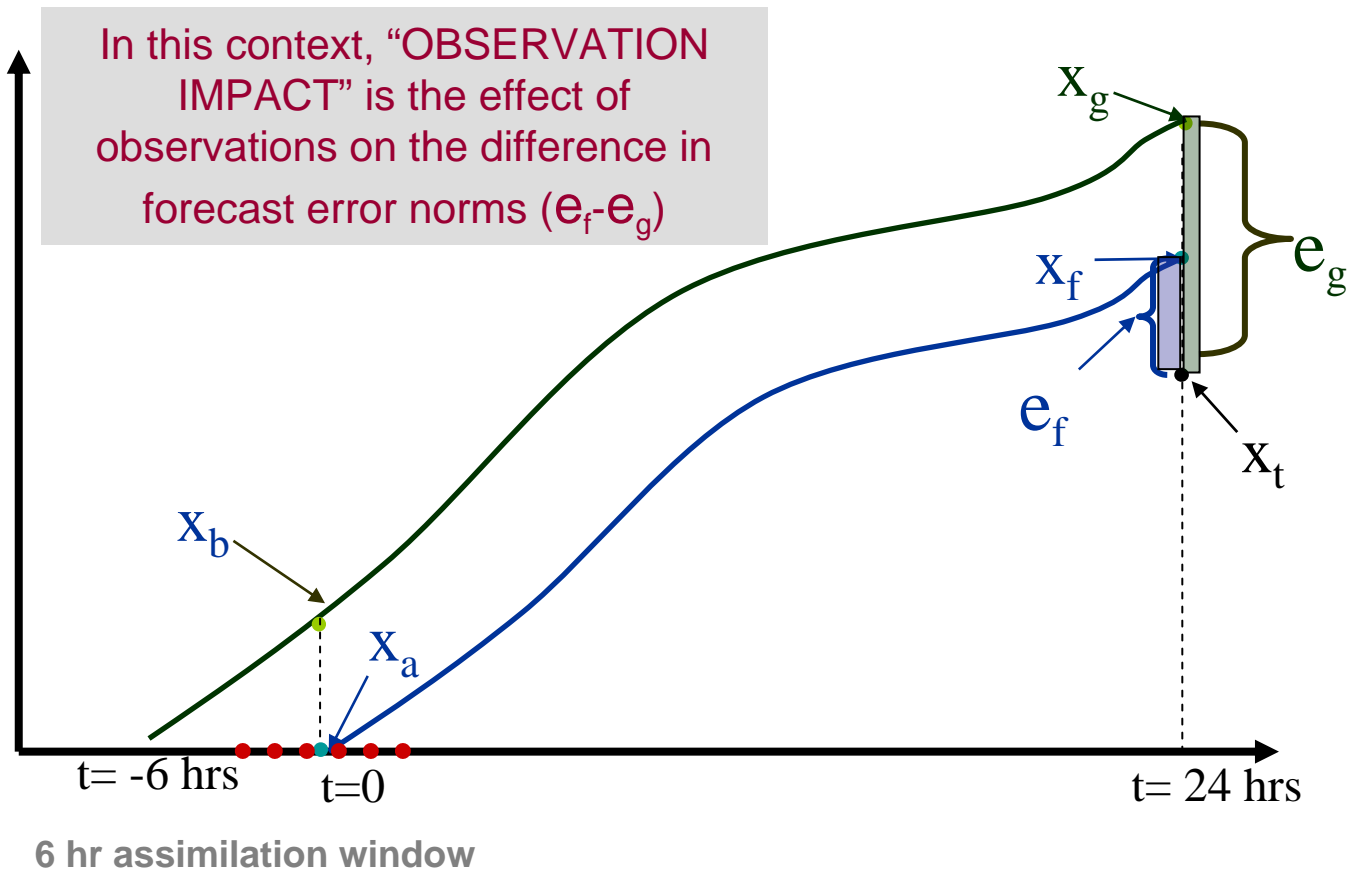**Gary Love**

NRL-Monterey

Progress

- Adjoint-based observation impact system (Langland and Baker) has been developed for routine monitoring of observations in operational data assimilation at NRL-FNMOC

- Similar approach now implemented with GEOS-5, Canada

- System is used for quality-control and beta -> ops decision-making

- Also used for selection of AIRS and SSMIS channels

http://ob_sens.nrlmry.navy.mil/obsens_main_od.html

Observations move the forecast from the **background trajectory** to the **trajectory starting from the new analysis**

In this context, "OBSERVATION IMPACT" is the effect of observations on the difference in forecast error norms (e_f-e_g)

x_g

e_g

x_f

e_f

x_t

x_b

x_a

t= -6 hrs

t=0

t= 24 hrs

6 hr assimilation window

Langland and Baker (Tellus, 2004)

Observation Impact Equation

$$\delta e_f^g = \left\langle (\mathbf{y} - \mathbf{H}\mathbf{x}_b), \mathbf{K}^{\mathbf{T}} \left\{ \frac{\partial e_f}{\partial \mathbf{x}_a} + \frac{\partial e_g}{\partial \mathbf{x}_b} \right\} \right\rangle$$

- We use a moist total energy forecast error norm, f=24h, g=30hr

- Forecasts are made with NOGAPS-NAVDAS.

- Adjoint versions of NOGAPS-NAVDAS are used to calculate observation impact

- The impact of observation subsets (e.g., separate channels, or separate satellites can be easily quantified)

$\delta e_f^g < 0.0$ the observation is BENEFICIAL

$\delta e_f^g > 0.0$ the observation is NON - BENEFICIAL

Year Impact Sum by Instrument Type

Impact of 00UTC observations on 24h global forecast error – moist total energy norm (J kg−1)
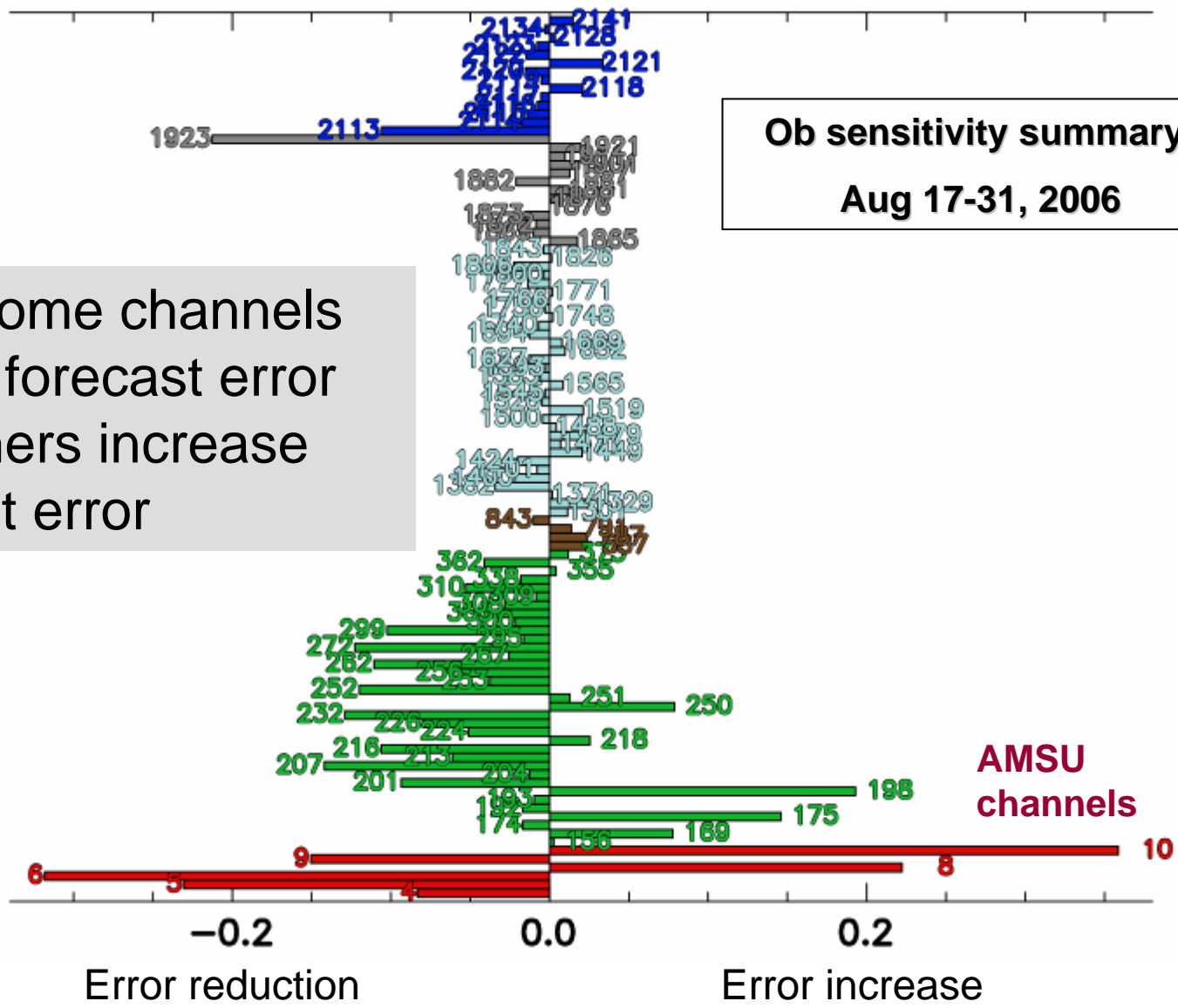
1 year ending 24 Apr 2007
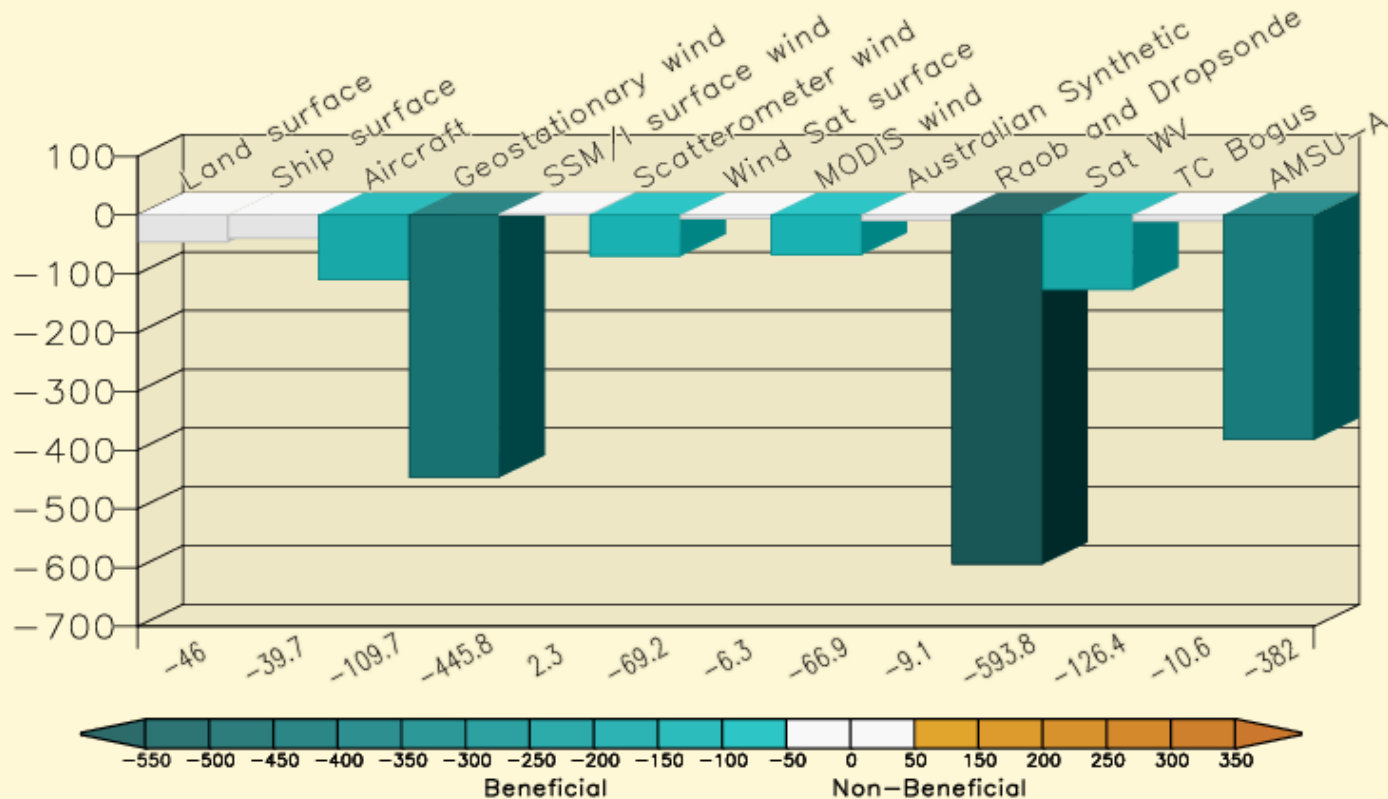
Note: some channels reduce forecast error and others increase forecast error

Ob sensitivity summary:

Aug 17-31, 2006

AMSU channels

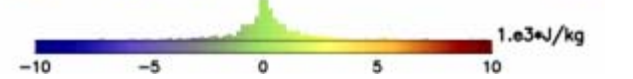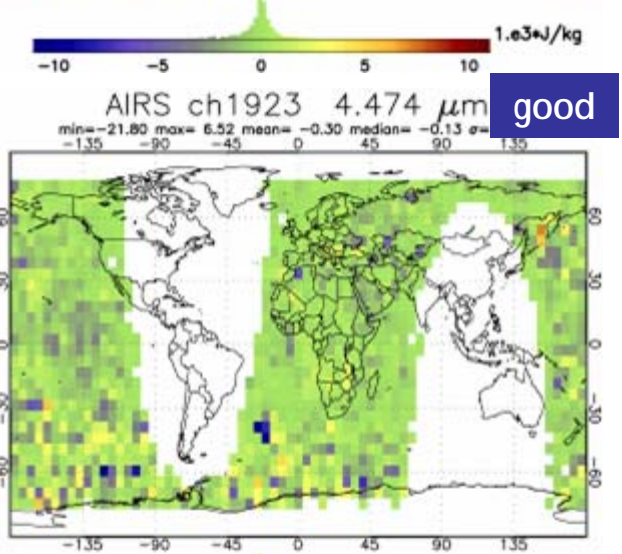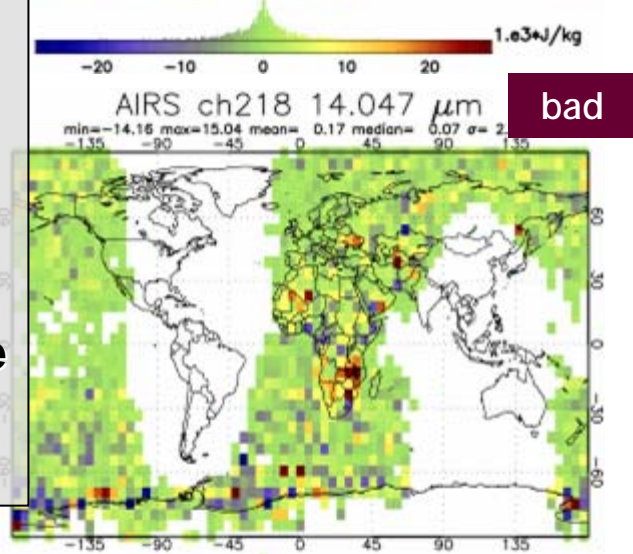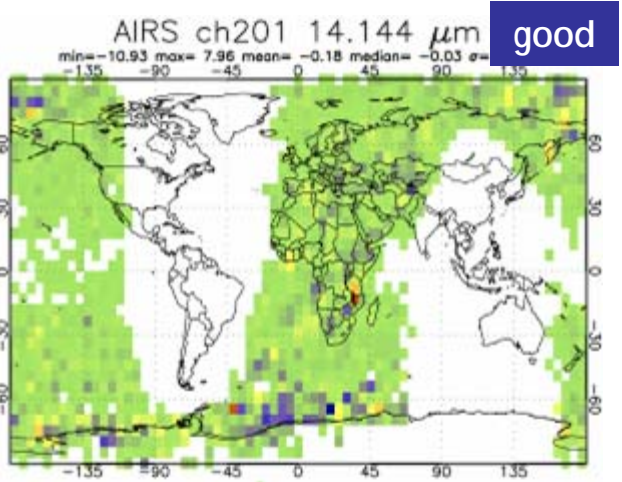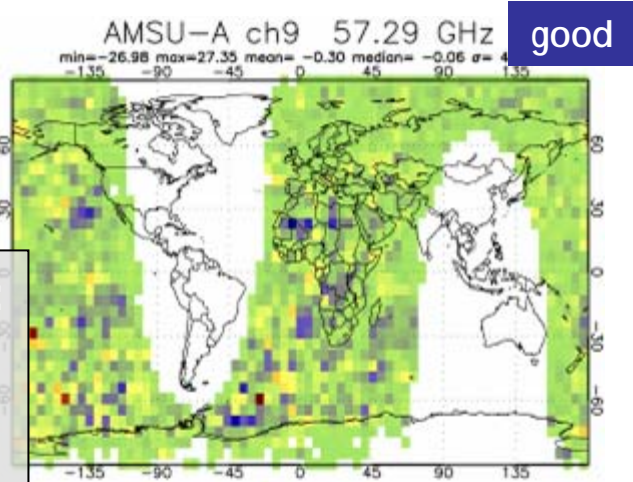Error reduction

Error increase

Ob sensitivity summary:

Aug 15-26, 2006

spatial distribution shows strong impacts are generally outliers

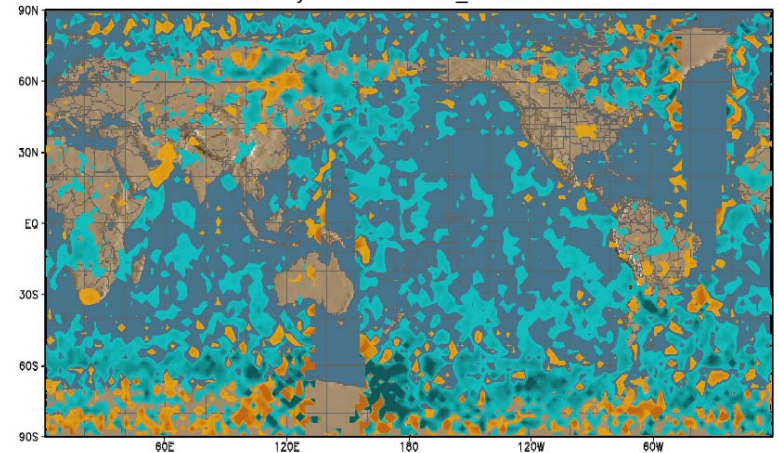**beneficial channels have slightly positively skewed distributions**

AMSU-A Impact Comparison

GEOS-5
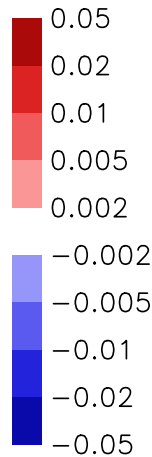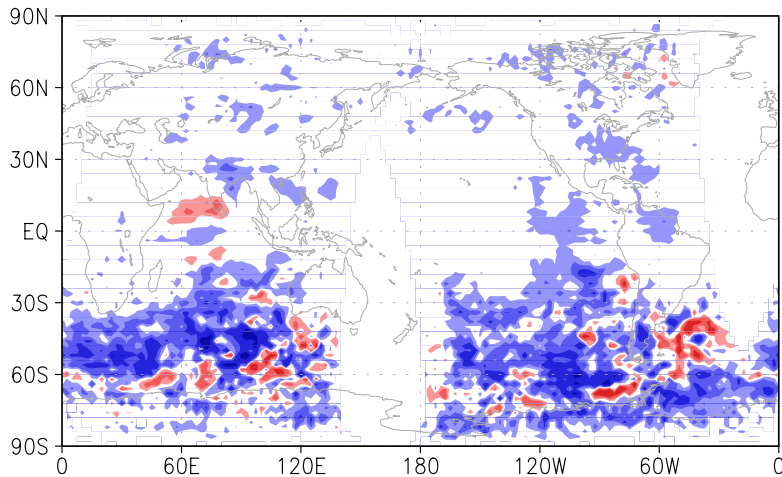
NAVDAS-NOGAPS

Error reduction   Error increase

Largest impacts occur in SHEM mid-latitudes in both systems.

However, AMSU-A has more impact in high latitudes in NAVDAS, compared to GEOS-5

Summary – Future Work

- Continue monitoring of observation impact in regular operational and beta assimilation

  - Identify problems with current observations

    - AIRS, SSMIS, AMSU-B channel selection

- Inter-comparison study: NAVDAS-GEOS5-Canadian observation impact

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