A Comparison of NWP Impacts from SSMIS and IASI Water Vapour Channels

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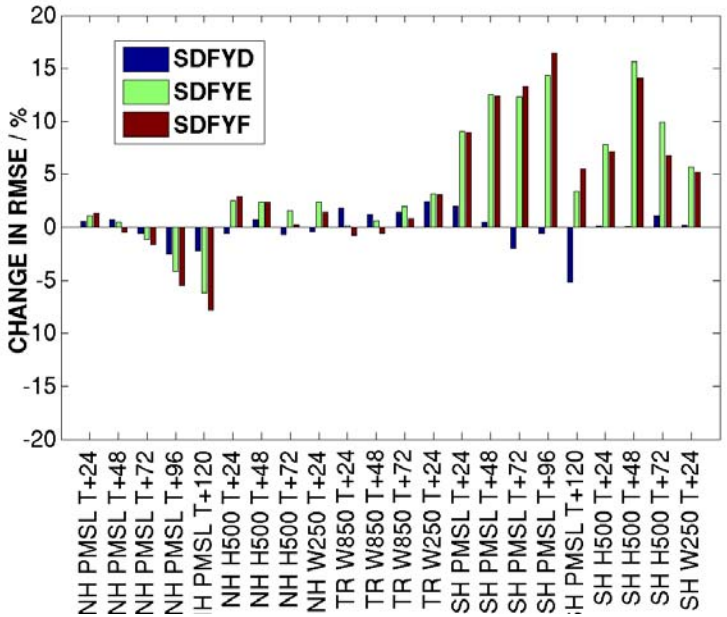
Outline

- Motivation: use IASI to assess SSMIS Q-impacts
- Co-locations (MetOp-A - F-16)
- Impact on Analyses
- Impact on Forecasts
- Impact on precipitation fields
- Summary

Motivation



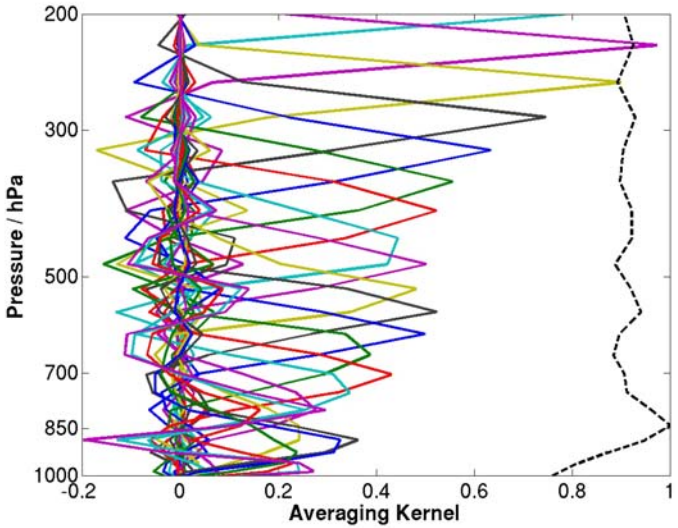
Clear sky SSMI / SSMIS window channel assimilation tests have produced, at best, mixed results in the Met Office global model

As IASI provides higher vertical resolution in the vertical for moisture:

- use IASI to assess the form of SSMIS WC analysis increments
- use IASI to indicate an *upper limit* on the expected forecast impacts from assimilation of SSMIS WC's in clear skies.

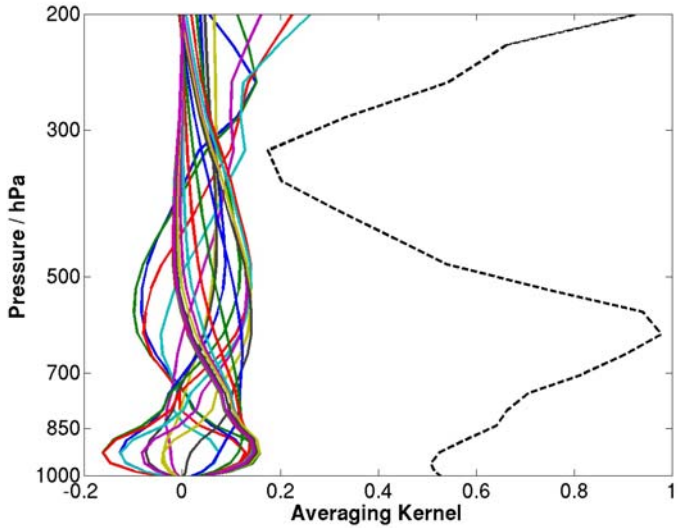
IASI *vs* SSMIS Averaging Kernels

averaging kernels for
31 IASI WV channels
assimilated operationally



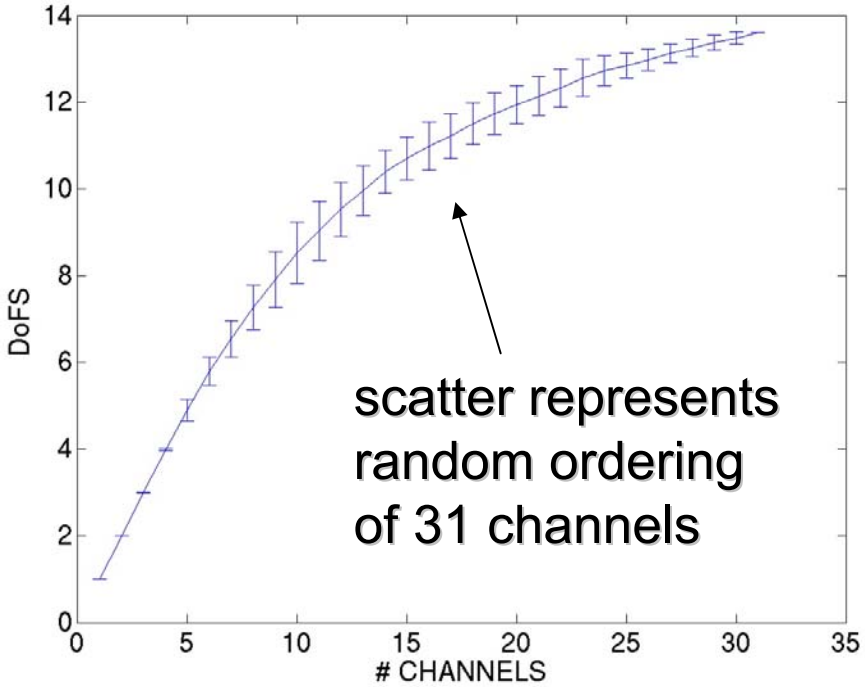
assumes
observation errors of 4K

averaging kernels for
SSMIS moisture channels
(windows at 19, 22, and 37 GHz)



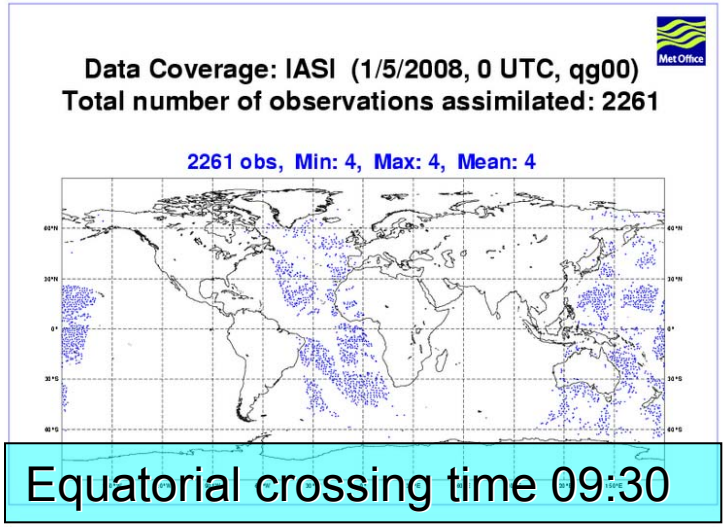
ch	19H	19V	22V	37H	37V
R / K	4	2	5	5	5

DFS for IASI

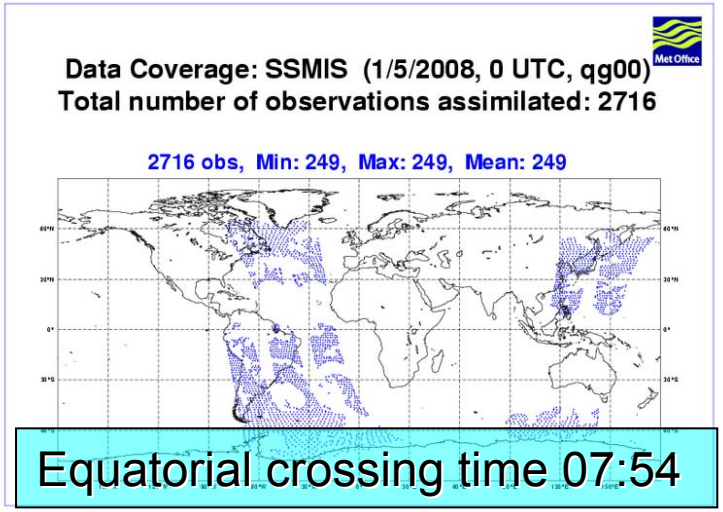


- Diminishing returns in using > 31 channels in NWP DA ?
- DFS for SSMIS ~5-6 for window channels + 3*183 GHz channels

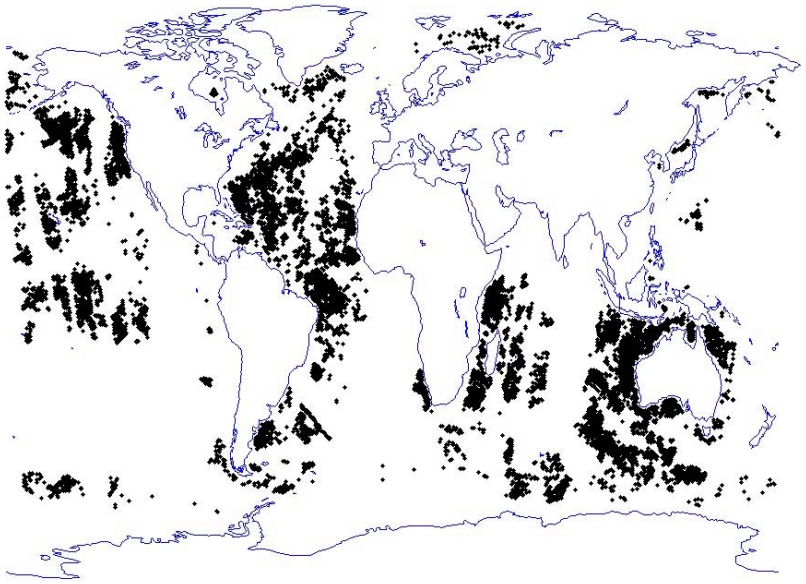
MetOp-A IASI / F-16 SSMIS orbit overlap : co-locations



Equatorial crossing time 09:30

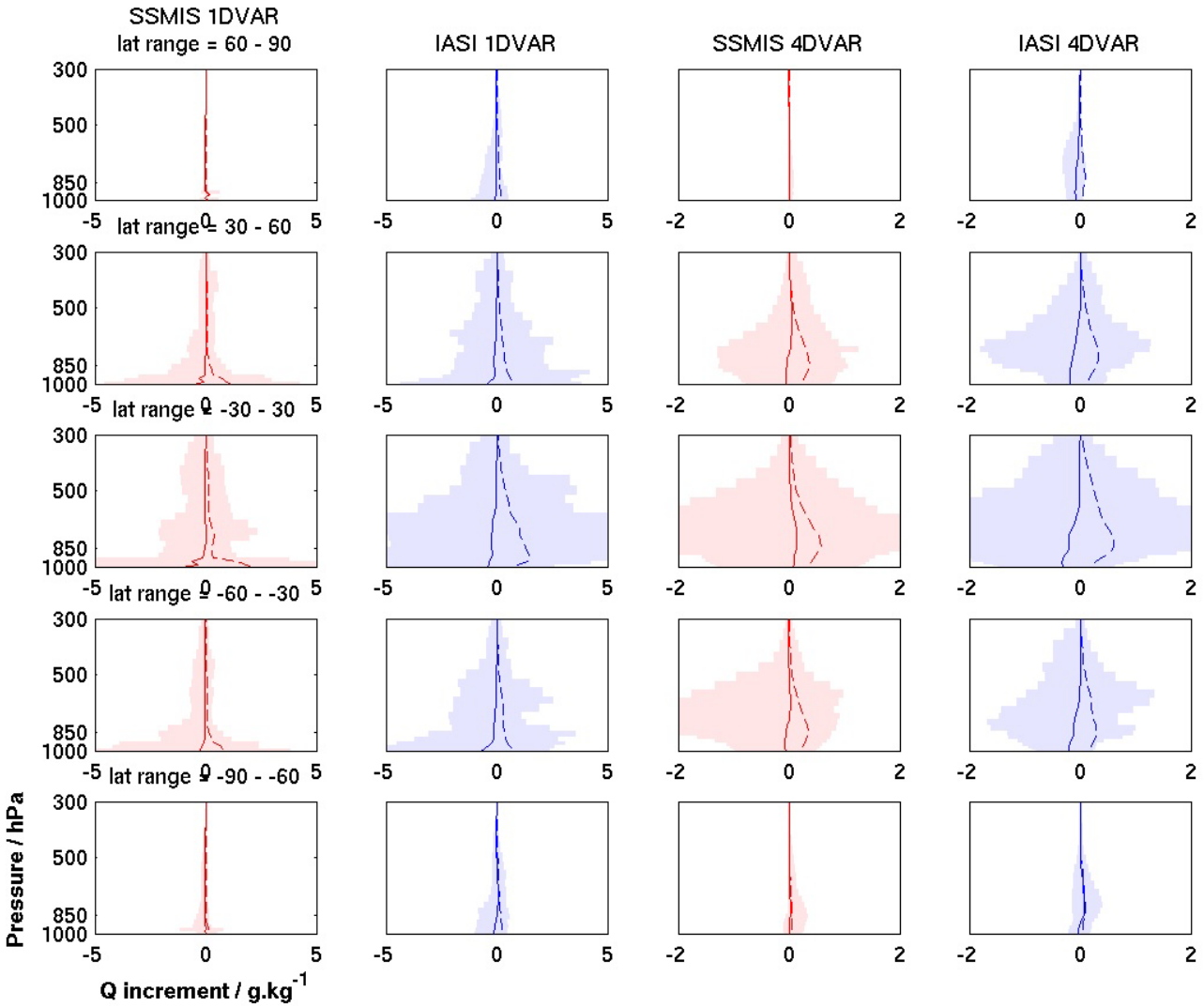


Equatorial crossing time 07:54



9,718 co-locations obtained
24th - 27th October 2007
Δx=20 km
Δt=95 minutes

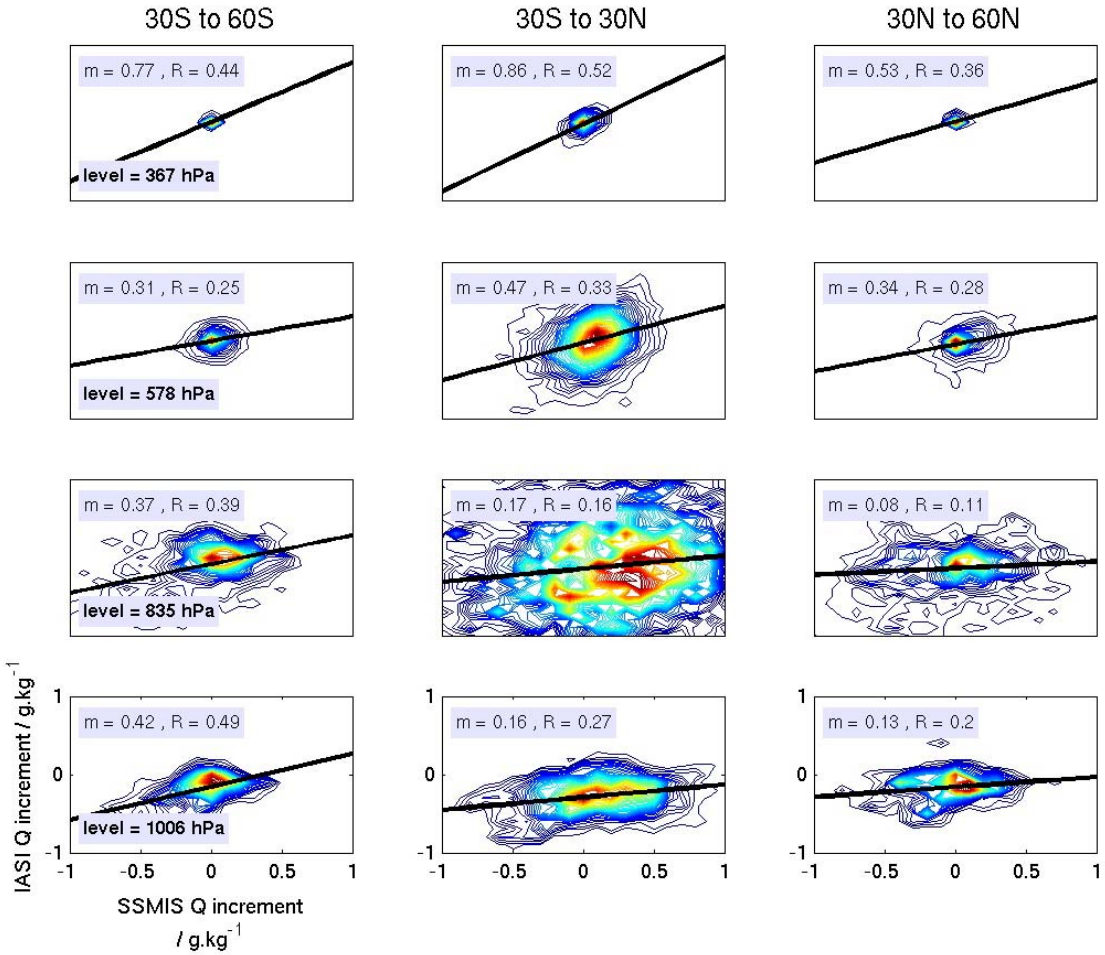
Analysis Impacts:
SSMIS *vs* IASI Q increments (1D- and 4D-Var)



- increments largest in tropics
- 1D-Var gives *complementary* increments. 4D-Var *homogenises*
- -ve bias in tropics for IASI (IASI *dries* tropics) – but sample size is small

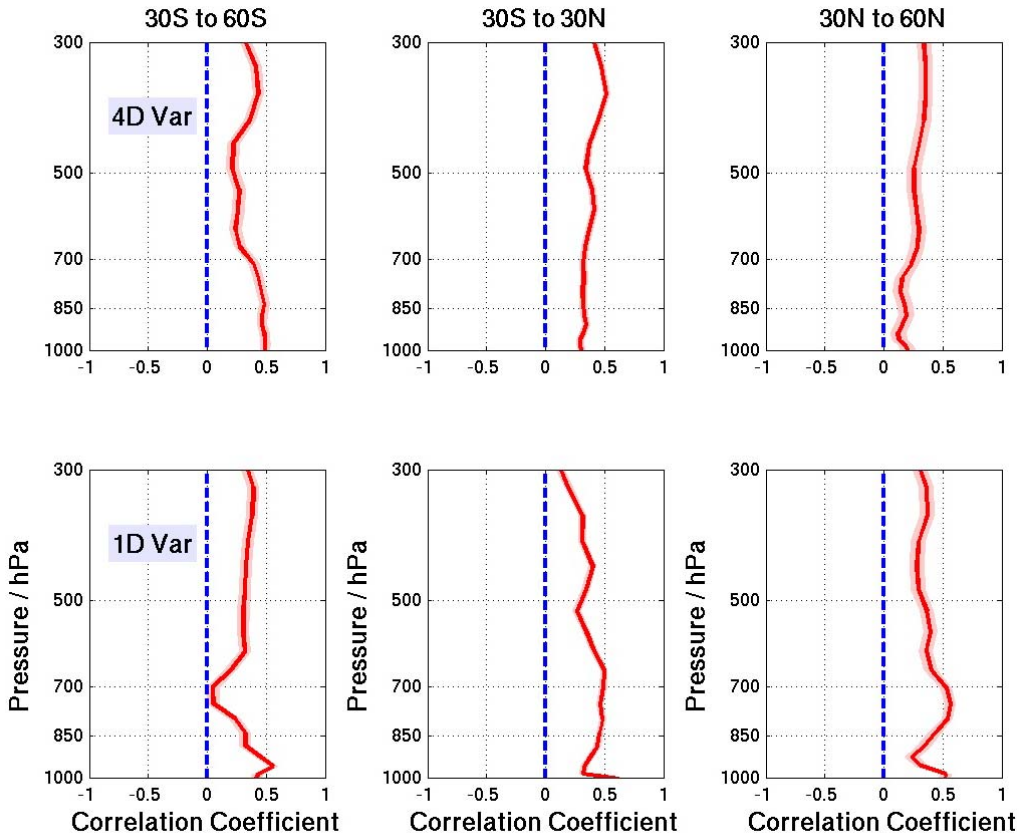
Analysis Impacts:

SSMIS *vs* IASI Q increments (1D- and 4D-Var)



correlations positive but weak

Analysis Impacts: SSMIS *vs* IASI Q increments (1D- and 4D-Var)

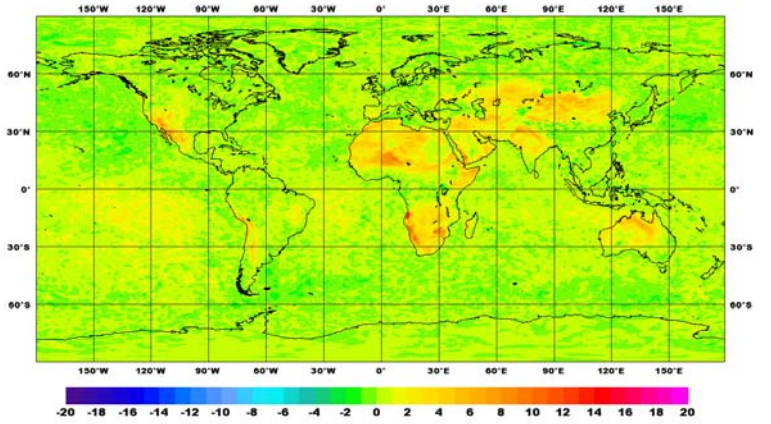


Positive correlations at all levels and in all regions, but relatively weak:

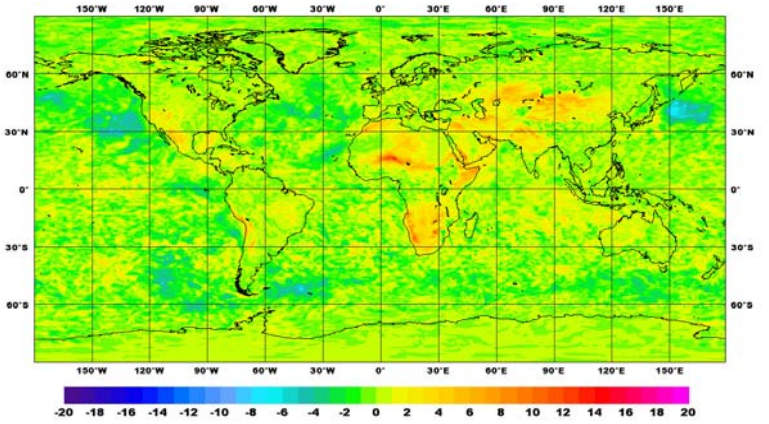
- Due to slack co-location criteria in Δx and Δt ?
- Due to IASI and SSMIS smearing Q-errors with different averaging kernels ?

Impact of SSMIS window channel assimilation on moisture (RH) fields

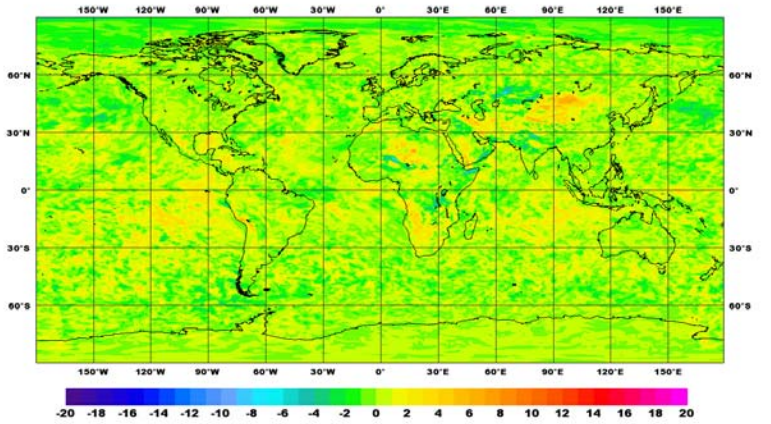
Mean ANL diff: 1000 hPa



Mean ANL diff: 850 hPa

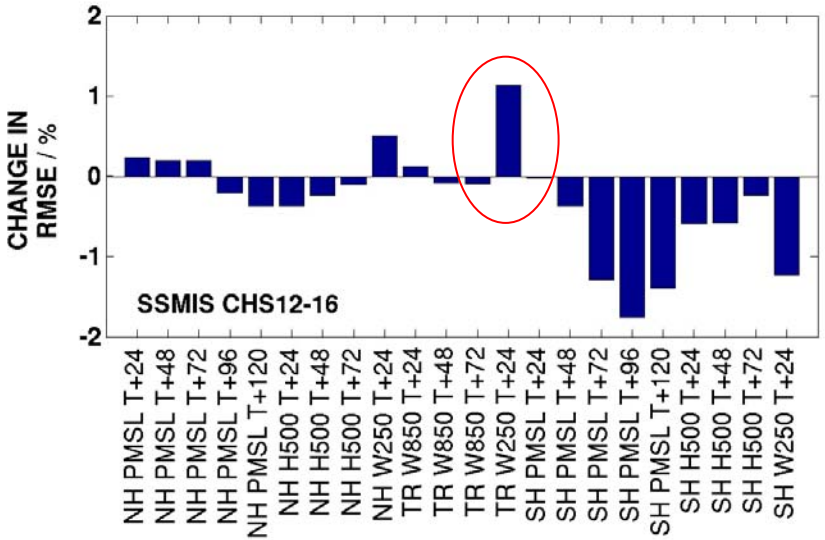


Mean ANL diff: 700 hPa

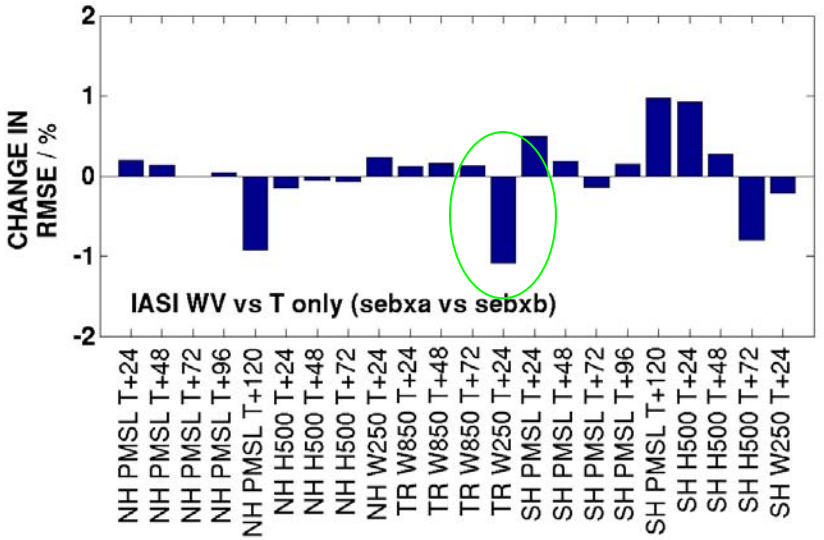


SSMIS window channel *vs* IASI WV channel forecast impacts (Z,PMSL,W250, W850)

SSMIS window channels
(19V, 19H, 22V, 37V and 37H)
tested on top of full system

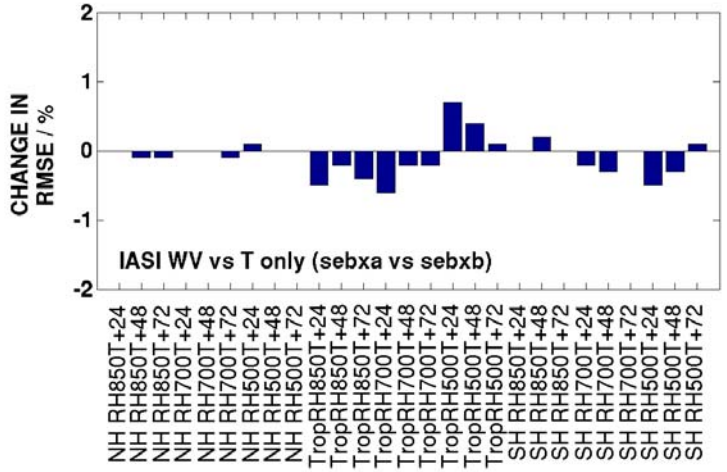


IASI WV channels
tested on top of full system

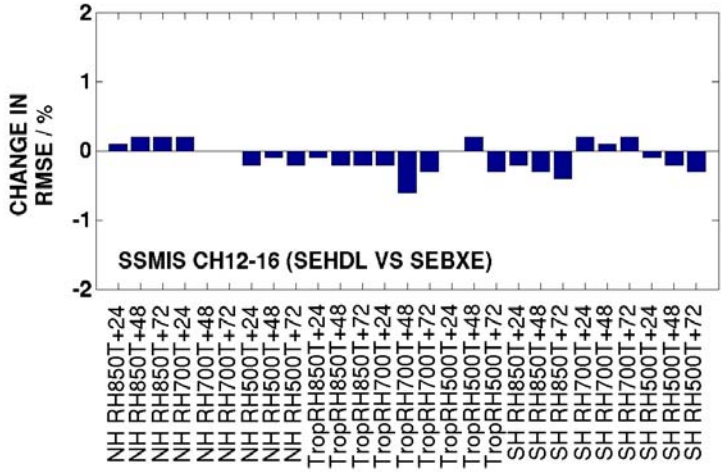


SSMIS window channel *vs* IASI WV channel forecast impacts (RH)

SSMIS window channels
(19V, 19H, 22V, 37V and 37H)
tested on top of full system



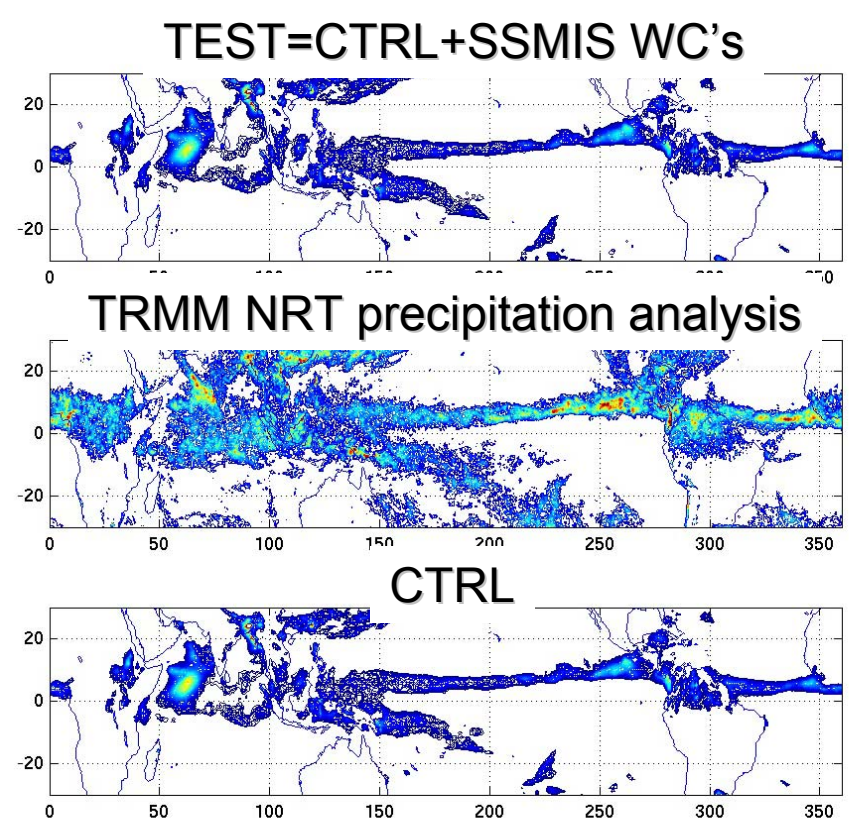
IASI WV channels
tested on top of full system

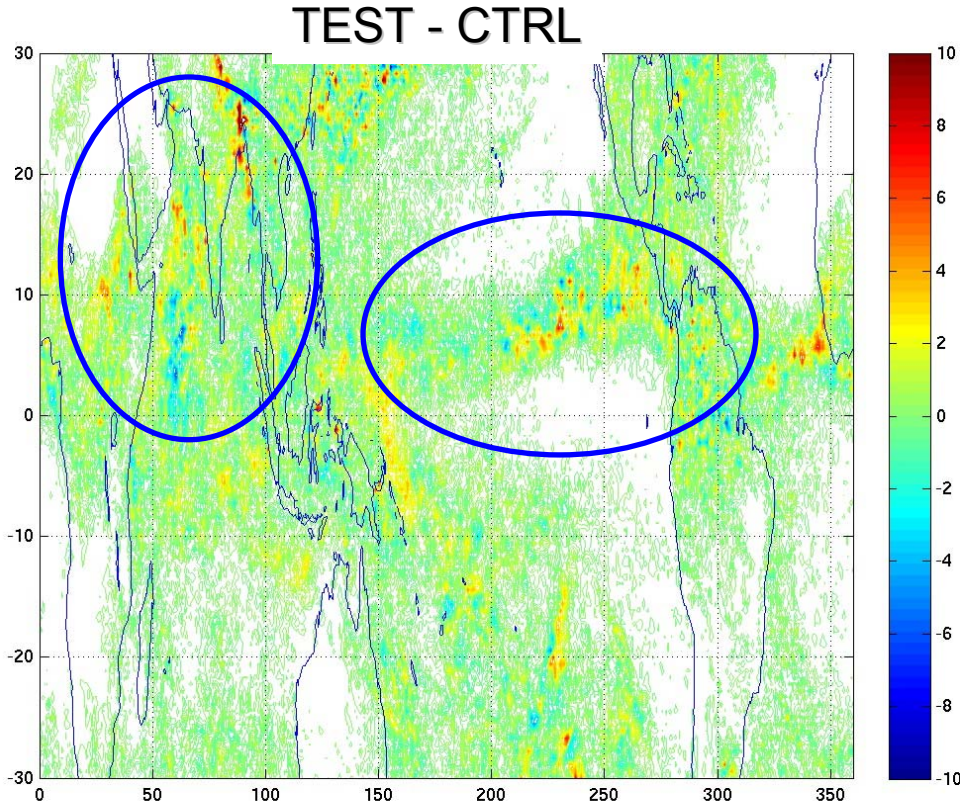


- Impacts on RH fields for forecast ranges T+1 to +3 days

v. small for both IASI and SSMIS

Impact of SSMIS WC's on tropical precipitation fields





Summary

- Proximity of MetOp-A and F-16 SSMIS allows co-located observations to be used to assess the consistency of q increments for both
- Simultaneous moisture increments in 4D-Var are weakly correlated, reasons not clear.
- Impact of SSMIS WC's mixed: positive in extra-tropics, negative in tropics. Not significantly worse than IASI WV channel impact.
- IASI does not give negative impacts in tropics, possibly due to a bias.
- Impact of SSMIS and IASI small (< 1%) on RH fields at T+1 day and beyond.
- Some qualitative evidence that SSMIS WC's are forcing corrections to badly misplaced precipitation fields associated with the Asian Monsson.

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