



Progress with the use of CrIS Radiances at NCEP

Andrew Collard¹, Jim Jung², Kristen Bathman¹,
Emily Liu³, David Groff¹, Li Bi¹, Paul van Delst¹,
and John Derber⁴

¹IMSG@NOAA/NWS/NCEP

²Univ. Of Wisconsin

³SRG@NOAA/NWS/NCEP

⁴NOAA/NWS/NCEP



Introduction

- Current status of CrIS assimilation at NCEP and possible short-term improvements
- Looking ahead to Full Spectral Resolution Data
- Conclusions and Future Plans



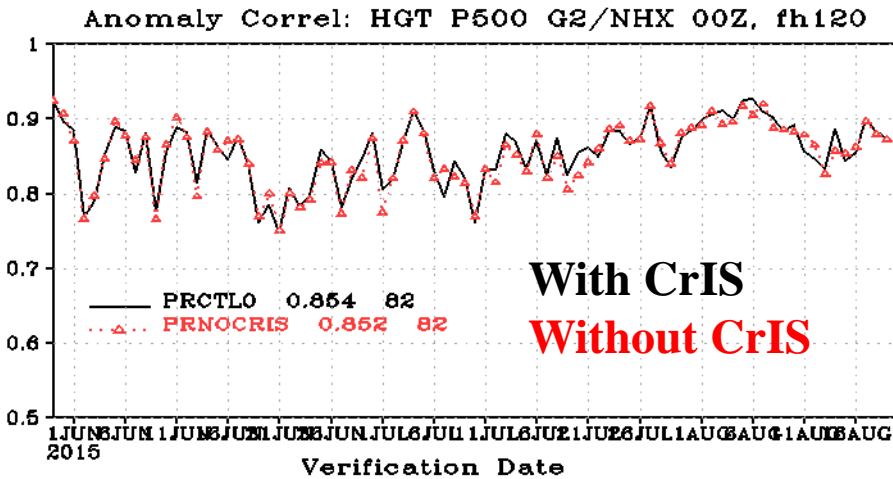
Current CrIS Configuration



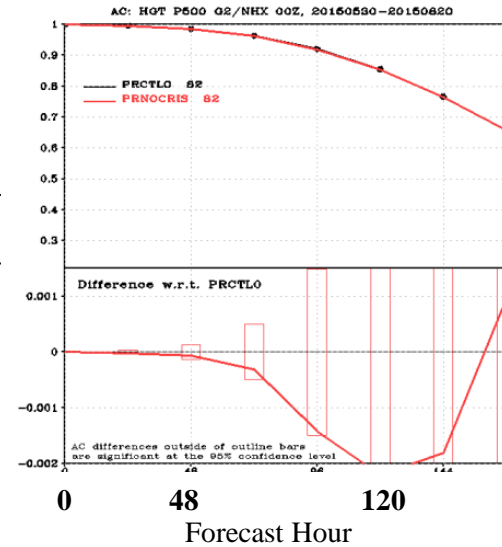
- Operational in NCEP system from 20th August 2013.
- 84 Channels selected from Gambacorta and Barnet*
399 Channel Selection
 - All channels in that selection designated for temperature, surface, cloud characterization, and CO₂ excepting channels affected by solar radiation and channels in the 667cm⁻¹ CO₂ Q-branch.
- Conservative observation errors and quality control.

*NOAA Technical Report NESDIS 133 available at https://www.wmo.int/pages/prog/sat/meetings/documents/RARS-ITSC18_Inf_02_NOAA-TR-133.pdf

500hPa Anomaly Correlation Scores

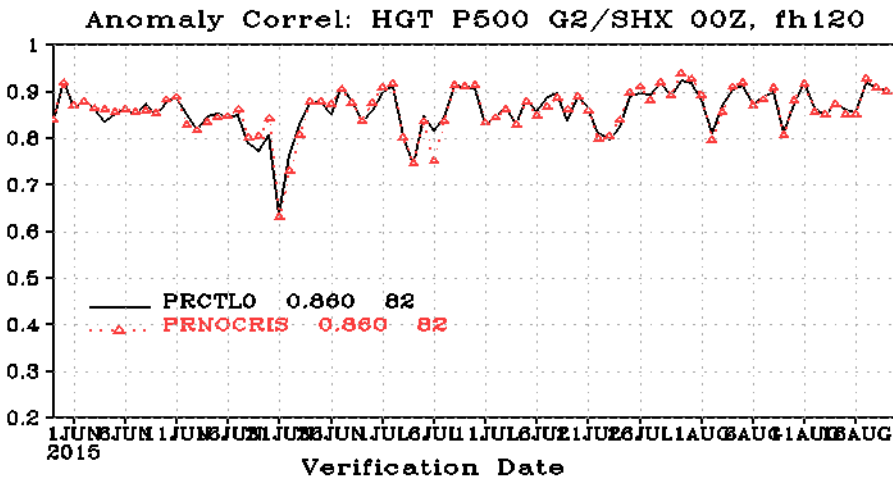


NH

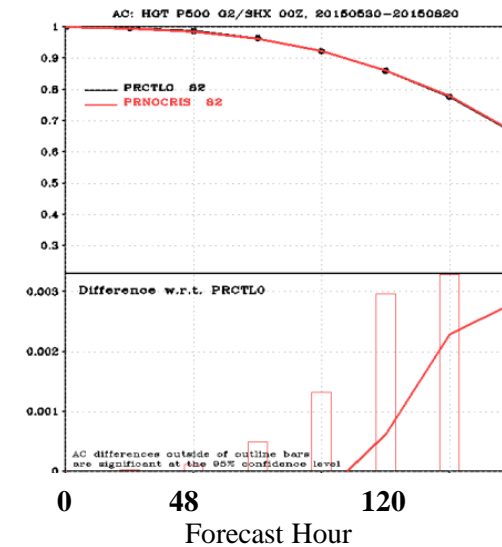


↑
**CrIS
 Degrades**

Timeseries of 120hr FC skill

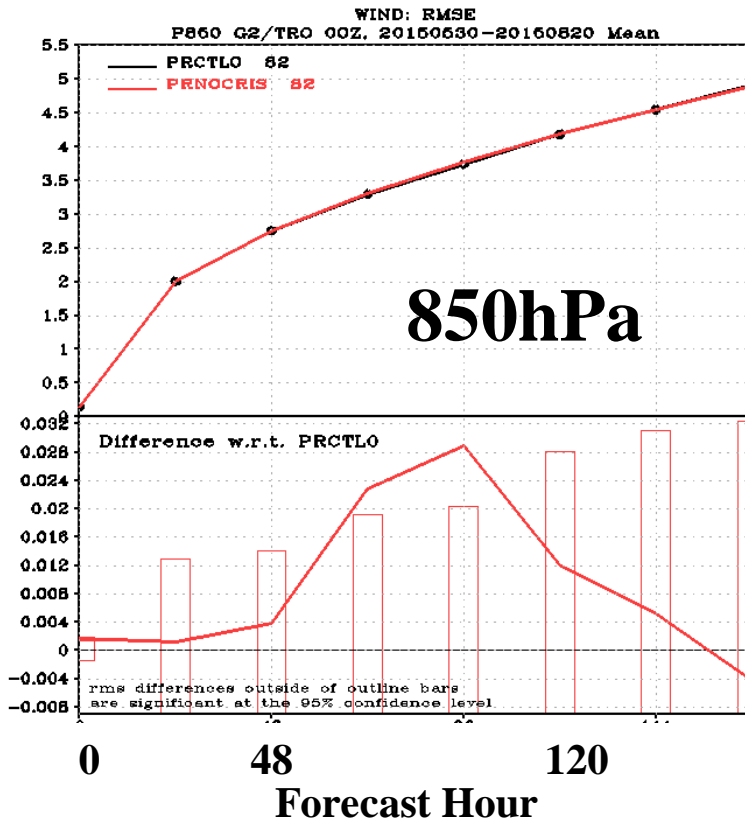


SH



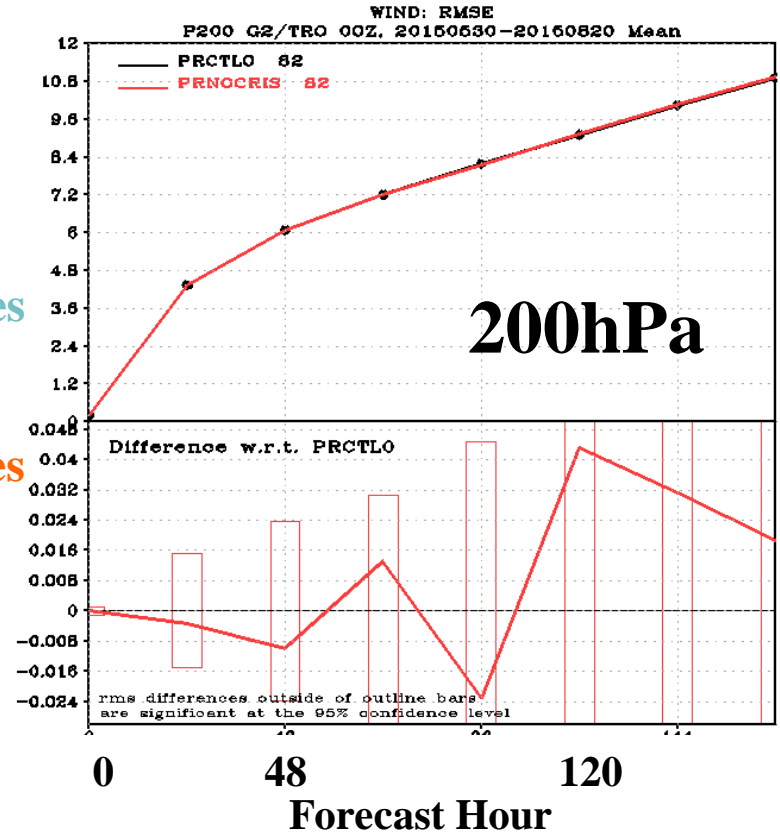
↓
**CrIS
 Improves**

Tropical Vector Wind RMS



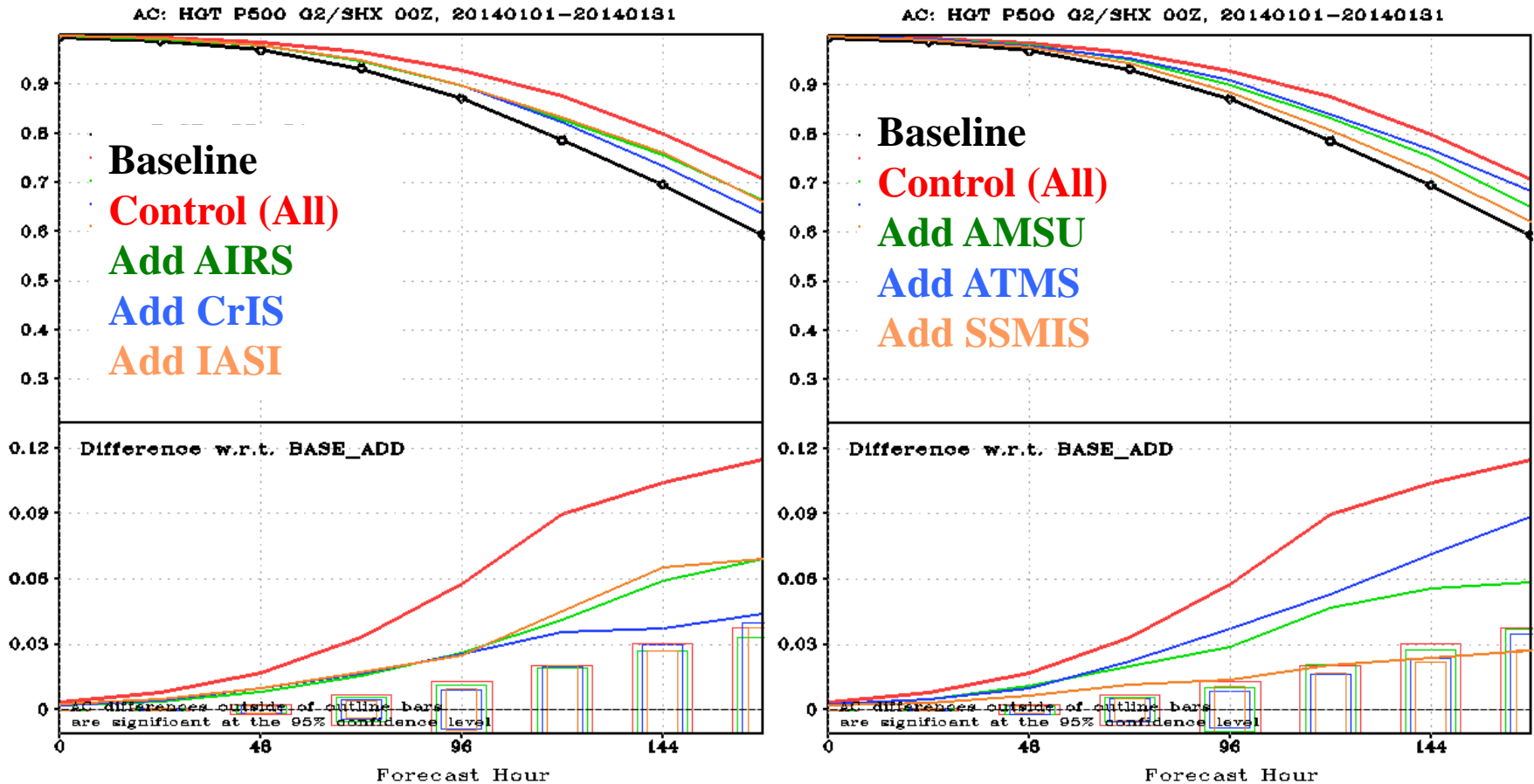
↑
CrIS
Improves

↓
CrIS
Degrades



Data Addition Experiments

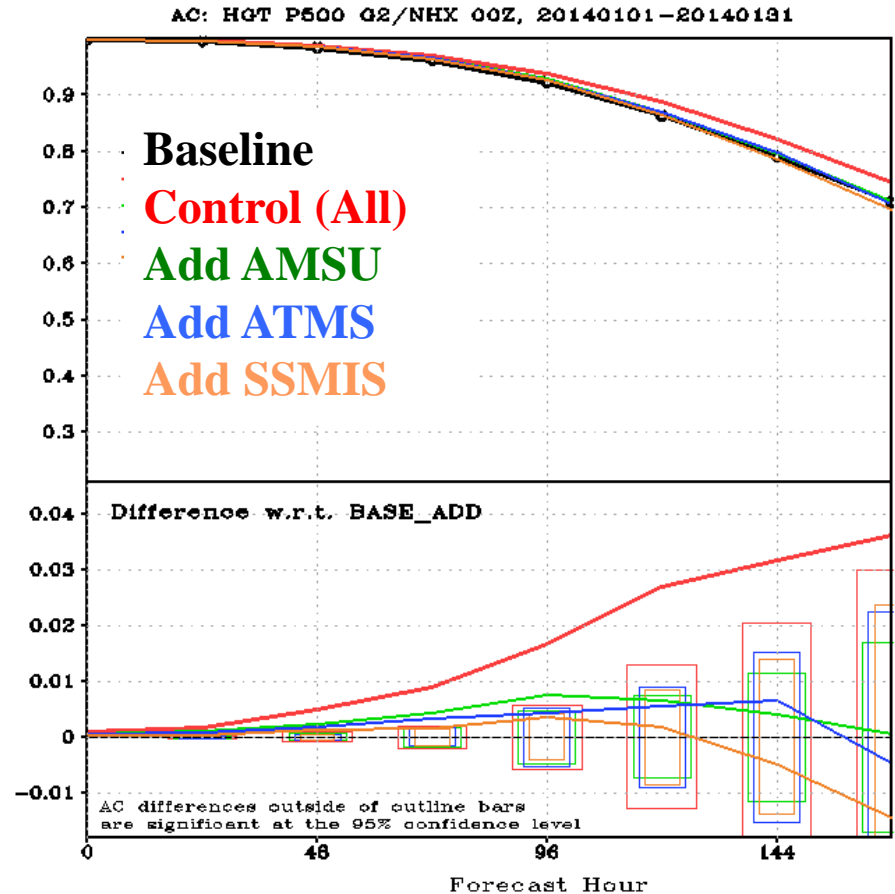
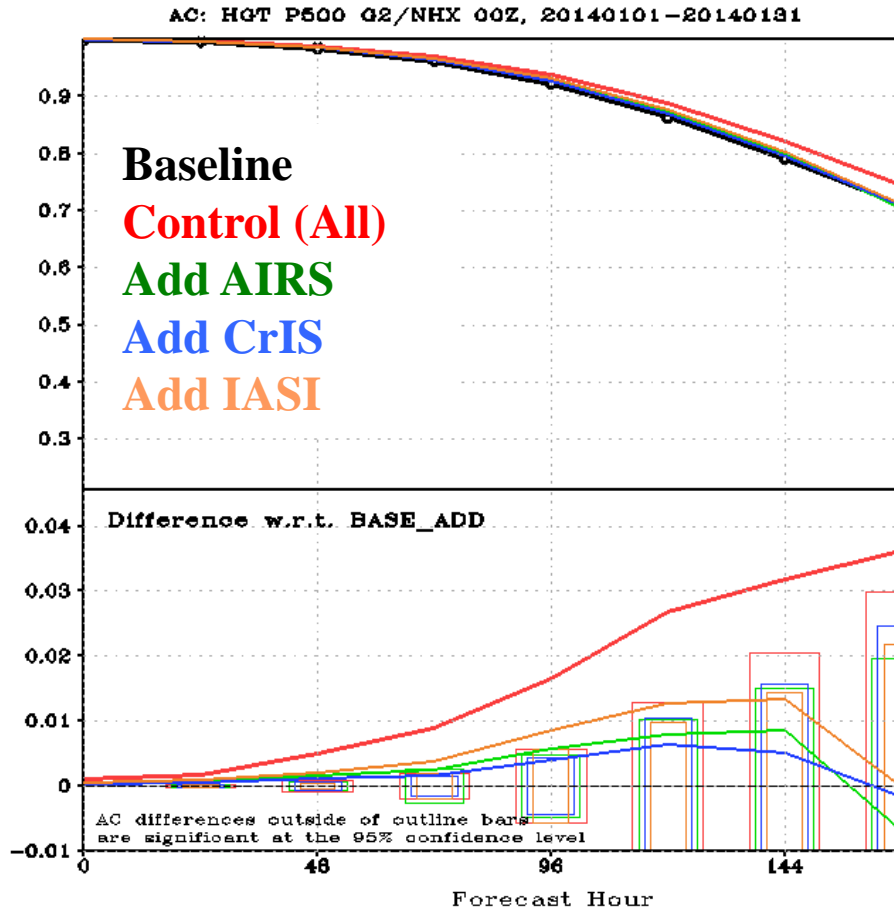
500 hPa Southern Hemisphere AC scores for
20140101 – 20140131 00Z





Data Addition Experiments

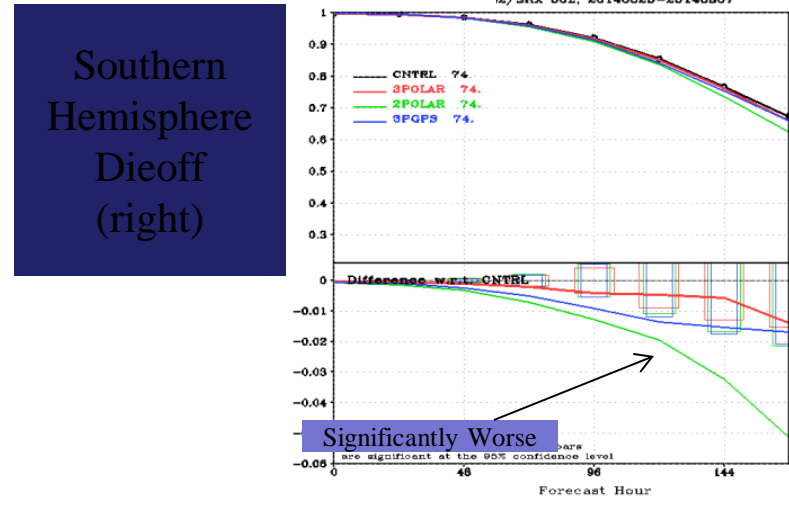
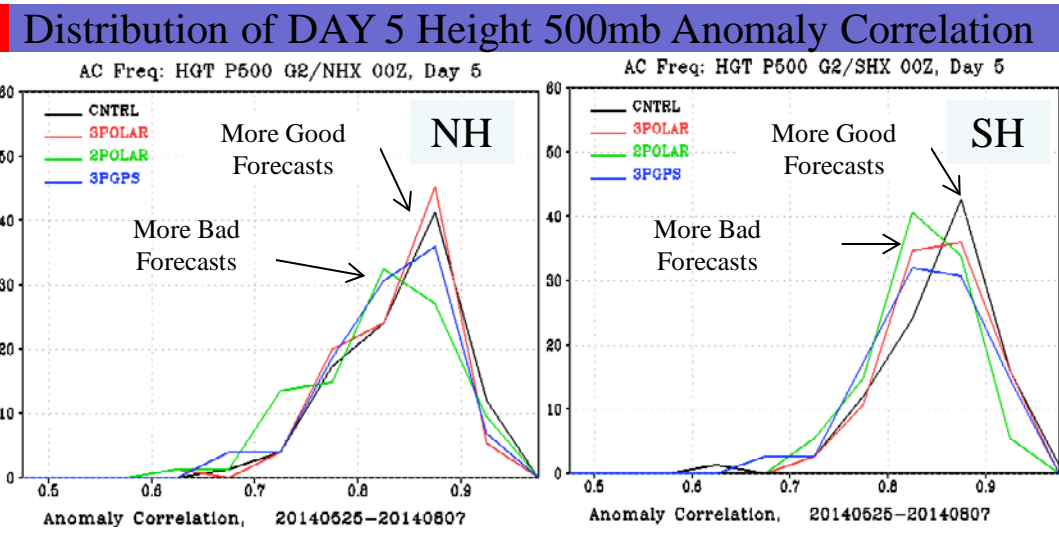
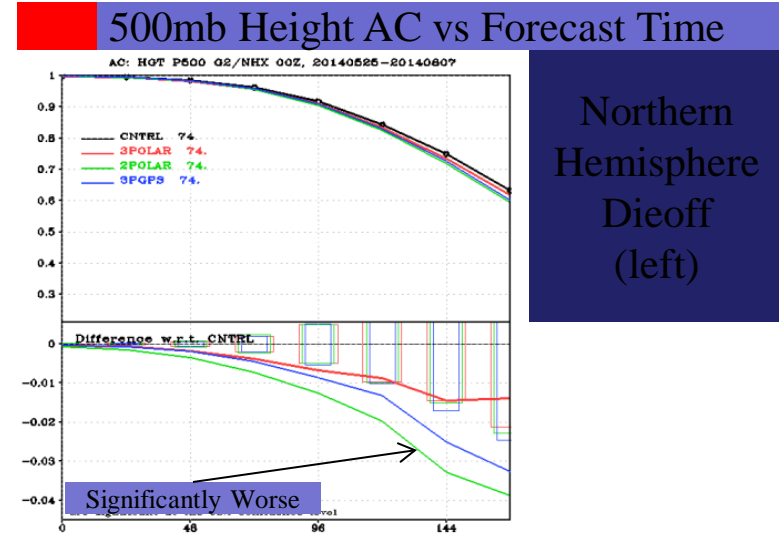
500 hPa Northern Hemisphere AC scores for
20140101 – 20140131 00Z



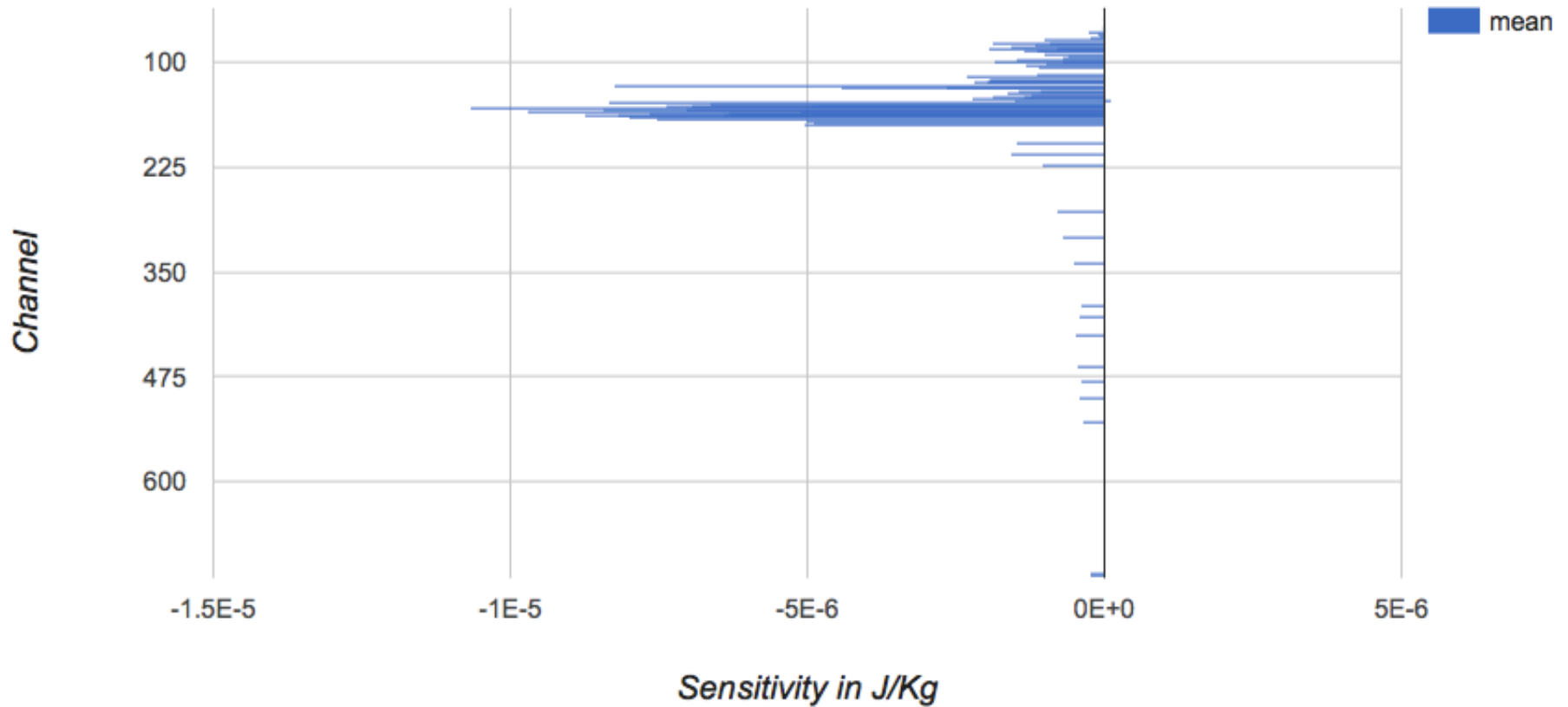
Impact of SNPP in a Reduced System

In a data sparse system (only one satellite per orbit to provide sounding data – F18 in Early AM; Metop-B in AM; SNPP in PM) the impact of removing SNPP is very significant (cf. **Red** and **Green** curves).

See Sid Boukabara's talk for more details.

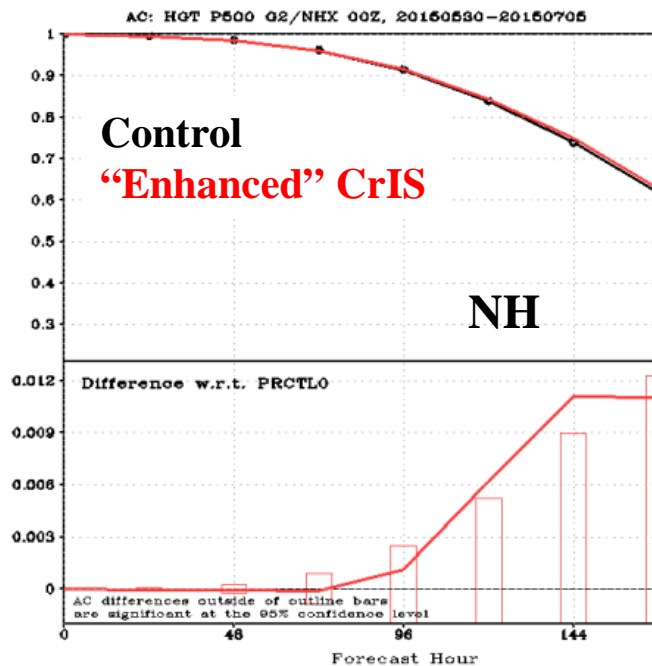


Forecast Sensitivity by Channel

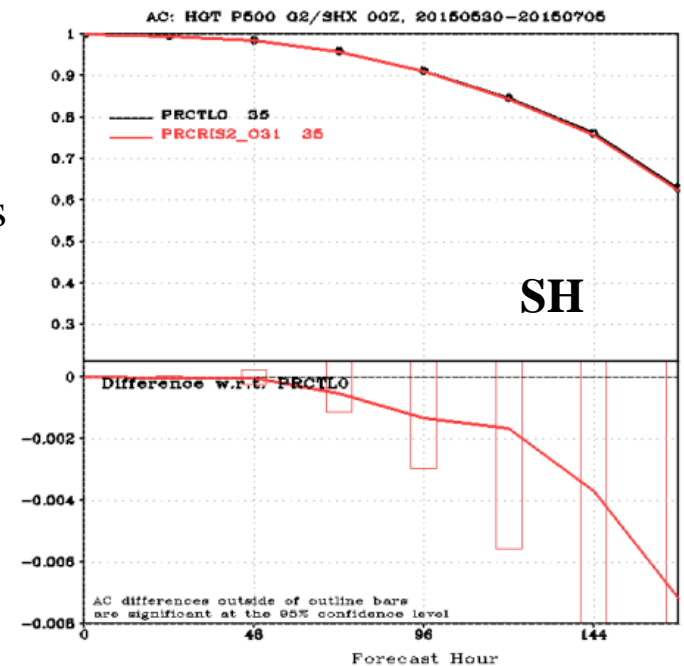


Improvements to Use of CrIS

- Our CrIS usage suffered from very low numbers of observations passing QC in the window channels
 - This was traces to an over-aggressive surface check that was interacting with the variational bias correction. This was removed.
- Reduced observation errors by up to 50%
- Removed adjacent channels in channel selection (FSO studies at GMAO indicated that these might cause negative impact).



500hPA
AC Scores



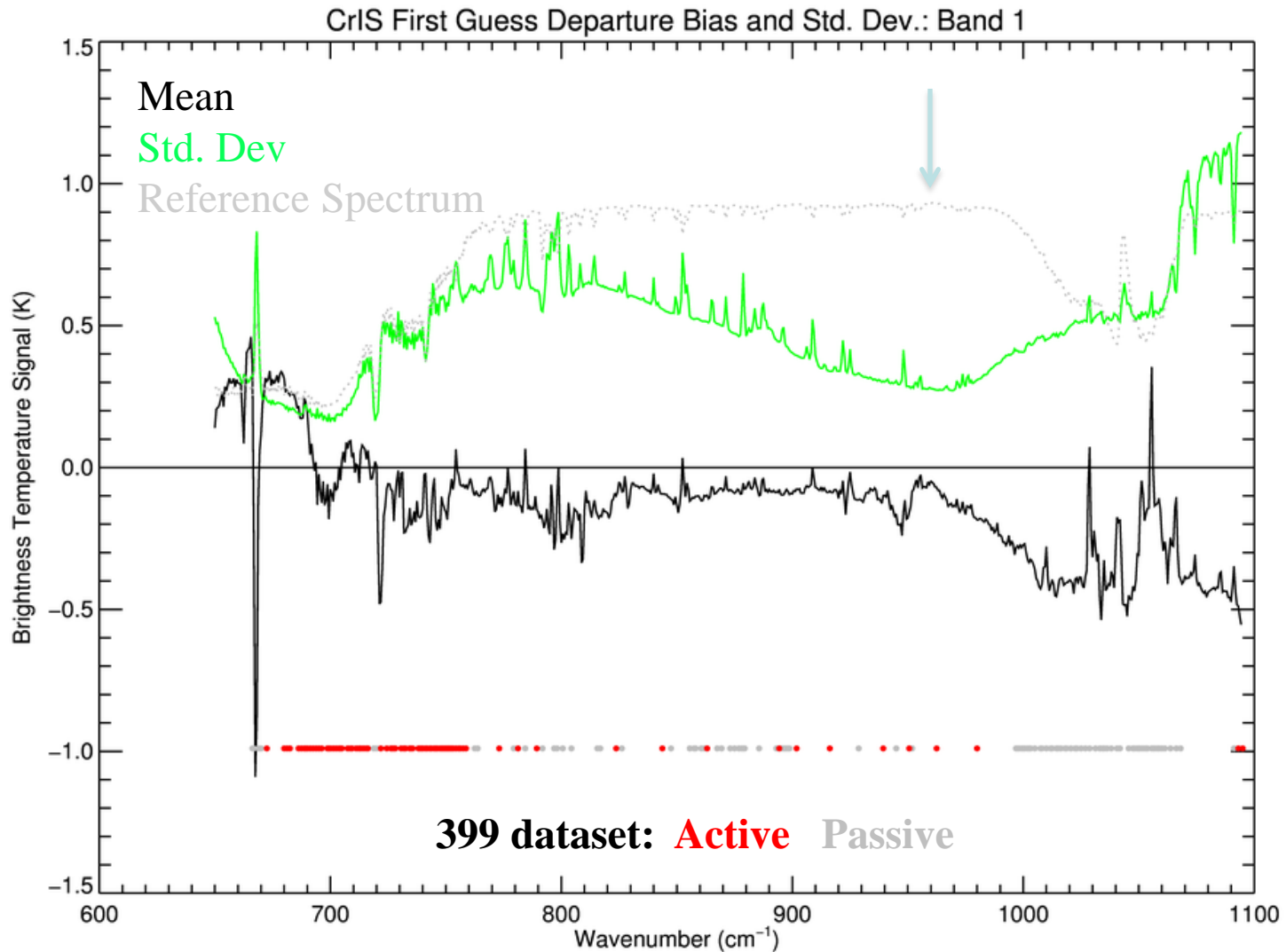


Full Spectral Resolution BUFR Data

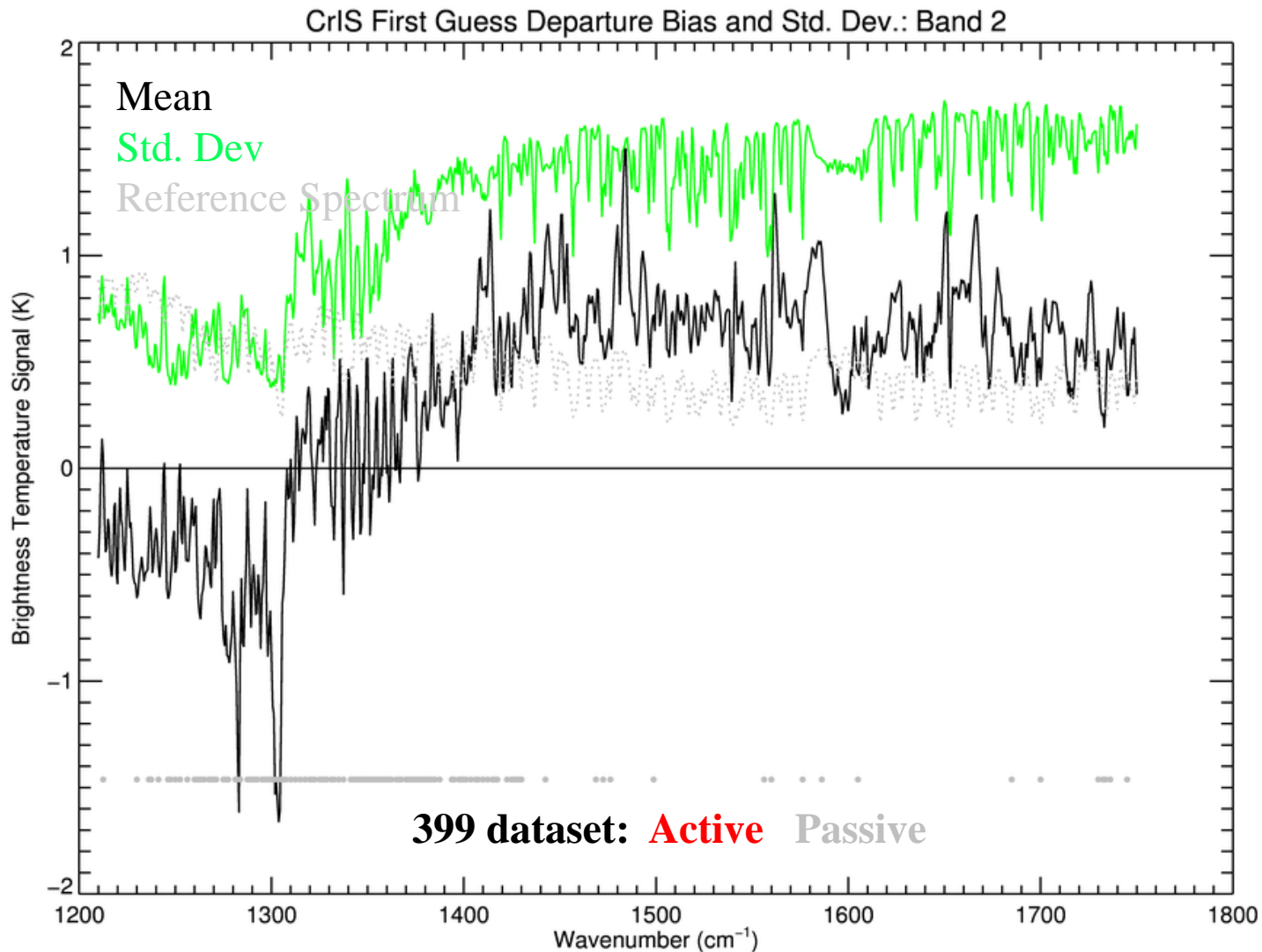


- CrIS Full Spectral Resolution (FSR) spectra have been delivered to the ground from SNPP since
- All bands are now at 0.625cm^{-1} resolution (was 1.25cm^{-1} for Band 2 and 2.5cm^{-1} for Band 3)
- Number of channels increases from 1305 to 2211.
- Sample BUFR data is currently on ftp://ftp2.star.nesdis.noaa.gov/smcd/letitias/CrIS_HR_BUFR/ (thanks to Tish Soulliard, Yi Song and Tom King for this!)
- Only FSR will be distributed for JPSS.
- At EMC/NCEP we are planning to ingest all these channels rather than a 399 channel subset to allow greater flexibility of channel usage.

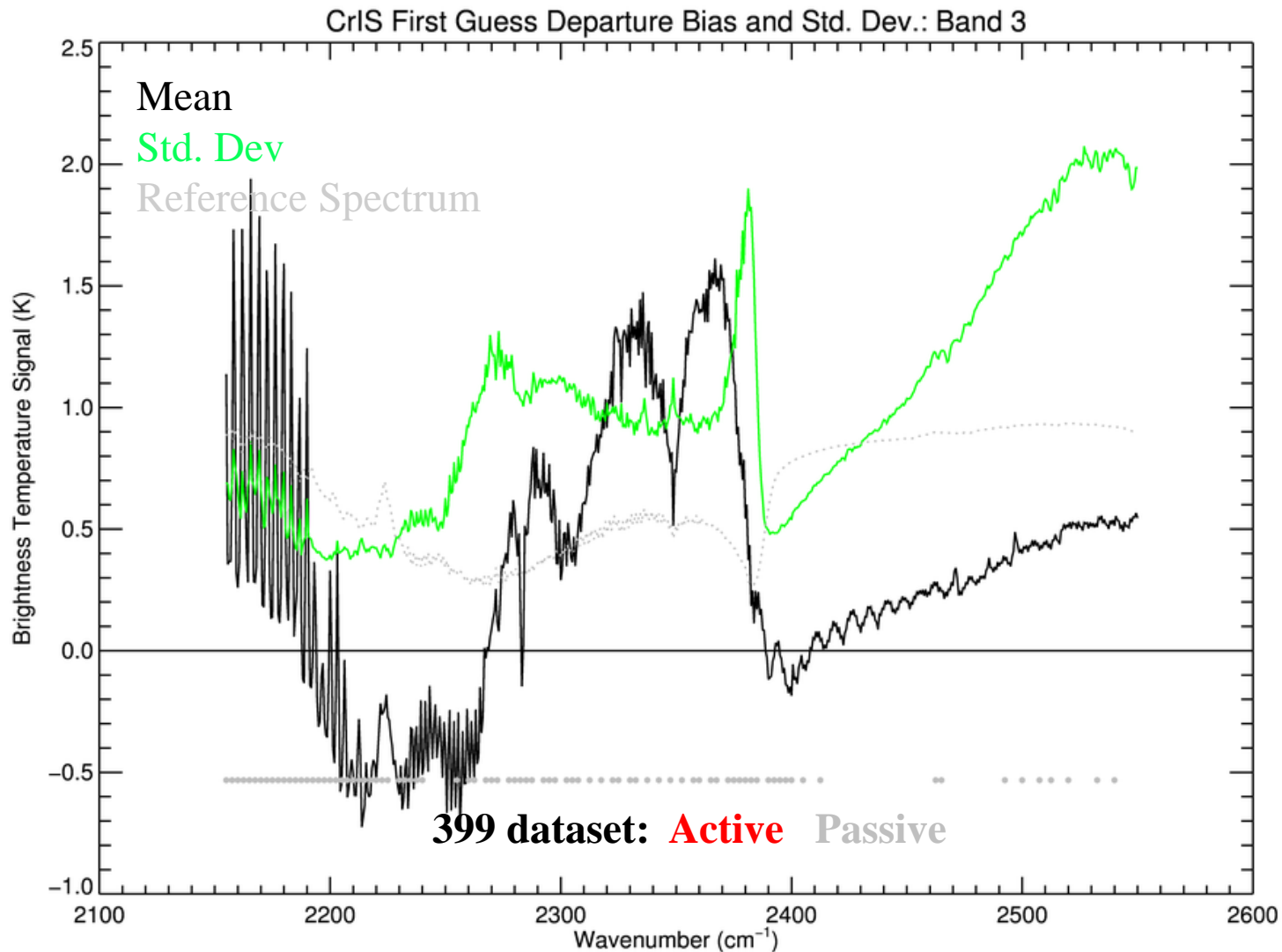
CrIS FSR Dataset – Band 1



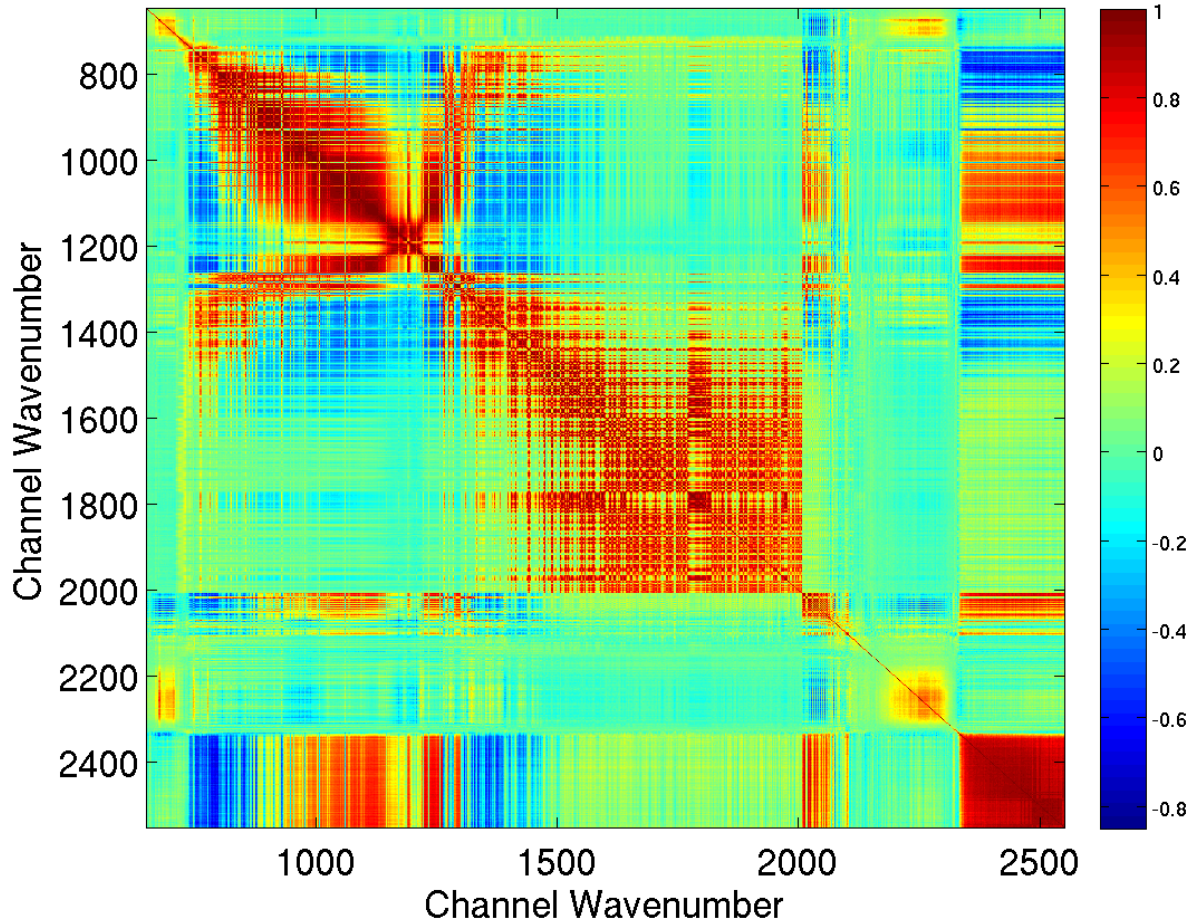
CrIS FSR Dataset – Band 2



CrIS FSR Dataset – Band 3

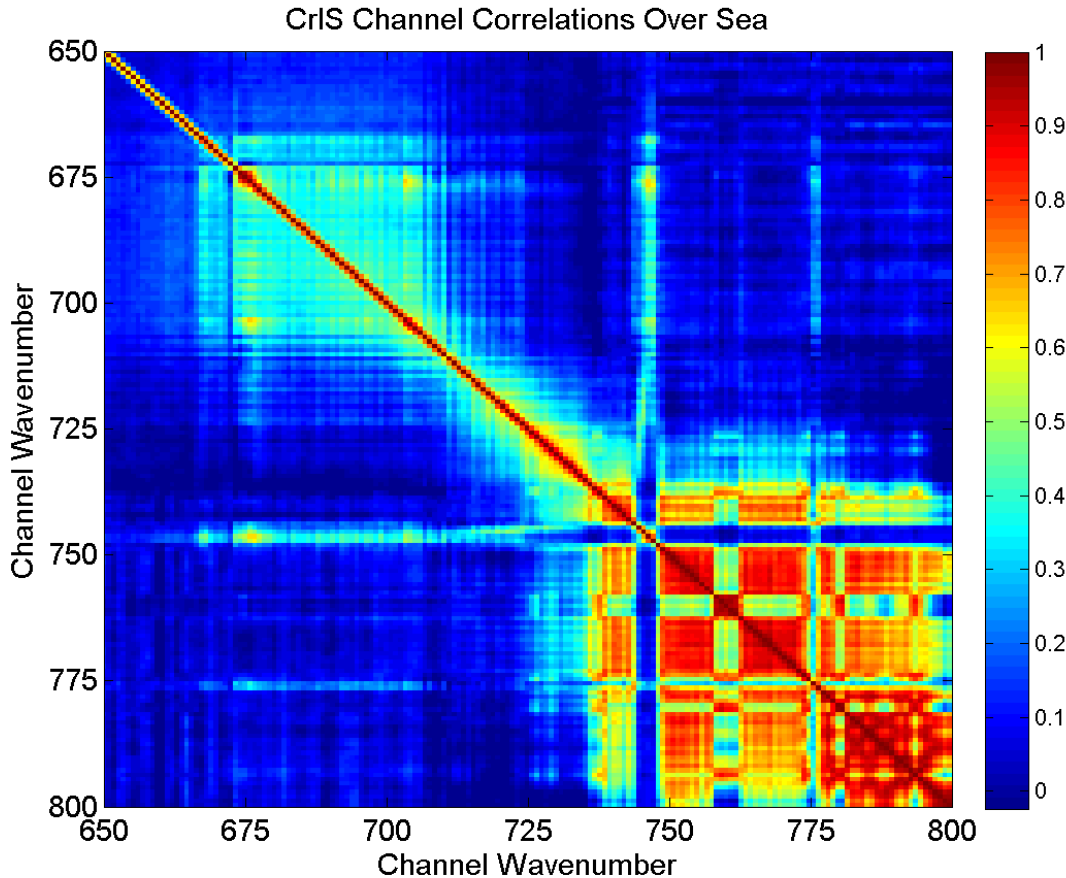


CRIS Channel Correlations Over Sea



Thanks to Ricardo Todling (NASA-GMAO) for developing this capability in GSI

Error Correlations from Desrosiers Technique Zoom in on the 15 μm CO₂ Band.



Strong adjacent-channel correlations due to apodisation....
.... in addition to significant broader correlation structures (forward model/representivity error?).



Conclusion and Future Plans

- CrIS currently has a modest impact on forecast accuracy consistent with other infrared sounders.
- CrIS cloud cleared radiance investigation continues (see talk by Haixia Liu).
- We are also investigating directed assimilation of cloudy IR radiances.
 - Work is currently focused on ensuring the forward model works as required.
- We anticipate transitioning to the use of FSR data in the 2017 model upgrade
 - We will reevaluate the channel selection for CrIS in the 15 μ m band while choosing new channels in Bands 2&3.
- Using the new GSI functionality from GMAO, we will investigate the use of correlated observation errors
 - ...possibly using this as a way to avoid issues with apodisation attenuating the first resonance in the Band 1 interferogram.