Impact Analysis of LEO Hyperspectral Sensor IFOV size on next generation NWP model forecast performance

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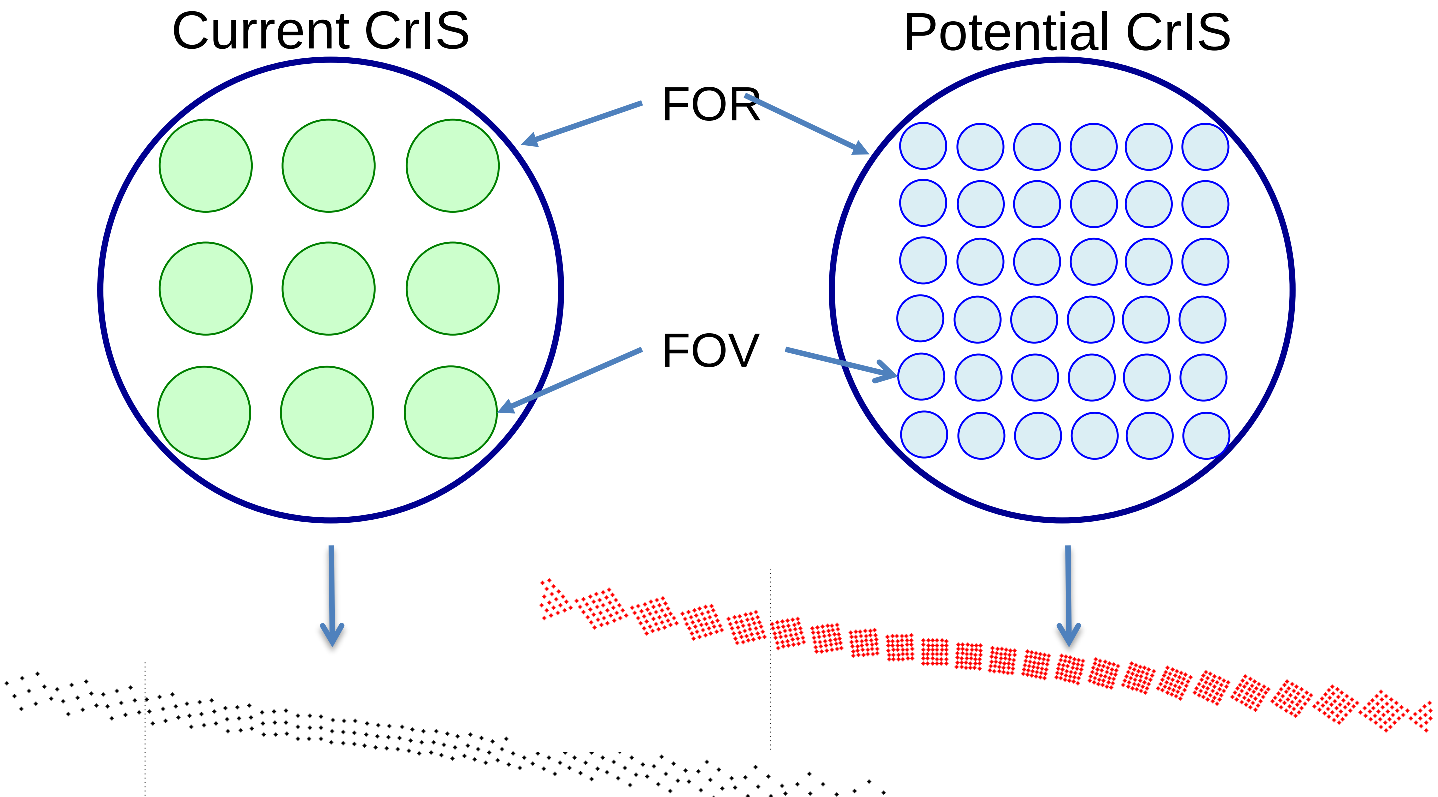
Current CrIS FOVs verses next generation CrIS FOVs

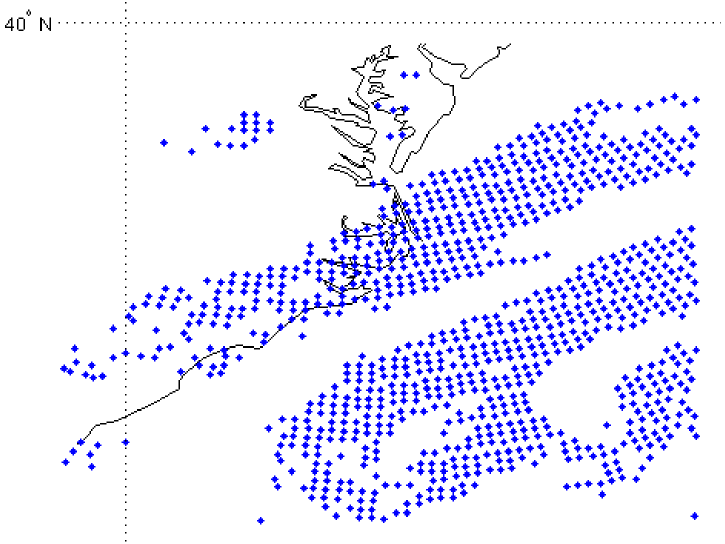


Current CrIS FOVs verses next generation CrIS FOVs

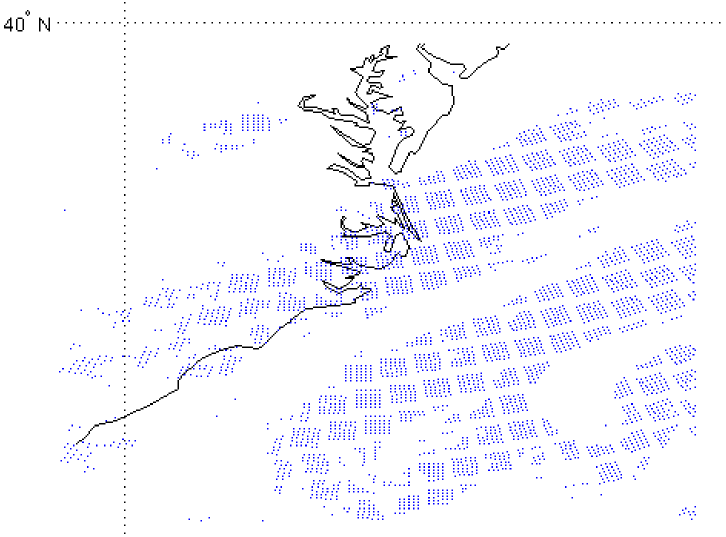
Smaller FOV size → more chance of hole hunting for clear sky condition

Current CrIS FOVs verses next generation CrIS FOVs

Current CrIS



Potential CrIS



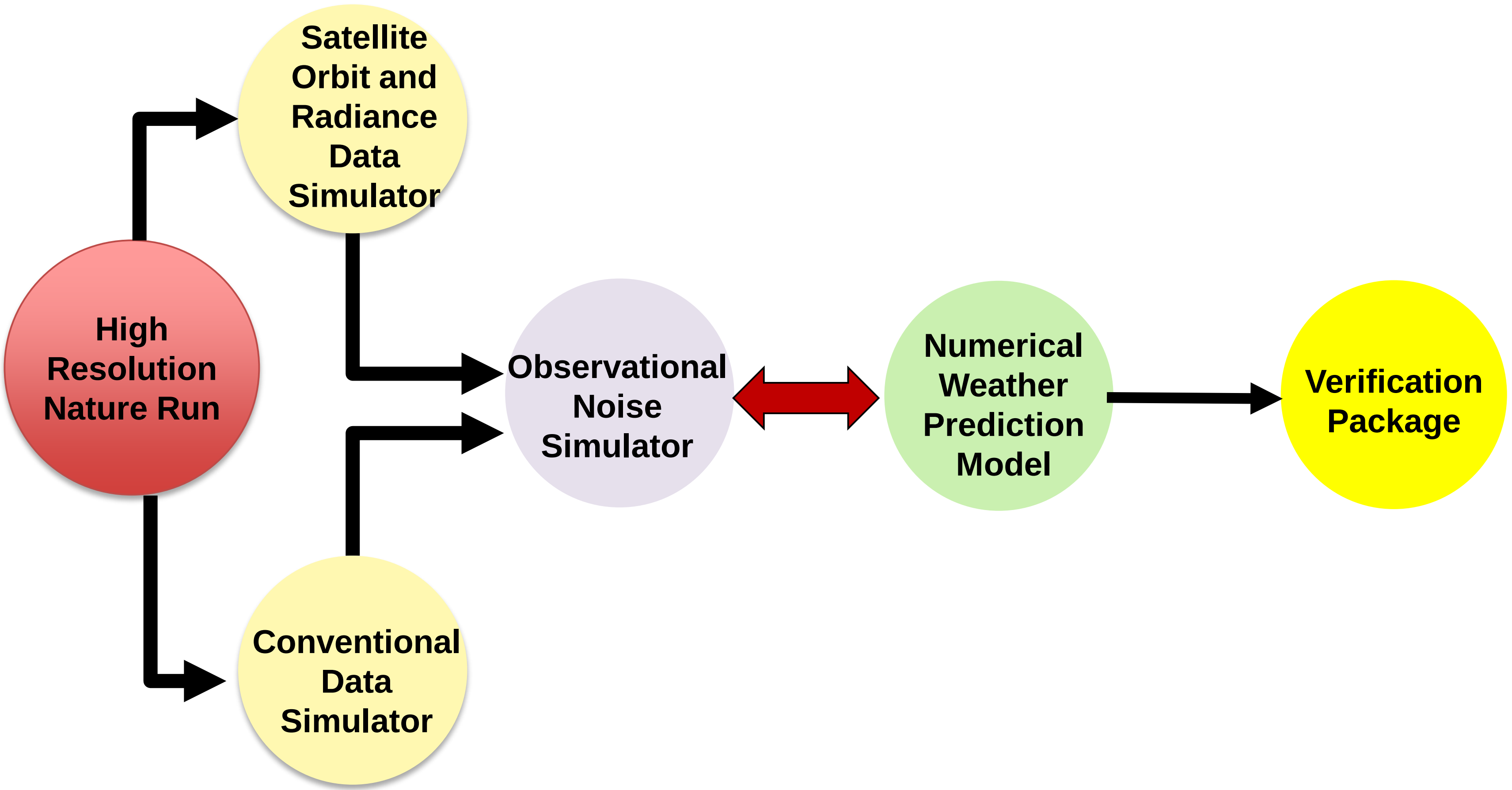
Cloud Mask

Current CrIS FOVs verses next generation CrIS FOVs

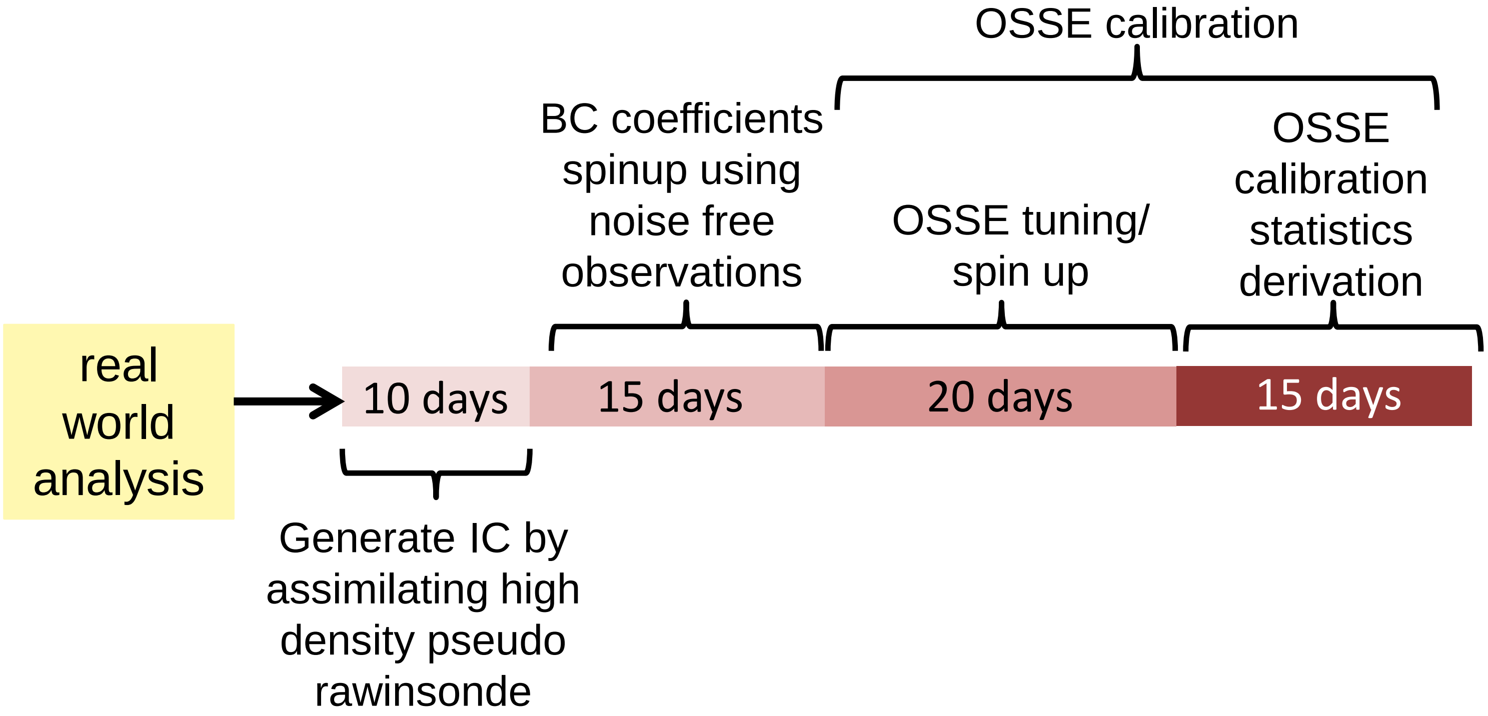
Smaller FOV size → more chance of hole hunting for clear sky condition

How will assimilation of CriS observations with smaller FOVs impact forecast performance?

Observing System Simulation Experiment



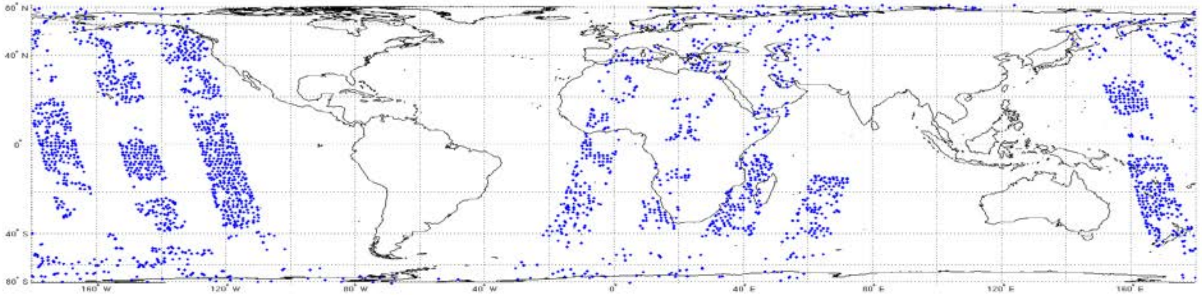
Experiment Framework



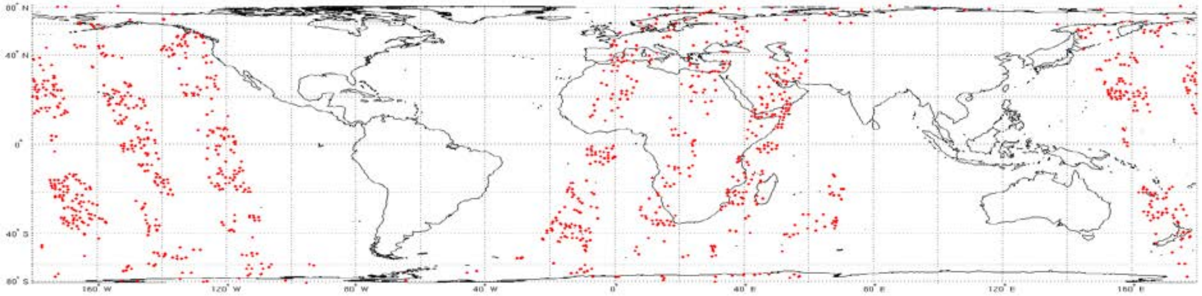
OSSE Calibration – Clear sky counts

Coverage for AIRS on 2006-05-02 00z

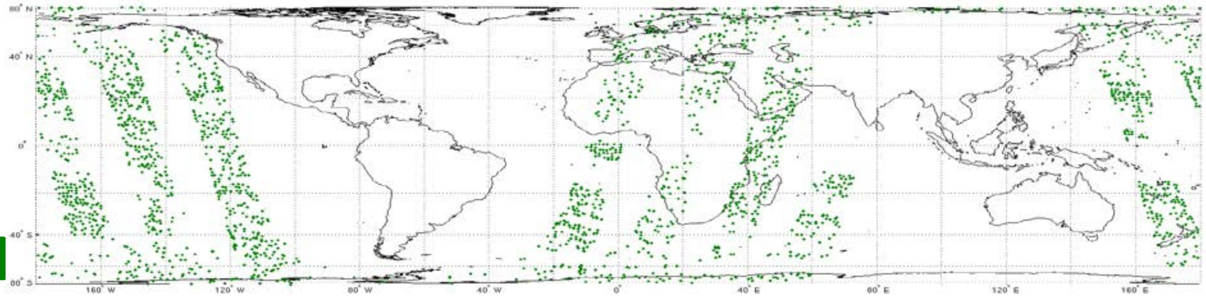
Real



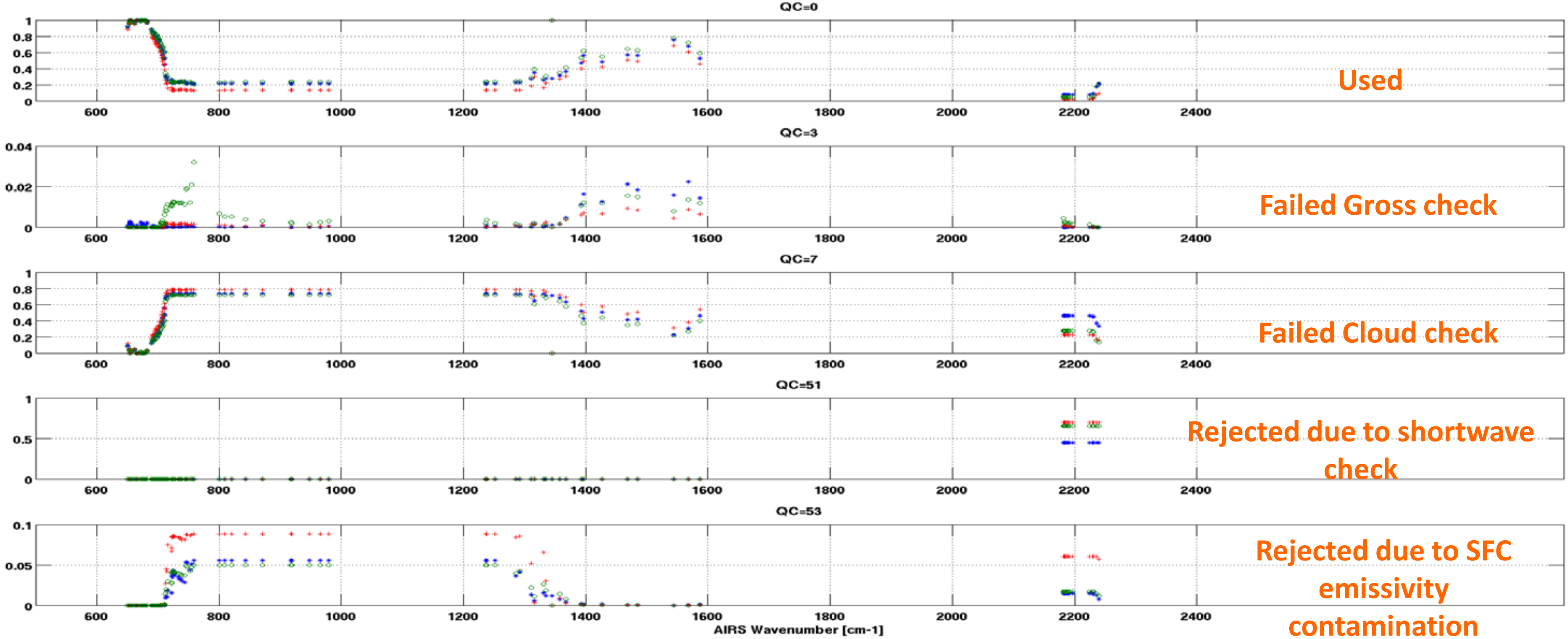
OSSE



OSSE tuned



OSSE Calibration –QC count ratios



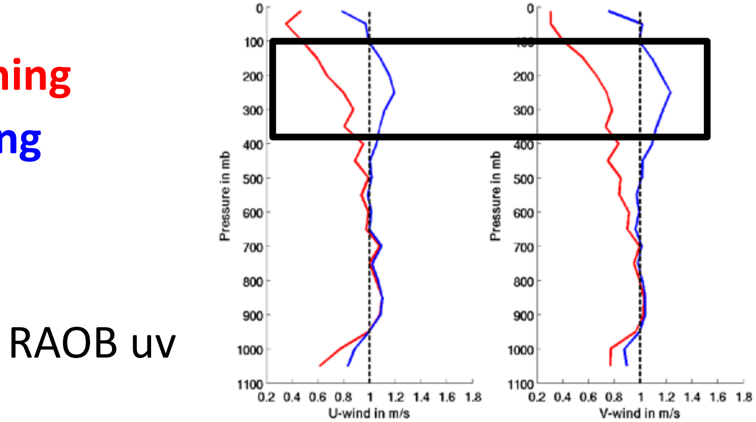
Ratio of used/rejected to total observation count considered for all used AIRS channels on 2006-05-02 00z

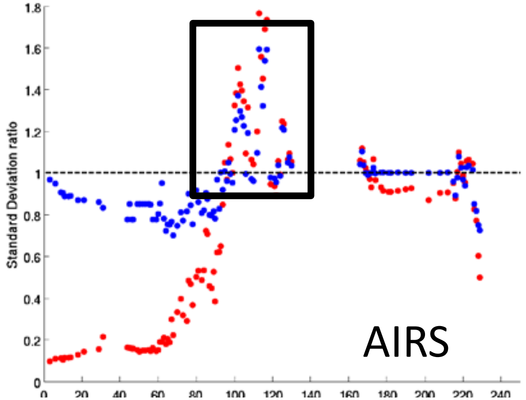
Real **OSSE** **Tuned OSSE**

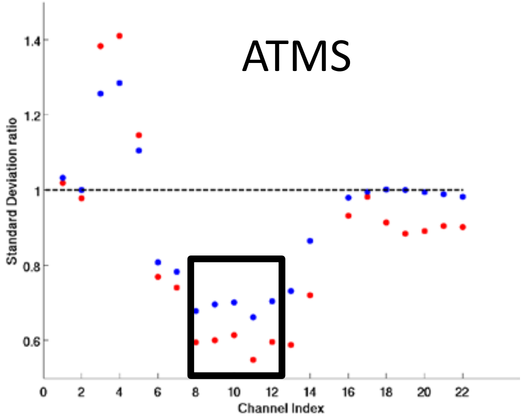
OSSE Calibration – Ratio of Standard Deviation

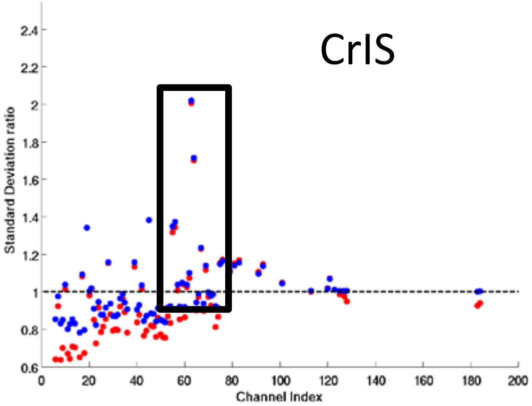
Before iterative tuning

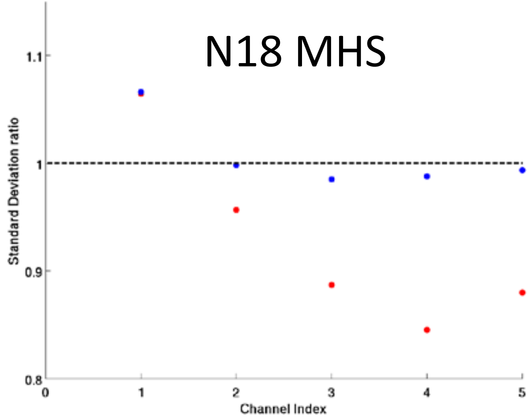
After iterative tuning



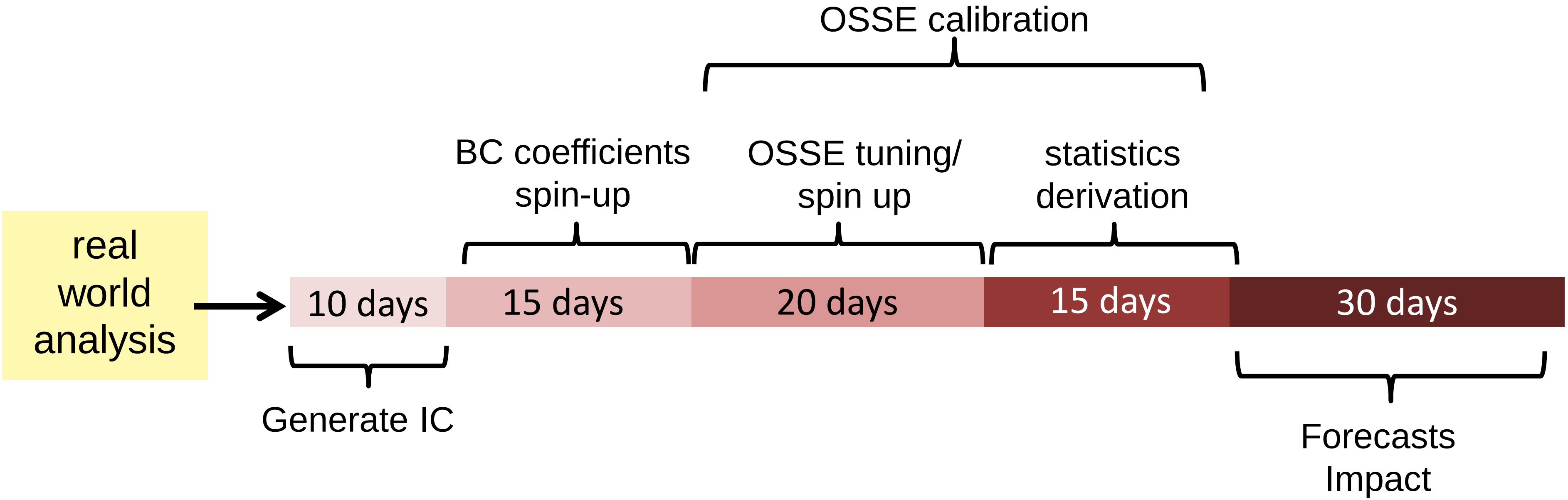








Experiment Framework



<u>Impact assessment</u>

- CTRL – CrIS 3x3, FOIV 5 @ 14km
- EXP – CrIS 6x6, all FOVs @ 7km

Scorecard (2006-06-01 to 2006-06-30)

		P Lev	N. Hemisphere			S. Hemisphere			Tropics		
			Day 1	Day 3	Day 5	Day 1	Day 3	Day 5	Day 1	Day 3	Day 5
RMSE	Heights	100 hPa									
		500 hPa									
		850 hPa									
		1000 hPa									
	Wind Vector	200 hPa									
		500 hPa									
		850 hPa									
		1000 hPa									
	Temp	100 hPa									
		500 hPa									
		850 hPa									
		1000 hPa									
Bias	Heights	100 hPa									
		500 hPa									
		850 hPa									
		1000 hPa									
	Wind Vector	200 hPa									
		500 hPa									
		850 hPa									
		1000 hPa									
	Temp	100 hPa									
		500 hPa									
		850 hPa									
		1000 hPa									

OSSE_EXP better than OSSE_CTRL		99.9% signififcant l
		99% signififcant level
		95% signififcant level
Neutral		No statistcal significant difference
OSSE_CTRL worse than OSSE_EXP		95% signififcant level
		99% signififcant level
		99.9% signififcant level

Scorecard (2006-06-01 to 2006-06-30)

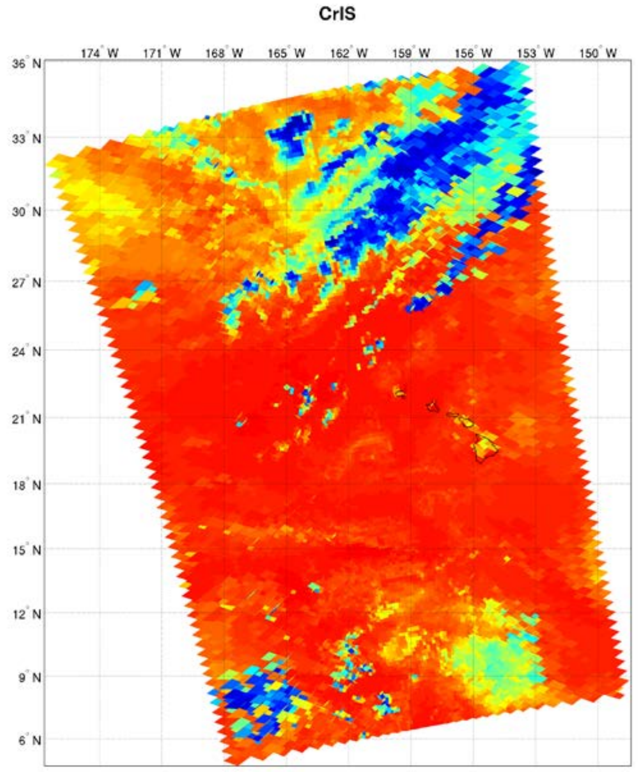
		P Lev	N. Hemisphere			S. Hemisphere		
			Day 1	Day 3	Day 5	Day 1	Day 3	Day 5
Anomaly Correlation	Heights	250 hPa						
		500 hPa						
		700 hPa						
		1000 hPa						
	Vector Wind	250 hPa						
		500 hPa						
		850 hPa						
	Temp	250 hPa						
		500 hPa						
		850 hPa						
	MSLP	MSL						

OSSE_EXP		99.9% signififcant l
better than		99% signififcant level
OSSE_CTRL		95% signififcant level
Neutral		No statistcal significant difference
OSSE_CTRL		95% signififcant level
worse than		99% signififcant level
OSSE_EXP		99.9% signififcant level

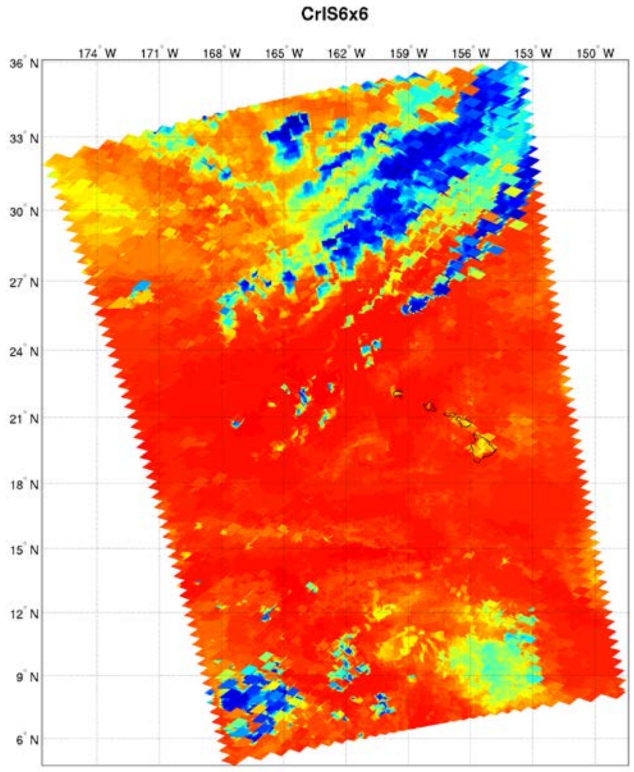
OSSE deficiencies

1) Errors to be added to CrIS 6x6 observations
2) Calibration:
   - Statistics within 20%, issues with microwave mid tropospheric channels, infrared surface channels and tropopause.
   - Correlated errors
   - GPSRO error model
3) Observations simulation:
   - Conventional data
   - CrIS

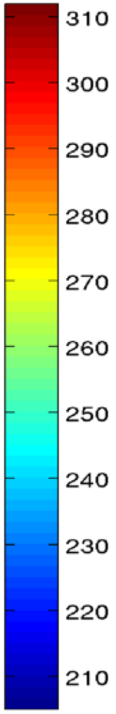
Comparison of CrIS simulation with different spatial resolution



CriS 3x3 @ 14km



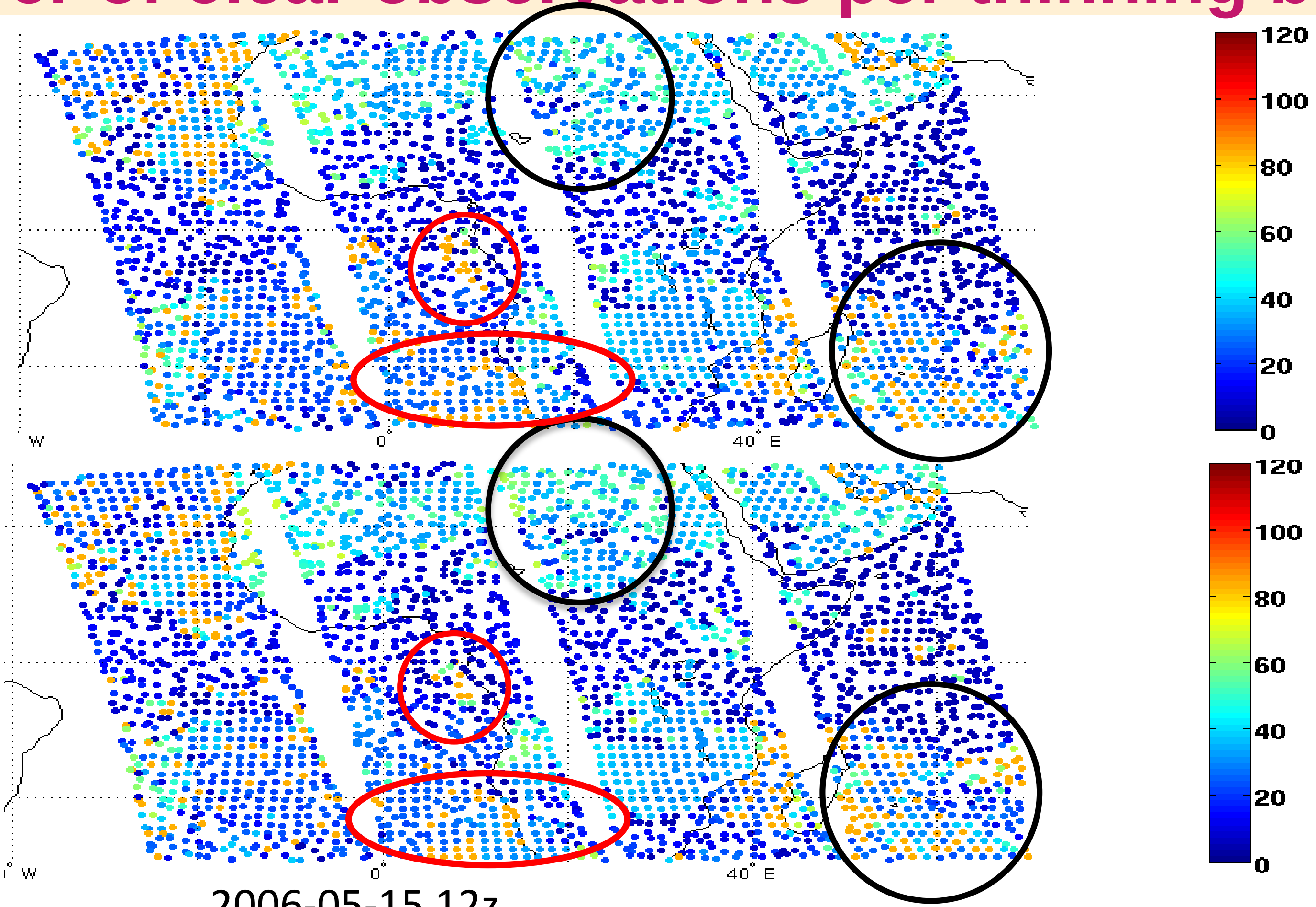
CriS 6x6 @ 7km



Number of clear observations per thinning box

CriS 3x3

CriS 6x6

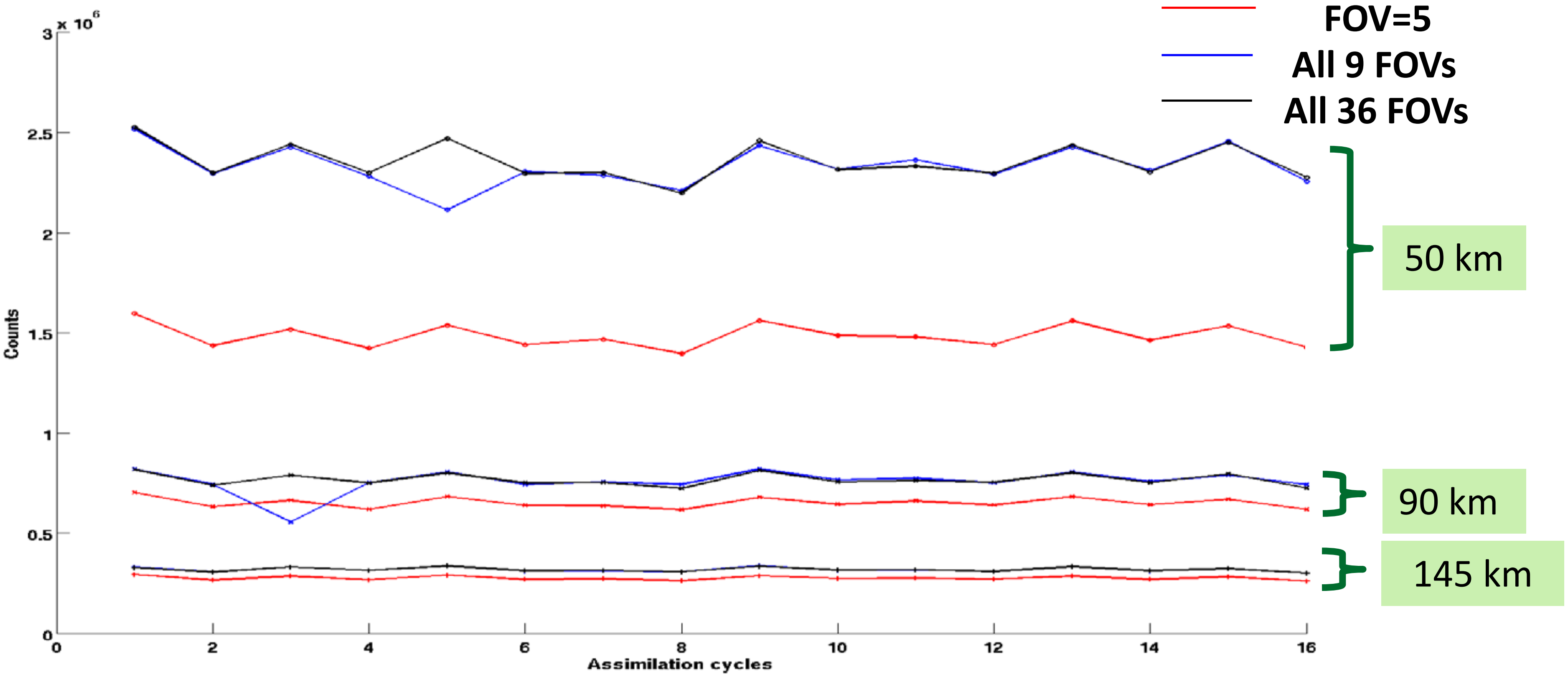


2006-05-15 12z

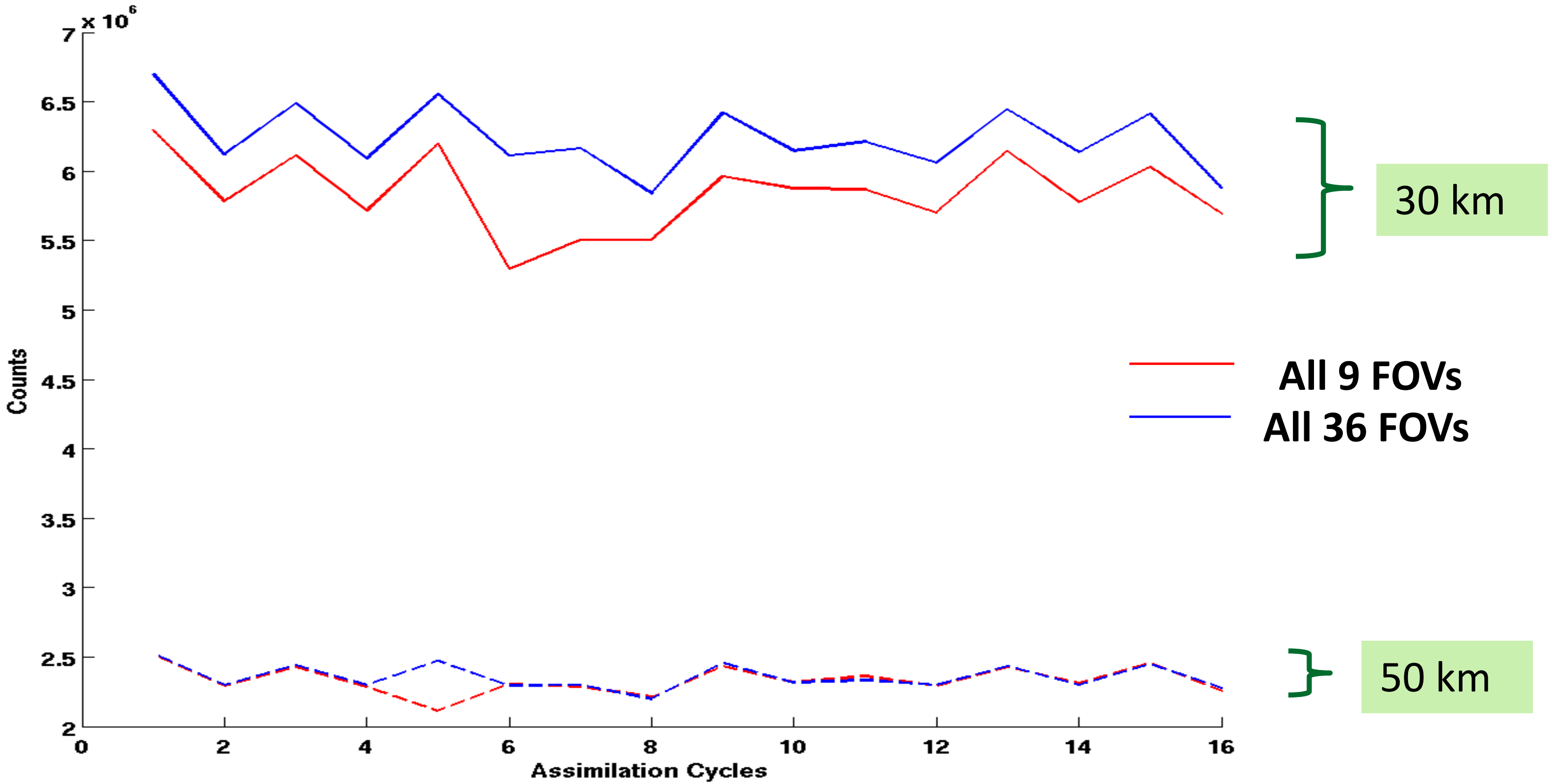
General deficiencies

1) Nature run
   - Missing small scale resolvable features
   - Cloud bias
2) GSI thinning
   - One observation location per thinning box.

Impact of different thinning resolution



Impact of different thinning resolution



Conclusion

- Forecast performance using higher spatial resolution CrIS observations
- A global OSSE system has been developed at CIMSS in coordination with NOAA OSSE team.
- Slight positive impact for bias, overall neutral results
- OSSE Deficiencies – simulation of observations, calibration and noise estimation for increased resolution CrIS.
- General Deficiencies – nature run and GSI thinning
- Better results expected with improvements in OSSE deficiencies .

Under the support from JPSS Program Office, a global OSSE framework is developed, dedicated to support future JPSS impact studies.

Acknowledgements

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