

SST Team Feedback to VCM

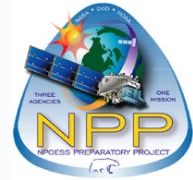
Sasha Ignatov

STAR: Prasanjit Dash, John Stroup, Yury Kihai, Boris Petrenko, Xingming Liang

NAVO: Jean-François Cayula, Doug May



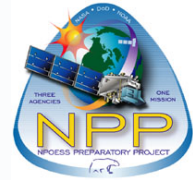
SST is very sensitive to VCM



- **Three major factors critically affect SST Quality/Accuracy**
 - Sensor Radiances – Addressed in SDR review.
Radiances are very good (except striping)
 - Cloud Mask – This presentation
 - SST Algorithm – SST Review tomorrow



VCM Provisional Review (Jan 2013): STAR Conclusions and Work in Progress



- VCM performance for SST suboptimal
 - IDPS domain larger than ACSPO, but SST statistics degraded
 - SST specs are not met (including revisited in new L1RD)
 - Part of SST performance is due to SST algorithms (e.g., limb cooling at swath edges) – work underway to revisit
 - Improvements to VCM needed during both day and night
- STAR work underway to improve VCM for SST
 - U. Wisconsin Andy Heidinger and Denis Botambekov to replicate SQUAM global analyses & fine-tune VCM, globally

STAR VCM/SST Analyses

- Consistent with earlier analyses (VCM Beta Review, Apr'2012, and VCM Provisional Review, Jan'2013)
 - Compare VIIRS SSTs with L4 fields and in situ, globally
 - Use VCM Confidently Clear ocean pixels (SST QFs overly restrictive and not used, pending redesign contingent upon adding Reynolds SST in IDPS)

ACSPPO (NOAA heritage) vs. IDPS SSTs

Objective: Ensure comparable SST performance in a comparable SST domain

Analysis of one globally representative day of data
– 28 December 2013 in SST Quality Monitor (SQUAM)

www.star.nesdis.noaa.gov/sod/sst/squam/



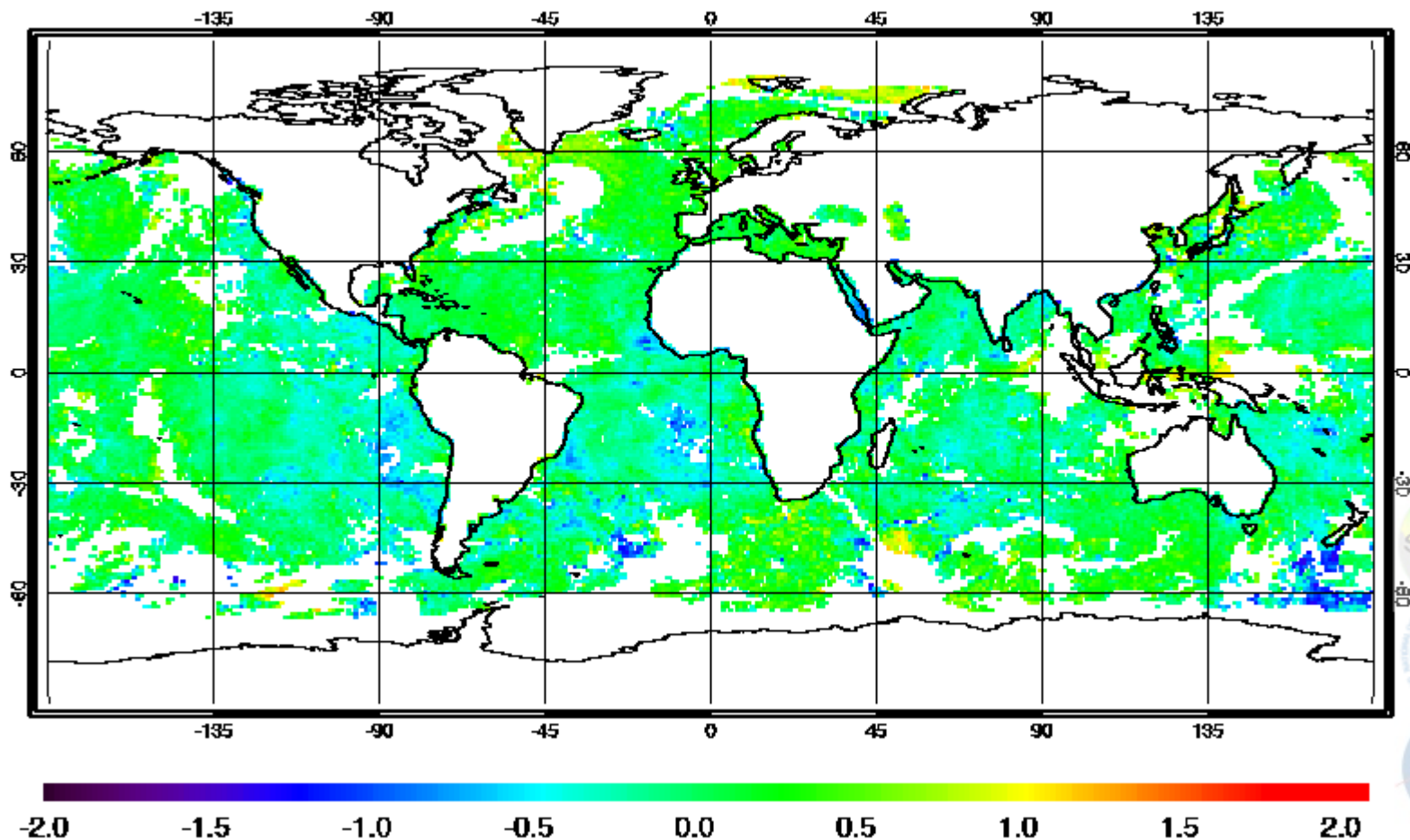
NIGHT Analyses



NIGHT: ACSP0 L2 minus OSTIA L4

28 December 2013

SST-OSTIA NPP 20131228 Night ACSP0 V2.30

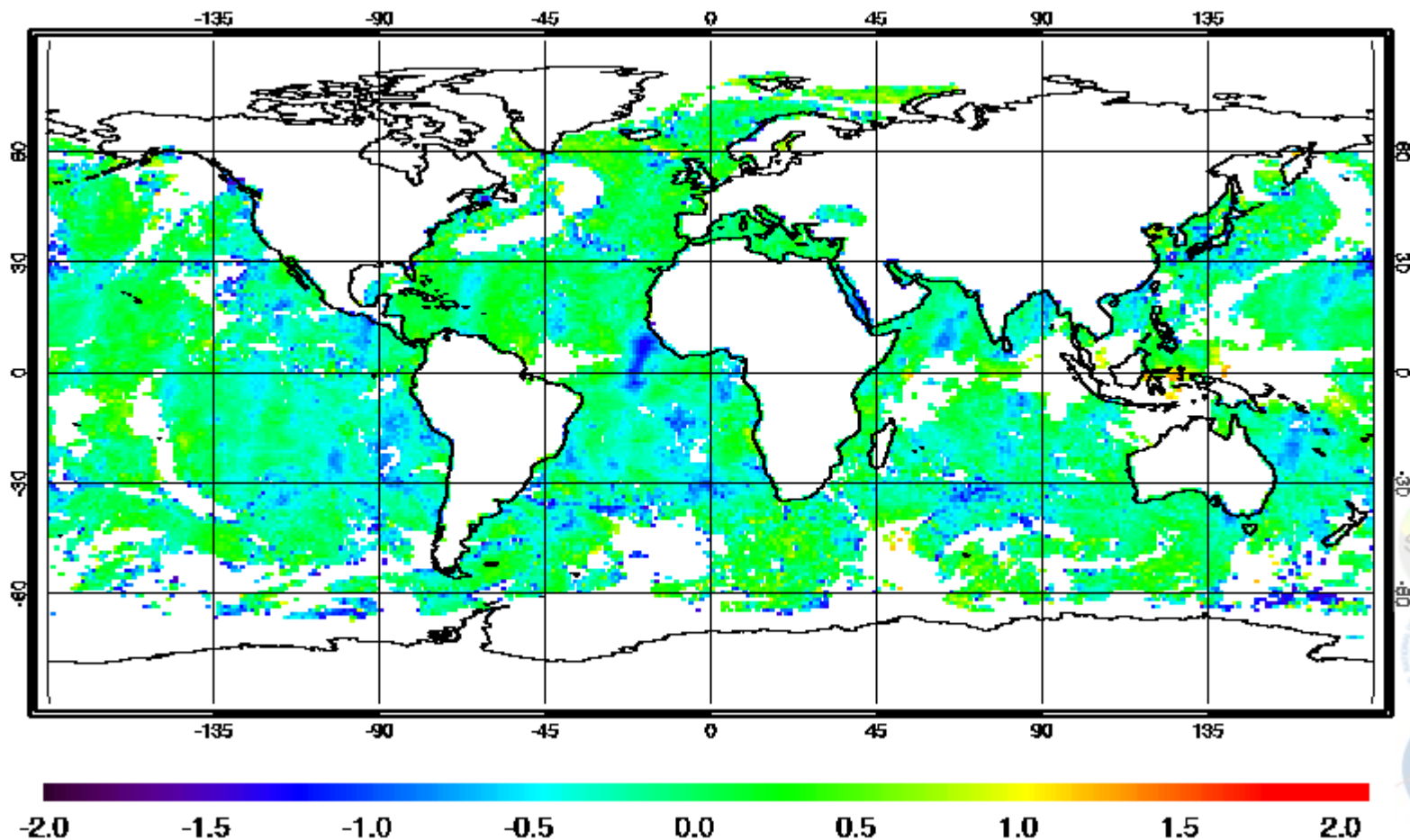


- Deviation from Reference SST is flat & close to 0
- Residual Cloud/Aerosol leakages seen as cold spots

NIGHT: IDPS L2 minus OSTIA L4

28 December 2013

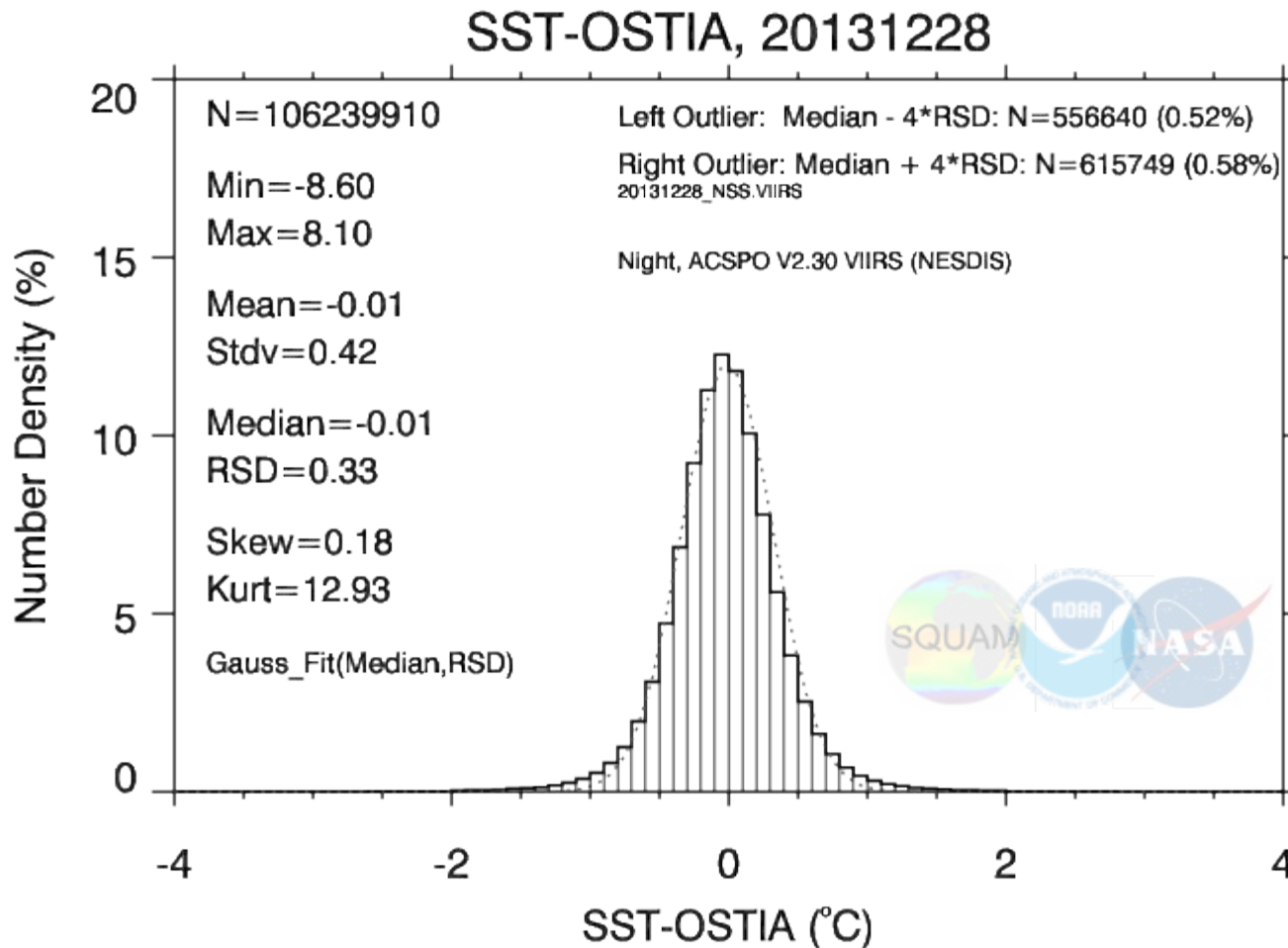
SST-OSTIA NPP 20131228 Night IDPS _11.5.08.00



- *More Cloud leakages than in ACSPO*
- *“Limb Cooling” – due to suboptimal SST equations (fixed in build 8.1, Feb 2014)*

NIGHT: ACSP0 L2 minus OSTIA L4

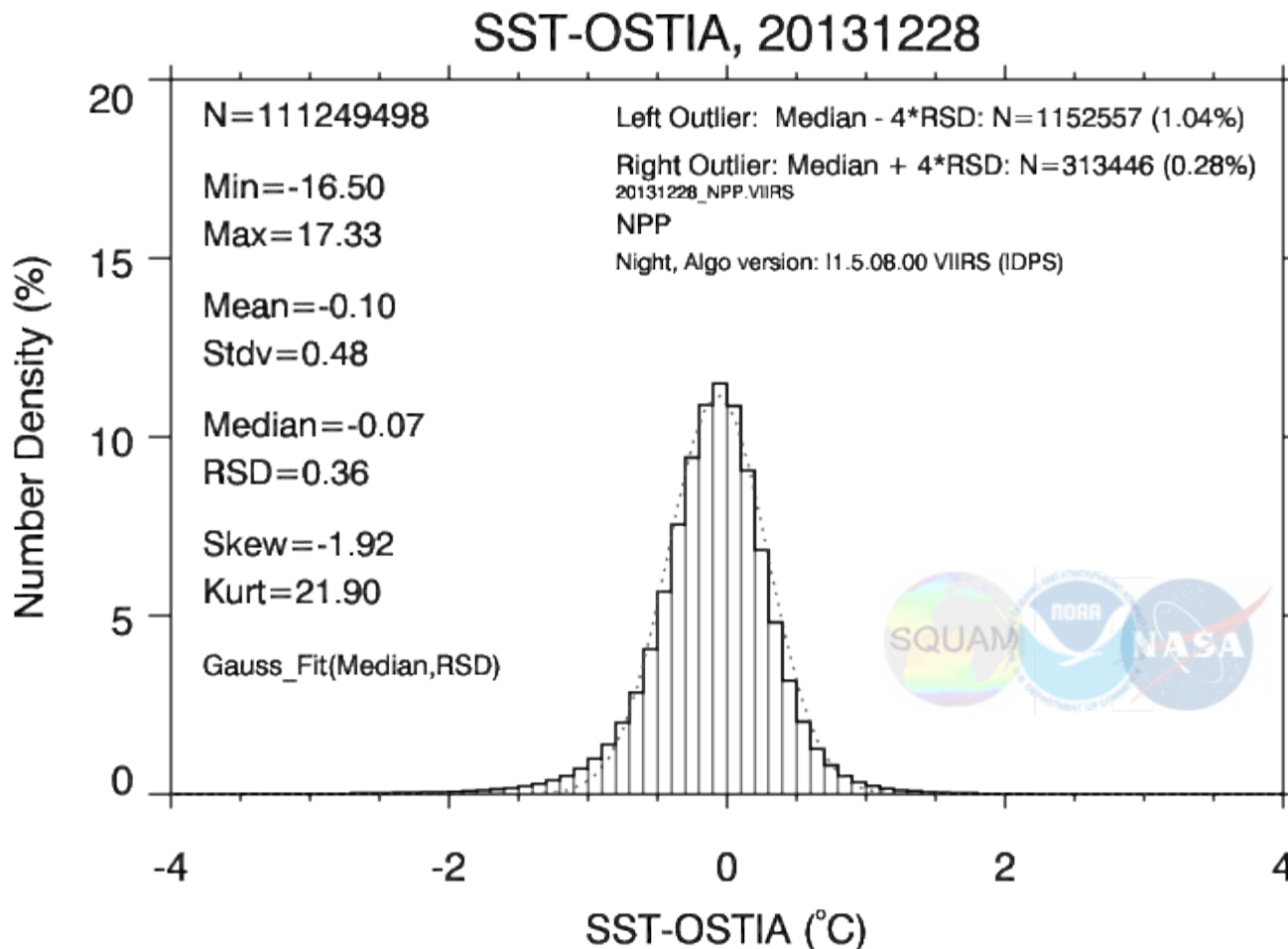
28 December 2013



- *Shape close to Gaussian*
- *Domain & Performance Stats close to expected*

NIGHT: IDPS L2 minus OSTIA L4

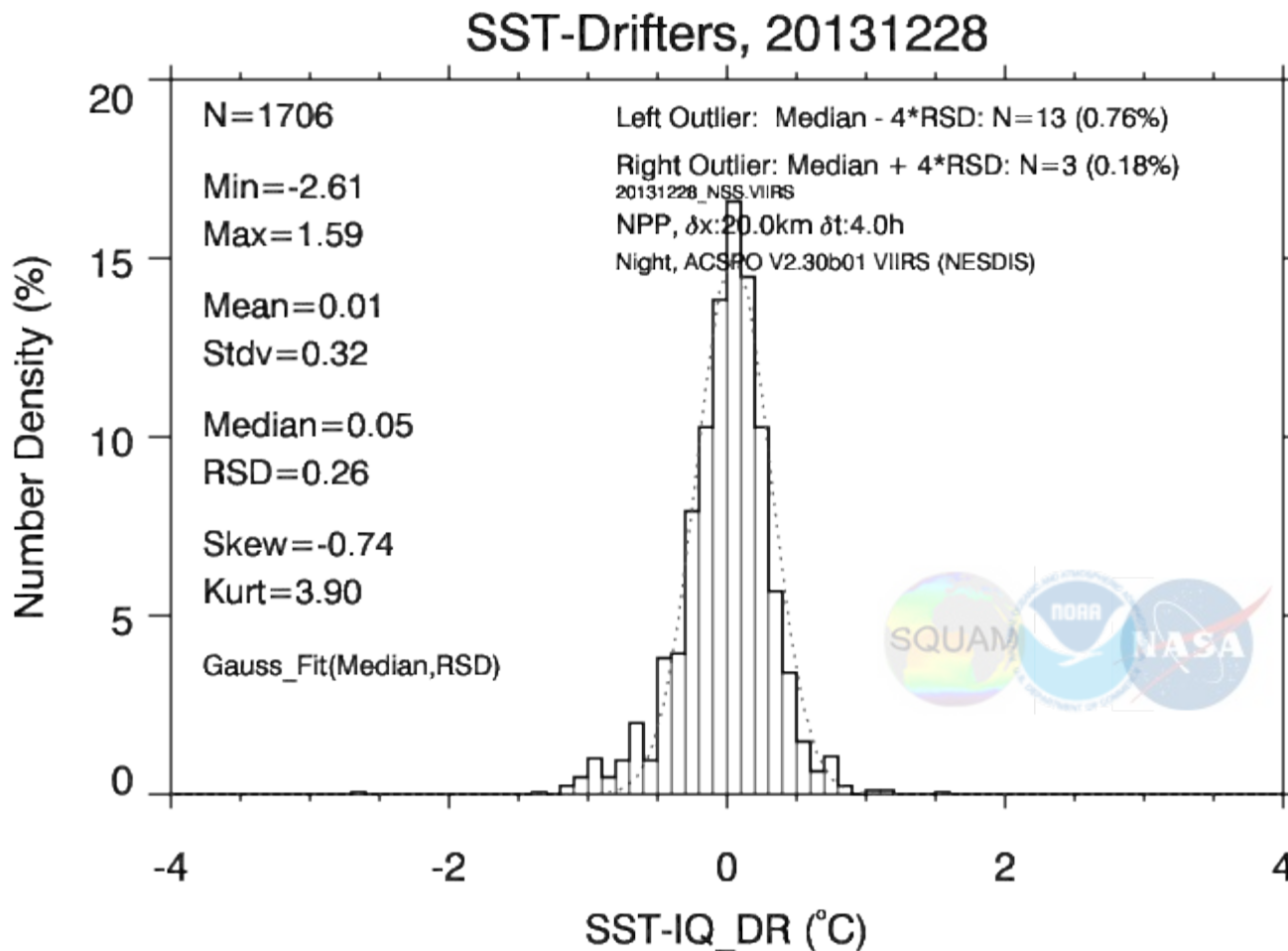
28 December 2013



- IDPS sample +5% larger compared to ACSPO
- Shape slightly less Gaussian (negative Skew / increased Kurt)
- increased Min/Max, negative Mean/Med, STDV/RSD & Larger fraction of outliers

NIGHT: ACSPO L2 minus *in situ* SST

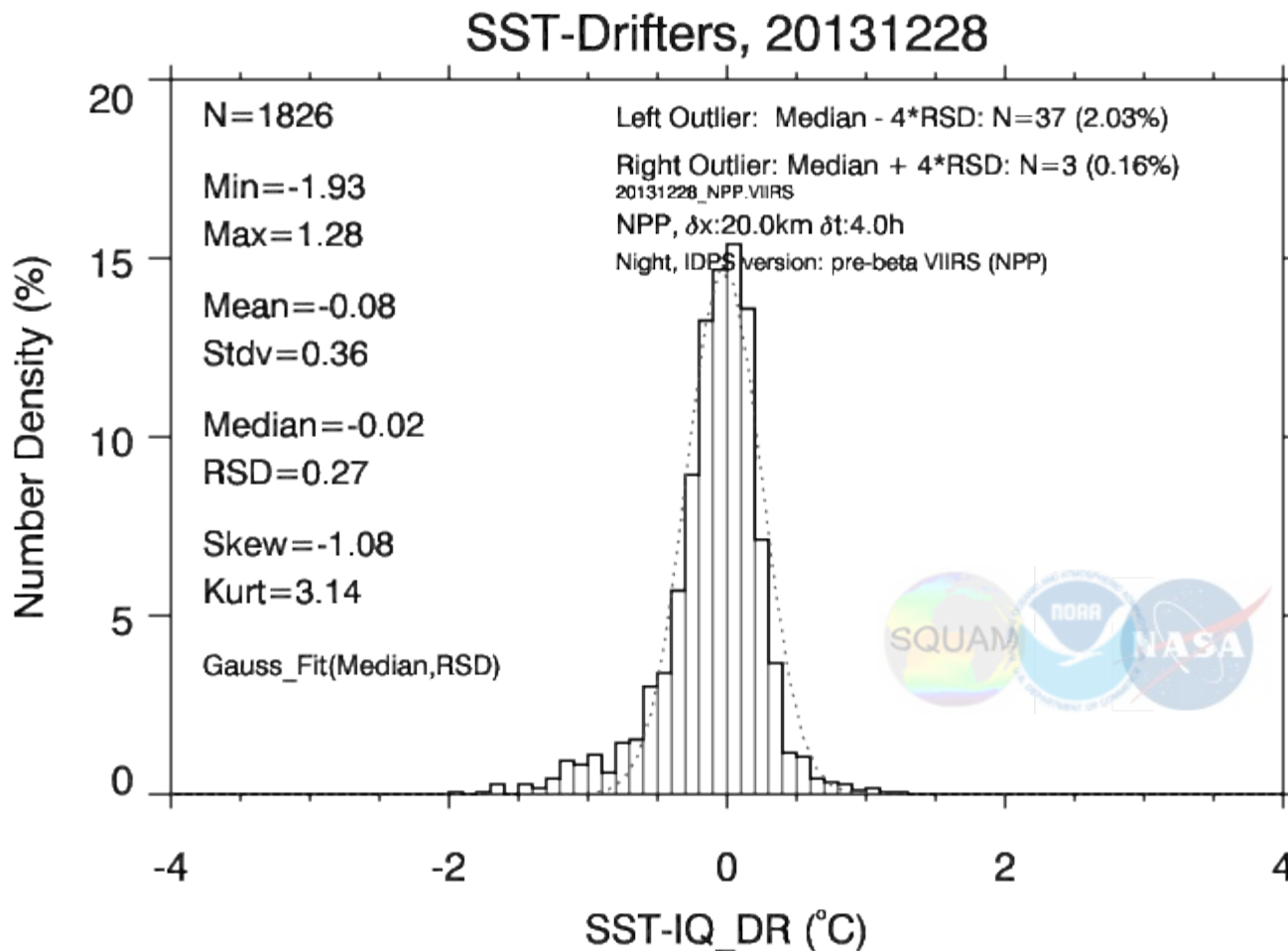
28 December 2013



- *Shape close to Gaussian but there is a cold tail – residual cloud*
- *Performance Stats better than specs (0.2 Accuracy/0.6K Precision)*

NIGHT: IDPS L2 minus *in situ* SST

31 December 2012



- IDPS match-up data set +7% larger compared to ACSPO
- Shape less Gaussian (increased Skew / Kurt)
- increased Min/Max, negative Mean/Med, STDV/RSD & Larger fraction of outliers

$\Delta T = \text{"VIIRS minus OSTIA"} \text{ SST (expected } \sim 0)$

	NOBS (%ACSPO)	Min/ Max	Mean/ STD	Med/ RSD	Skew/ Kurt
ACSPO	106.2M (100%)	-8.6/ +8.1	-0.01/0.42	-0.01/0.33	+0.2/ +12.9
IDPS	111.2M (105%)	-16.5/+17.3	-0.10/0.48	-0.07/0.36	-1.9/+21.9

- IDPS SST domain is +5% larger but all Stats are degraded, compared to ACSPO
- Gap between Conventional and Robust stats wider in IDPS - More outliers

$\Delta T = \text{"VIIRS minus in situ"} \text{ SST (expected } \sim 0)$

	NOBS (%ACSPO)	Min/ Max	Mean/ STD	Med/ RSD	Skew/ Kurt
ACSPO	1,706 (100%)	-2.6/ +1.6	+0.01/0.32	+0.05/0.26	-0.7/ +3.9
IDPS	1,826 (107%)	-1.9/+1.3	-0.08/0.36	-0.01/0.27	-1.1/+3.4

- IDPS SST in situ match-up is +7% larger but all Stats degraded, compared to ACSPO
- Gap between Conventional and Robust stats wider in IDPS - More outliers

NIGHT 31 December 2012 – Summary (reported @ VCM Provisional Jan 2013)

$\Delta T = \text{"VIIRS minus OSTIA"} \text{ SST (expected } \sim 0)$

	NOBS (%ACSPO)	Min/ Max	Mean/ STD	Med/ RSD	Skew/ Kurt
ACSPO	83.2M (100%)	-6.8/ +4.9	+0.03/0.46	+0.04/0.37	-0.3/ +5.3
IDPS	106.3M (128%)	-15.3/+30.4	-0.10/0.66	-0.05/0.41	-1.1/+31.9

- IDPS SST domain is +28% larger but all Stats degraded, compared to ACSPO
- Gap between Conventional and Robust stats wider in IDPS - More outliers

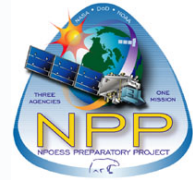
$\Delta T = \text{"VIIRS minus in situ"} \text{ SST (expected } \sim 0)$

	NOBS (%ACSPO)	Min/ Max	Mean/ STD	Med/ RSD	Skew/ Kurt
ACSPO	1,230 (100%)	-1.6/ +1.2	-0.00/0.33	+0.04/0.27	-1.4/ +3.7
IDPS	1,640 (133%)	-5.0/+1.3	-0.18/0.59	-0.05/0.31	-3.7/+24.7

- IDPS SST domain is +28% larger but all Stats degraded, compared to ACSPO
- Gap between Conventional and Robust stats wider in IDPS - More outliers



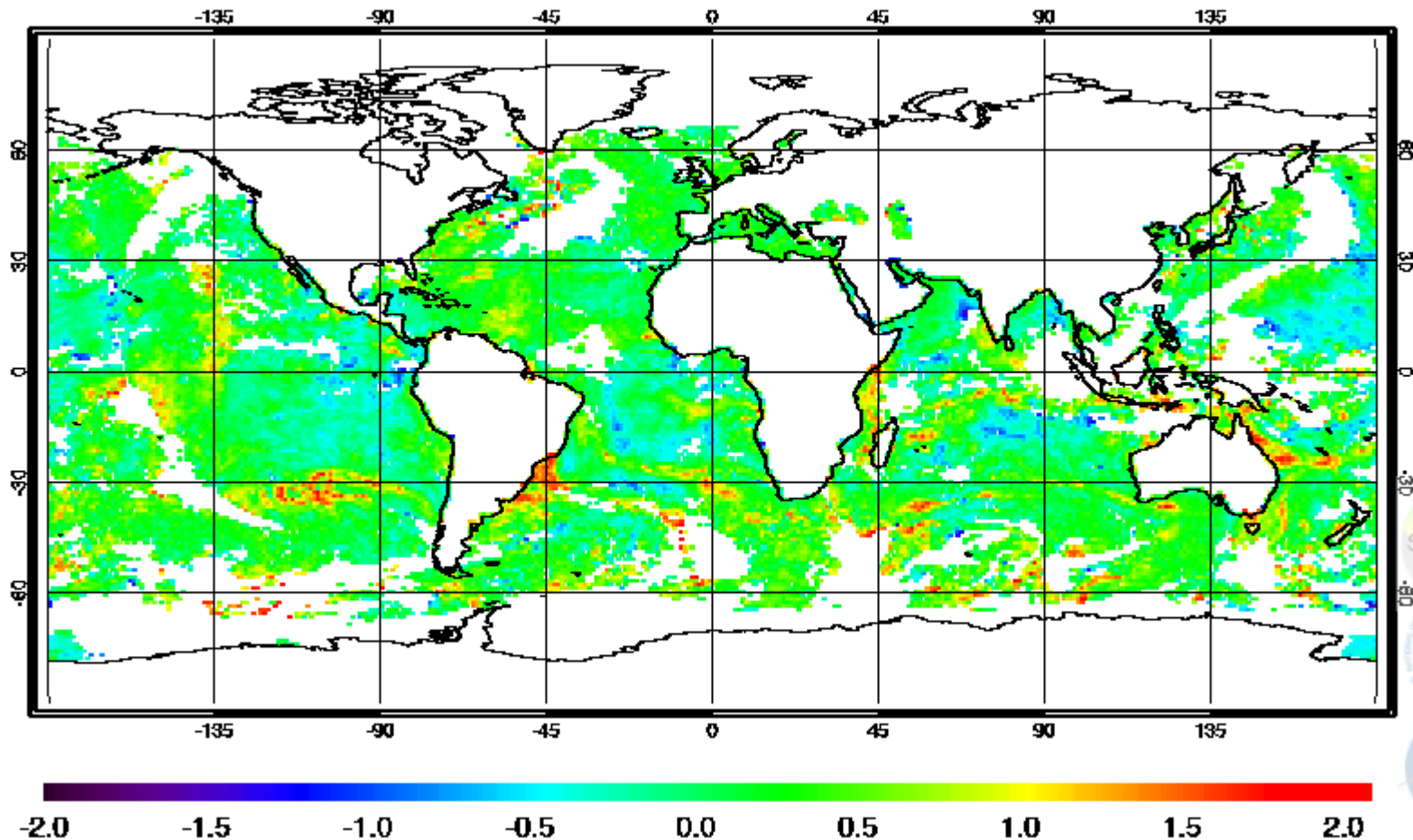
DAY Analyses



DAY: ACSPO L2 minus OSTIA L4

28 December 2013

SST-OSTIA NPP 20131228 Day ACSPO V2.30

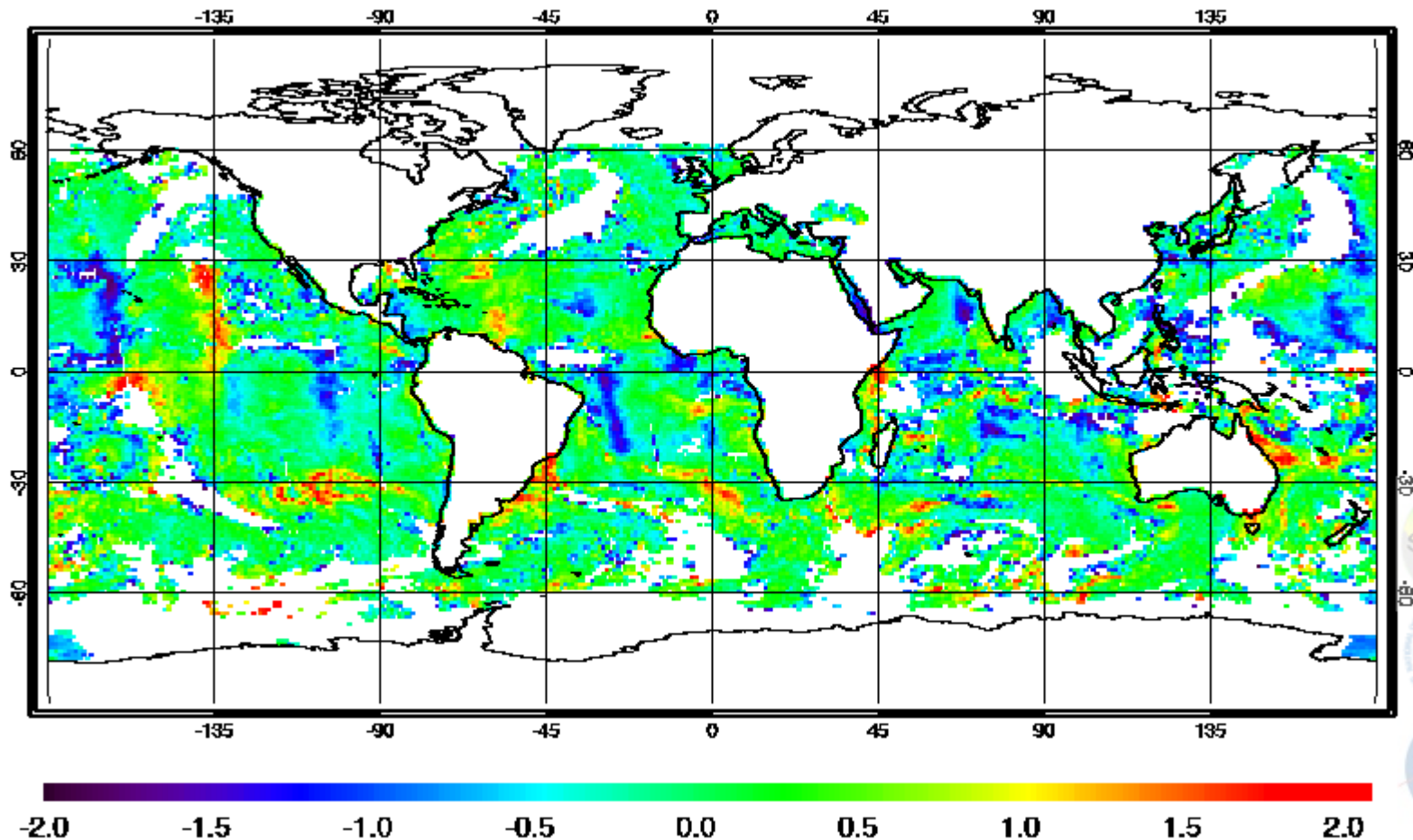


- Deviation from Reference SST is flat & close to 0
- Residual Cloud/Aerosol leakages seen as cold spots
- Warm spots show areas with diurnal warming during daytime

DAY: IDPS L2 minus OSTIA L4

28 December 2013

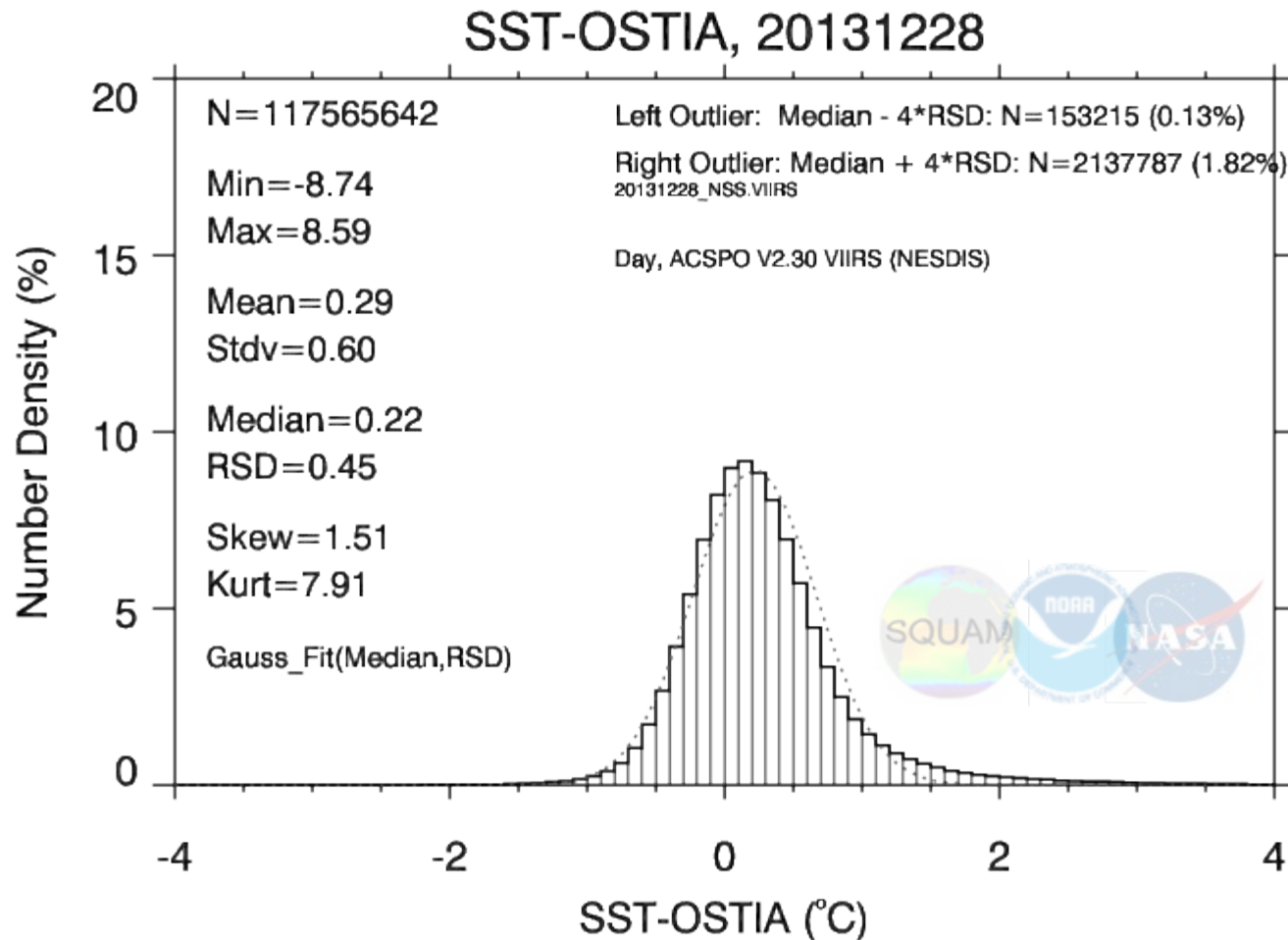
SST-OSTIA NPP 20131228 Day IDPS _11.5.08.00



- *More Cloud leakages than in ACSPO*
- *“Limb Cooling” – due to suboptimal SST equations (fixed in build 8.1, Feb 2014)*

DAY: ACSPO L2 minus OSTIA L4

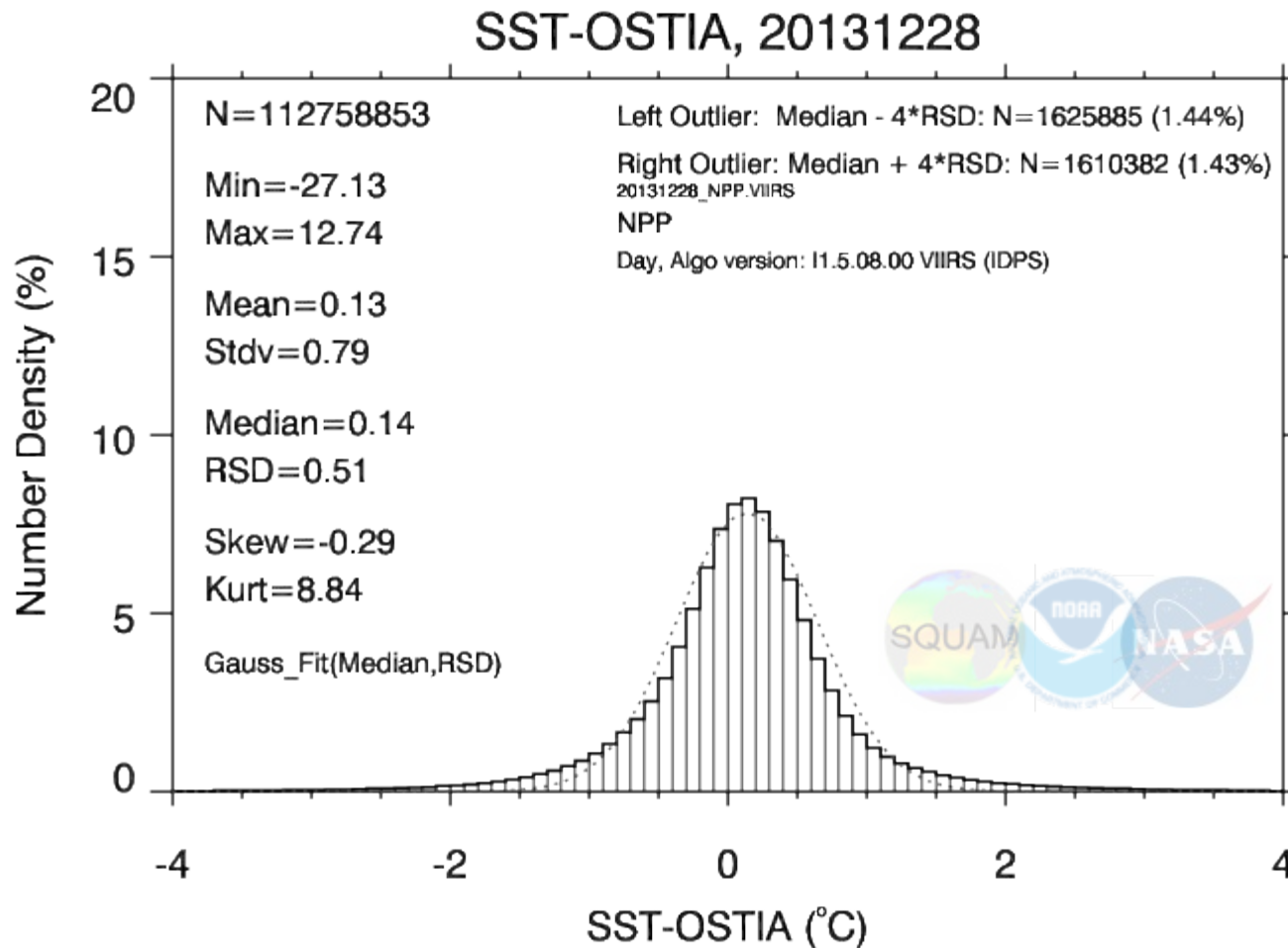
28 December 2013



- *Shape close to Gaussian but skewed positively due to diurnal warming*
- *Domain & Performance Stats close to expected*

DAY: IDPS L2 minus OSTIA L4

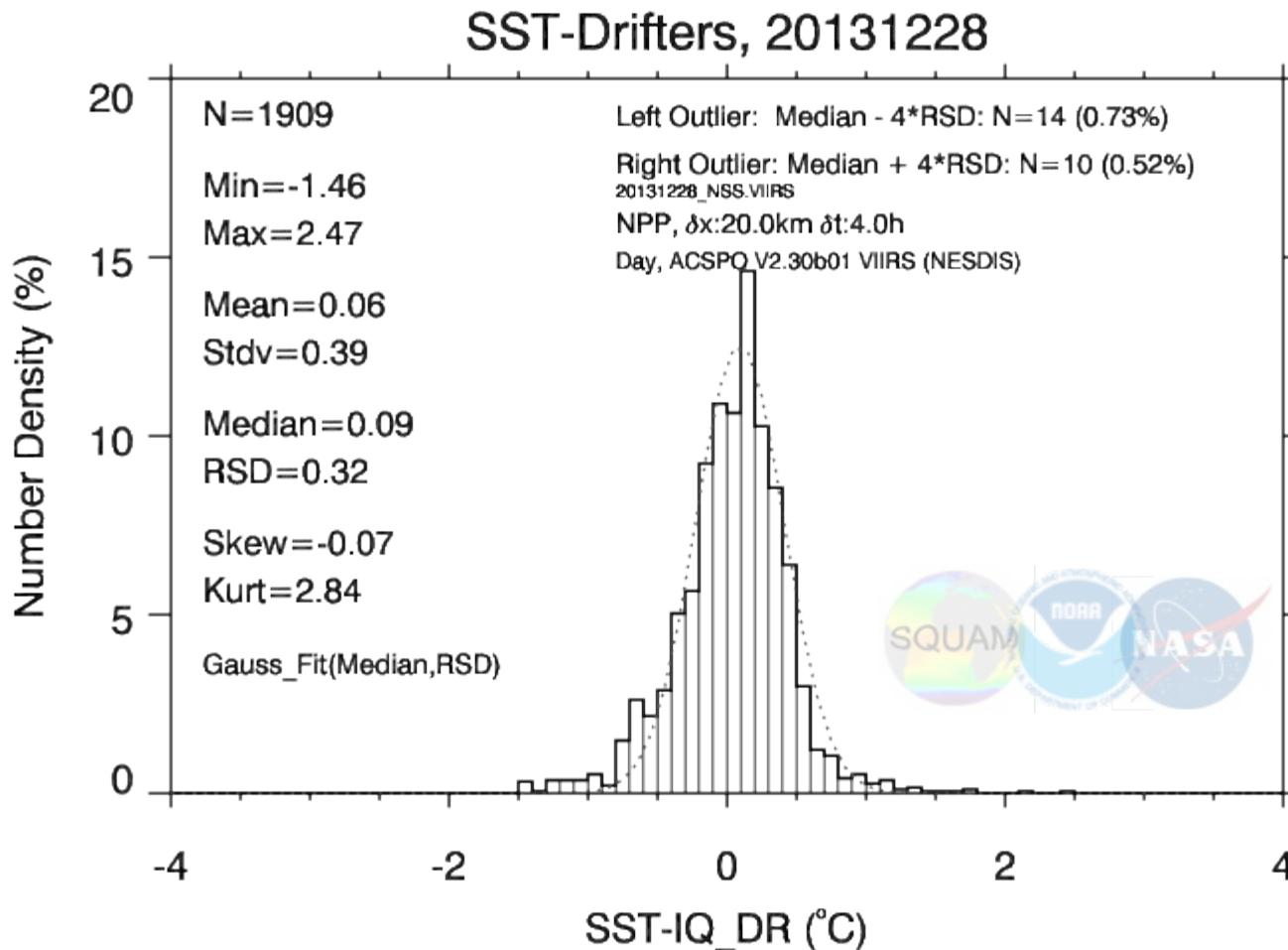
28 December 2013



- *IDPS sample -4% smaller compared to ACSPO*
- *Degraded Min/Max, STDV/RSD & Larger fraction of outliers*

DAY: ACSPO L2 minus *in situ* SST

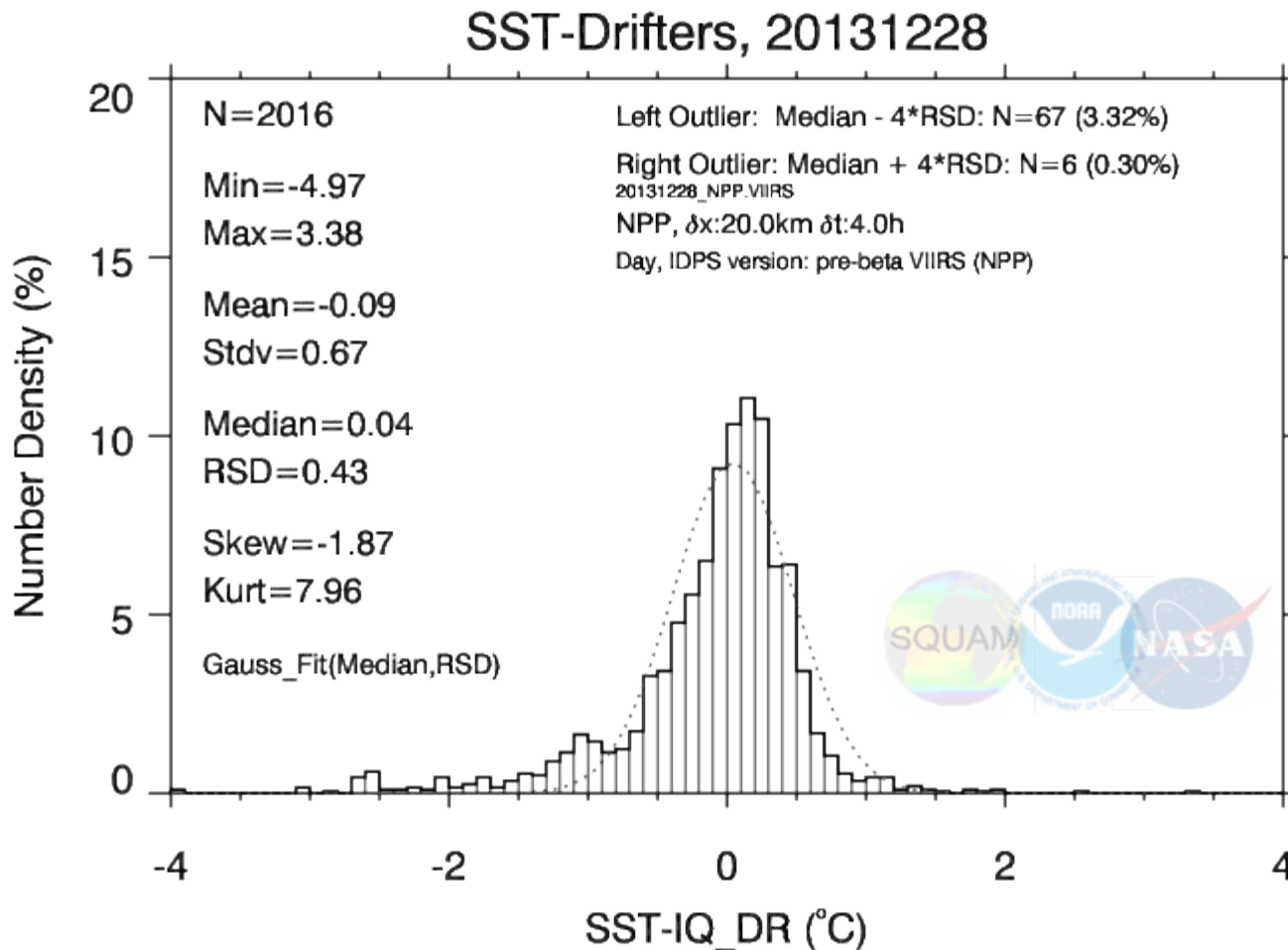
28 December 2013



- *Shape close to Gaussian*
- *Domain & Performance Stats better than spec*

DAY: **IDPS** L2 minus *in situ* SST

28 December 2013



- *IDPS match-up data set +6% larger compared to ACSPO*
- *Increased Min/Max, STDV/RSD & Larger fraction of outliers*

DAY 28 December 2013 – Summary

$\Delta T = \text{"VIIRS minus OSTIA"} \text{ SST (expected } \sim 0)$

	NOBS (%ACSPO)	Min/ Max	Mean/ STD	Med/ RSD	Skew/ Kurt
ACSPO	117.6M (100%)	-8.7/ +8.6	+0.29/0.60	+0.27/0.45	+1.5/ +7.9
IDPS	112.8M (96%)	-27.1/+12.7	+0.13/0.79	+0.14/0.51	-0.3/ +8.8

- IDPS SST domain -4% smaller but all Stats degraded, compared to ACSPO
- Gap between Conventional and Robust stats wider in IDPS - More outliers

$\Delta T = \text{"VIIRS minus in situ"} \text{ SST (expected } \sim 0)$

	NOB (%ACSPO)	Min/ Max	Mean/ STD	Med/ RSD	Skew/ Kurt
ACSPO	1,909 (100%)	-1.5/ +2.5	+0.06/0.39	+0.09/0.32	-0.1/ +2.8
IDPS	2,016 (106%)	-5.0/+3.4	-0.09/0.67	+0.04/0.43	-1.9/ +8.0

- IDPS SST domain is +6% larger but all Stats degraded, compared to ACSPO
- Gap between Conventional and Robust stats wider in IDPS - More outliers

DAY 31 December 2012 – Summary (reported @ VCM Provisional Jan 2013)

$\Delta T = \text{"VIIRS minus OSTIA" SST (expected } \sim 0)$

	NOBS (%ACSPO)	Min/ Max	Mean/ STD	Med/ RSD	Skew/ Kurt
ACSPO	84.4M (100%)	-6.8/ +9.8	+0.26/0.65	+0.22/0.49	+1.0/ +7.9
IDPS	105.4M (125%)	-33.5/+10.4	-0.03/0.88	+0.03/0.60	-0.9/ +8.2

- IDPS SST domain +25% larger but all Stats degraded, compared to ACSPO
- Gap between Conventional and Robust stats wider in IDPS - More outliers

$\Delta T = \text{"VIIRS minus in situ" SST (expected } \sim 0)$

	NOBS (%ACSPO)	Min/ Max	Mean/ STD	Med/ RSD	Skew/ Kurt
ACSPO	811 (100%)	-1.4/ +2.2	-0.11/0.46	+0.12/0.37	+0.4/ +3.0
IDPS	1,223 (151%)	-3.8/+2.9	-0.25/0.76	-0.14/0.51	-0.4/+3.2

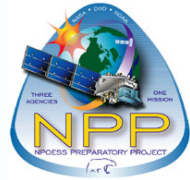
- IDPS SST domain is +51% larger but all Stats degraded, compared to ACSPO
- Gap between Conventional and Robust stats wider in IDPS - More outliers

Summary STAR SST Feedback to VCM

- **Observations for both day and night VCM**
 - Improved since VCM Provisional @Jan'13: Larger domain, improved stats
 - Degraded performance is in part due to suboptimal IDPS SST algorithm (e.g., limb cooling at swath edges) – fixed in IDPS 8.1 (Feb'14)
- **Night**
 - IDPS domain +6% larger than ACSPO, and SST stats are degraded
 - IDPS SST close to meeting specs @new L1RD (ACSPO does meet specs)
- **Day**
 - IDPS domain now -4% smaller than ACSPO, but SST stats degraded
 - IDPS SST does not meet specs @new L1RD (ACSPO does meet specs)
- **VCM is thought to have realized its potential, Further measurable VCM improvements for SST are deemed unlikely**
- **Remaining VCM issues will be fixed, by redesigning SST QFs (pending bringing Reynolds SST in IDPS)**



Summary NAVO SST Feedback to VCM (Jean-François Cayula and Doug May)



- VCM change since VCM Provisional @Jan'13 is minor
 - Statistics against in situ data have barely changed
- Using “best SST QFs”
 - SST stats comparable with NAVO heritage SEATEMP system
 - However, the IDPS sample is from ~30% (night) to 40% (day) of SEATEMP sample
- Using VCM “confidently clear” pixels
 - IDPS domain larger than SEATEMP
 - However, SST statistics are significantly degraded
- NAVO plans to explore aerosol information to see if VCM can be supplemented