GHRSST-XVI, ESA/ESTEC, The Netherlands

Inter-comparison Technical Advisory Group (IC-TAG)

Breakout Session Report

Alexey Kaplan (Chair), Mike Chin (Vice-Chair)

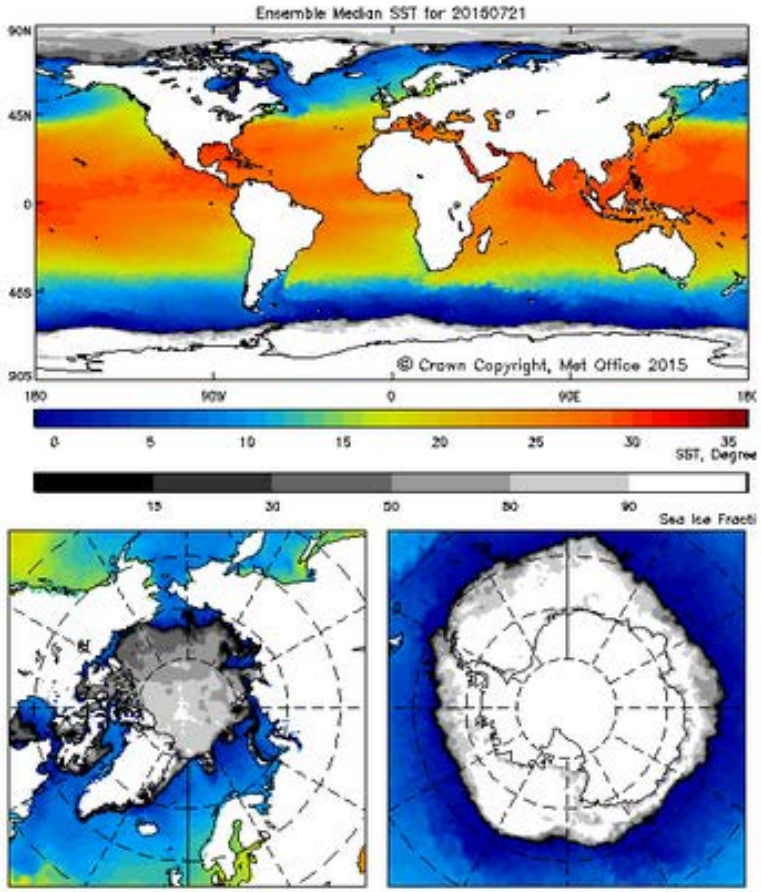
Thursday 23 July 2015
16:30-18:30

Current Membership

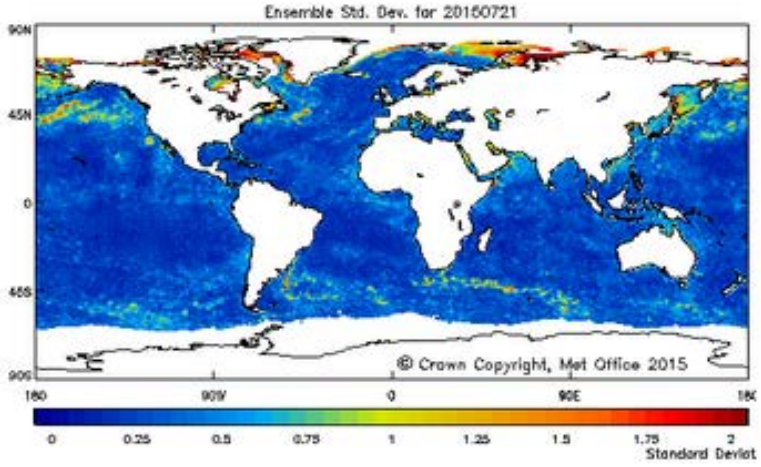
- Alexey Kaplan, Columbia University, USA (Chair)
- Mike Chin, NASA JPL, USA (Vice-Chair)
- Ed Armstrong, JPL, USA
- Viva Banzon, NOAA/NCDC, USA
- Ian Barton, Australia
- Helen Beggs, BoM, Australia
- Bruce Brasnett, Canada retired
- Dudley Chelton, OSU, USA
- Jim Cummings, NRL, USA
- Prasanjit Dash (SQUAM), NOAA/NESDIS, USA
- Chelle Gentemann, RSS, USA
- Robert Grumbine, NWS, USA
- Jacob Hoeyer, DMI, Denmark
- Alexander Ignatov (SQUAM), NOAA/NESDIS, USA
- Shiro Ishizaki, JMA, Japan
- Eileen Maturi, NOAA/NESDIS/STAR, USA
- Bruce McKenzie, NAVOCEANO, USA
- Jean-François Piollé (Felyx), IFREMER, France
- David Poulter (Felyx), Pelamis Scientific Software Ltd, UK / IFREMER, France
- Nick Rayner, Met Office, Hadley Centre, UK
- Jonah Roberts-Jones (GMPE), Met Office, UK leaving his job
- Martin Rutherford, Australia
- Jorge Vazquez, JPL, USA

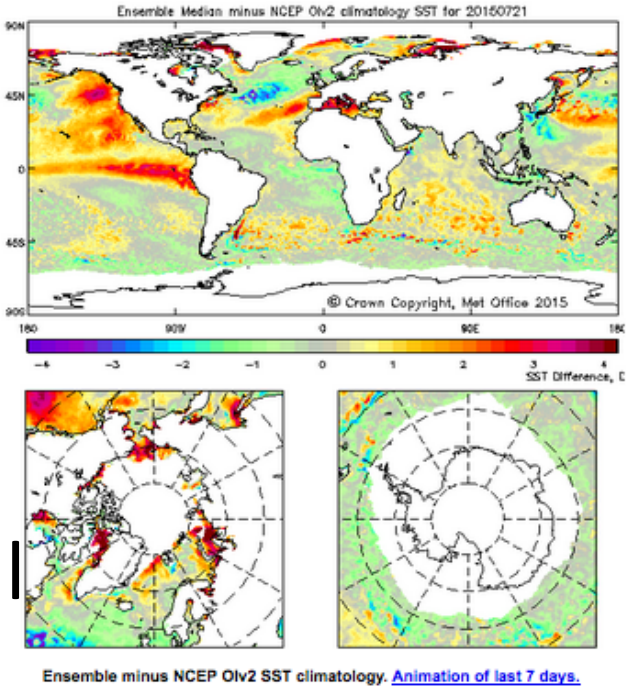
GMPE

maintains its operational status



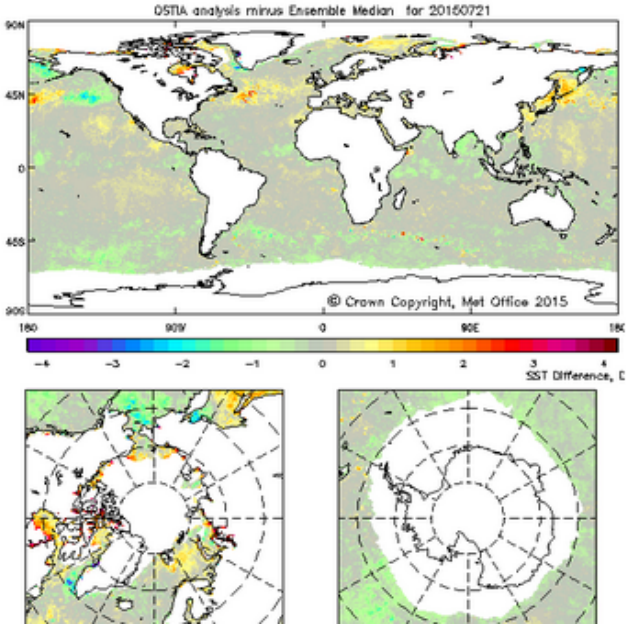
ledian SST analysis. Animation of last 7 days. The sea ice data shown is derived from OSTIA.





Ensemble minus NCEP Olv2 SST climatology. Animation of last 7 days.

of each contributing SST analysis are also shown.



UPDATE 2: 2 new products were fully included

- DMI OISST
- Geo_Polar 5km blended

File Edit View Histo

Daily Level-4 (L4

www.star.nesd

SQUAM

SST Quality Monitor: Level-4

SQUAM v10.0

Home | Level 2 + | Level 3 + | Level 4 | L4 → | Maps | Histograms | Timeseries | Hovmöller | About +

Modified on: Jul-21-2015

Modify font-size inside table: A+ A- A

SST products	Resolution	Coverage	Input				Ice bit	Further info
			Infrared	Microwave	Insitu	Other		
Bulk								
Reynolds (AVHRR) : DOI_AV	0.25° Daily	Sep-1981 onwards	AVHRR (PF till '05, then NAVO)		✓	ice info	✓	URL FTP EMail
Reynolds (+ AMSRE-E): DOI_AA	0.25° Daily	Jun-2002 to 4-Oct-2011	AVHRR	‡AMSR-E	✓	ice info	✓	-do- -do- -do-
RTG high resolution: RTG_HR	1/12° Daily	Feb-2007 onwards	AVHRR physical retrievals		✓	NCEP ice	X	URL FTP EMail
RTG low resolution: RTG_LR	0.50° Daily	Jan-2001 onwards	AVHRR		✓	NCEP ice	X	-do- FTP -do-
NAVO K10	0.10° Daily	Apr-2008 onwards	AVHRR,GOES	†		JPL climate	X	PPT FTP EMail
GeoPolar Blended	0.05° Daily	Jun-2014 onwards	AVHRR,GOES			NCEP ice	✓	URL FTP EMail
RSS MISST(tmi_amsre)	0.25° Daily	Jun-2002 onwards	x	TMI,‡,Windsat		ice info	✓	URL FTP EMail
NASA JPL 1km G1SST: G1SST	0.01° Daily,±80°	Jun-2010 onwards	AVHRR,AATSR,MODIS, GOES,SEVIRI,MTSAT	TMI,‡	✓	ice info	✓	URL FTP EMail
Foundation/Sub-skin								
OSTIA, UK MetOffice	0.05° Daily	Apr-2006 onwards	AVHRR,AATSR,SEVIRI	TMI,‡	✓	SSM/I ice	✓	URL FTP EMail
OSTIA Reanalysis, UK MetOffice	0.05° Daily	1985-2007 onwards	AVH PF, AVH,(A)ATSR,SEVIRI?	TMI,‡	✓	SSM/I ice	✓	FTP EMail
CMC 0.2°, Environment Canada	0.20° Daily	Jan-2002 onwards	AVHRR,AATSR	‡	✓	CMC ice	X ✓	EMail
GAMSSA 28km, Australian BOM	0.25° Daily	Aug-2008 onwards	AVHRR,AATSR	‡, AMSR-2†, Windsat	✓	NCEP ice	✓	PDF FTP EMail
MUR, NASA JPL	0.011° Daily	Jan-2004 onwards	MODIS(T/A), N19GAC MetopA	‡ Windsat	✓(iQm)	O&SI SAF ice	✓	URL FTP EMail
ODYSSEA, MERSEA France	0.10° Daily,±80°	Dec-2010 onwards	AVHRR,AATSR,GOES,SEVIRI	TMI,†		O&SI SAF ice	✓	URL FTP EMail
DMI, Danish Met. Inst	0.05° Daily	Apr-2013 onwards	AVHRR,MODIS,VIIRS,SEVIRI	AMSR2		O&SI SAF ice	✓	URL FTP EMail
Ensemble of L4 SSTs								
GHRSST Median Ensemble	0.25° Daily	Sep-2009 onwards	Median ensemble			ice info	X	URL FTP EMail GDS2 doc
Insitu used for L4 val								
Insitu SST Quality Monitor	point, 1min	Jan-1991 onwards	Ships, Drifters, Coastal & Tropical Moorings				-na-	URL FTP EMail

Related info

→ "L4 - Ref" SSTs match-up:- Space: nearest neighbor with "Ref" as spatial anchor; Time: Same day
→ iQUAM insitu data only with highest quality flag are used for validation
→ OSTIA Reanalysis (1985-2007) has been included (ice mask not analyzed)
→ ‡ AMSR-E data was an input to many L4 SSTs but its production has been suspended on 04 October 2011
→ †: AMSR-2 included since 01-Dec-2014
→ **++ New additions:** JPL MUR, DMI OISST, GeoPolar Blended

Related publications:
GHRSST analysis fields inter-comparisons, Part-1, Part-2

Agencies and L4 SST POC (agencies listed as data are added)

D.Reynolds V.Banzon B.Grumbine B.Katz E.Maturi A.Harris

B.Mckenzie D.May

M.Chin J.Vazquez E.Armstrong Y. Chao

Met Office M.Martin J.Robert-Jones E. Fiedler

H. Beggs

Canadian Meteorological Centre B. Brasnett D. Surcel-Colan

dmi.dk Jacob L. Høyer

J.-F.Piolle E.Autret

Group & other info

GHRSST
- Inter Comparison TAG
- A.Kaplan (IC-Tag chair)
- Data summary at NODC
- GDAC summary

Recommended browsers: those supporting HTML5 e.g., Mozilla Firefox, Opera, Apple Safari, Chrome, IE >v9

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felyx

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Ifremer

PML Plymouth Marine Laboratory

pelamis scientific software

PROJECT FUNDED BY

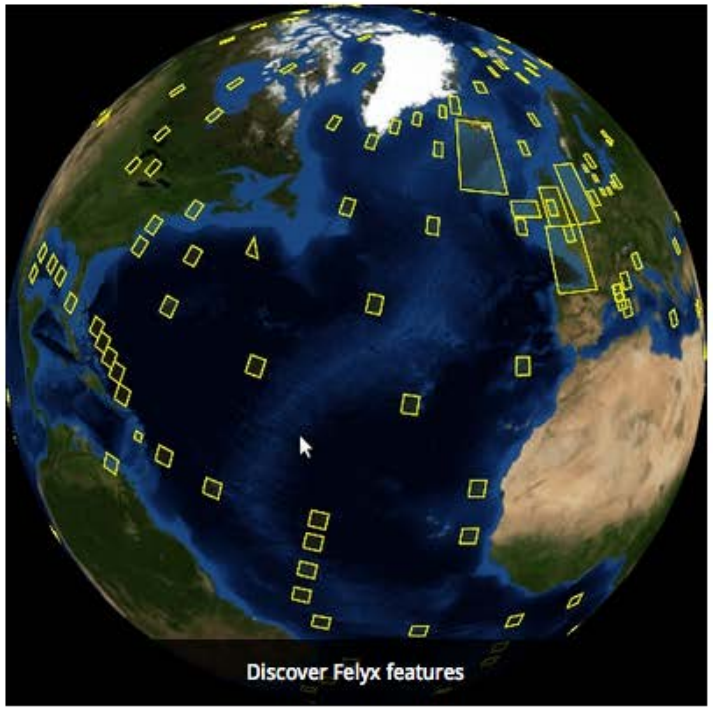
esa

Free, open source, software system for the analysis of large Earth Observation datasets

The aim of the Felyx project is to provide an open-source, flexible and reusable software system that can be used to research and monitor the quality and performance of Earth observation (EO) data streams. The input data streams can be from sensors mounted on satellites, generated by models, or collected in-situ. The Felyx system is being developed to support both producers and users of EO data.

Felyx is being developed by IFREMER, PML and Pelamis and funded by the European Space Agency.

DISCOVER THE PROJECT



LATEST BLOG ENTRIES

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L4 SST Error in Coastal Zones

Talk by Gutemberg França (Federal University of Rio de Janeiro, Brazil) – large L4 (>6K) errors in coastal Brasil during coastal upwelling period (based on a single buoy comparison). Similar observations about South African coastal area was made at G15. This kind of problems, even if first noticed in L4 products, has been traced to L2 products. So it is a peculiar retrievals problem, which would be very interesting and worthwhile to investigate (and possibly, correct).

L4 per se coastal problems: gradients their smoothing diffusion of observational error, etc. Jorge Vazquez (JPL), Helene Beggs (Australian Bureau of Meteorology), Rosalia Santoleri (CMEMS, a.k.a Copernicus, x-myOcean) have interests in coastal quality (and shortcomings) of L4 products.

Eric Crosman (U. of Utah) made a comment that in the Lakes SST WG (which was recently renamed Near-Shore SST WG) there similar interests as well.

L4 SST Error in Coastal Zones

A post-session thought: perhaps all the available knowledge of coastal SST has to be pulled together… A workshop?

Impact of SSES on L4 SST Products

Brief res. contrib.: ***Nick Rayner,***
Emma Fiedler,
Mike Chin,
Boris Petrenko

Turned out to be a subtle and difficult question to study (J.Roberts-Jones and J.Cummings talk brought this topic to our attention on the last 2 G meetings).
Requires time-consuming experiments and significant effort from L4 data producers, with the outcome probably going mostly to the benefit of L2-producers. There was a surprising lack of will to pursue these topics now.

Impact of SSES on L4 SST Products

Another post-session thought: to make a case for the necessity of SSES and L4 consistency study by making it painfully obvious how inconsistent they are. E.g. for two L4 data sets
D1=[T1 E1] and D2 =[T2 E2]
we often can see see that

$$\mathbf{\langle (T1-T2)^2 \rangle > \langle (E1)^2 \rangle + \langle (E2)^2 \rangle}$$

which would mean that both L4 producers can be right…

Ditto with L2 products.

Perhaps we should step back and first do that systematically?

APPENDIX

Major IC-TAG Discussion Topics

- ***Conversion*** *of inter-comparisons to user recommendations (i.e., answering questions: "Why do all these products differ?" and "Which SST should I use?")*
- *Inter-comparison results to date and* ***uncertainty*** *in L4 products*
- *Inter-comparison systems (****GMPE, SQUAM, FELYX****)*
- *Suggestions/Recommendations for* ***further*** *inter-comparisons*

Table 1
Summary of the various L4 SST analysis systems.

Name of system	*Institute, country*	*Reference*	*Date of availability of NRT data*	*Reanalysis period*
CMC	Canadian Meteorological Center, Canada	Brasnett (2008), Brasnett (1997)	April 2008	September 1991
FNMOC	Fleet Numerical Meteorology and Oceanography Center, USA	Cummings (2005), Cummings (2011)	2005	N/A
GAMSSA	Bureau of Meteorology, Australia	Beggs et al. (2011), Zhong and Beggs (2008)	October 2008	N/A
MGDSST	Japan Meteorological Agency, Japan	Kurihara et al. (2006)	September 2002	September 1981
NAVO K10	Naval Oceanographic Office, USA	–	July 2004	N/A
OISST.v2:AVHRR, AVHRR+AMSR	NCDC/NOAA, USA	Reynolds et al. (2007)	November 2008 (V1 started 2006 and was discontinued in 2009)	September 1981 (AVHRR), June 2002 (AVHRR+AMSR)
OSTIA	Met Office, UK	Donlon et al. (2011)	November 2006	January 1985
POES/GOES	NESDIS/NOAA, USA	Maturi et al. (2008)	June 2007	N/A
RSS MW, MW/IR	Remote Sensing Systems, USA	Gentemann et al. (2006)	2007	June 2002, January 2002
RTG	NWS/NCEP/NOAA, USA	Gemmill et al. (2007)	September 2005	N/A

Table 2
Summary of the data types used by the various L4 SST analyses in NRT. Note that AMSR-E data are not available since 5th October 2011.

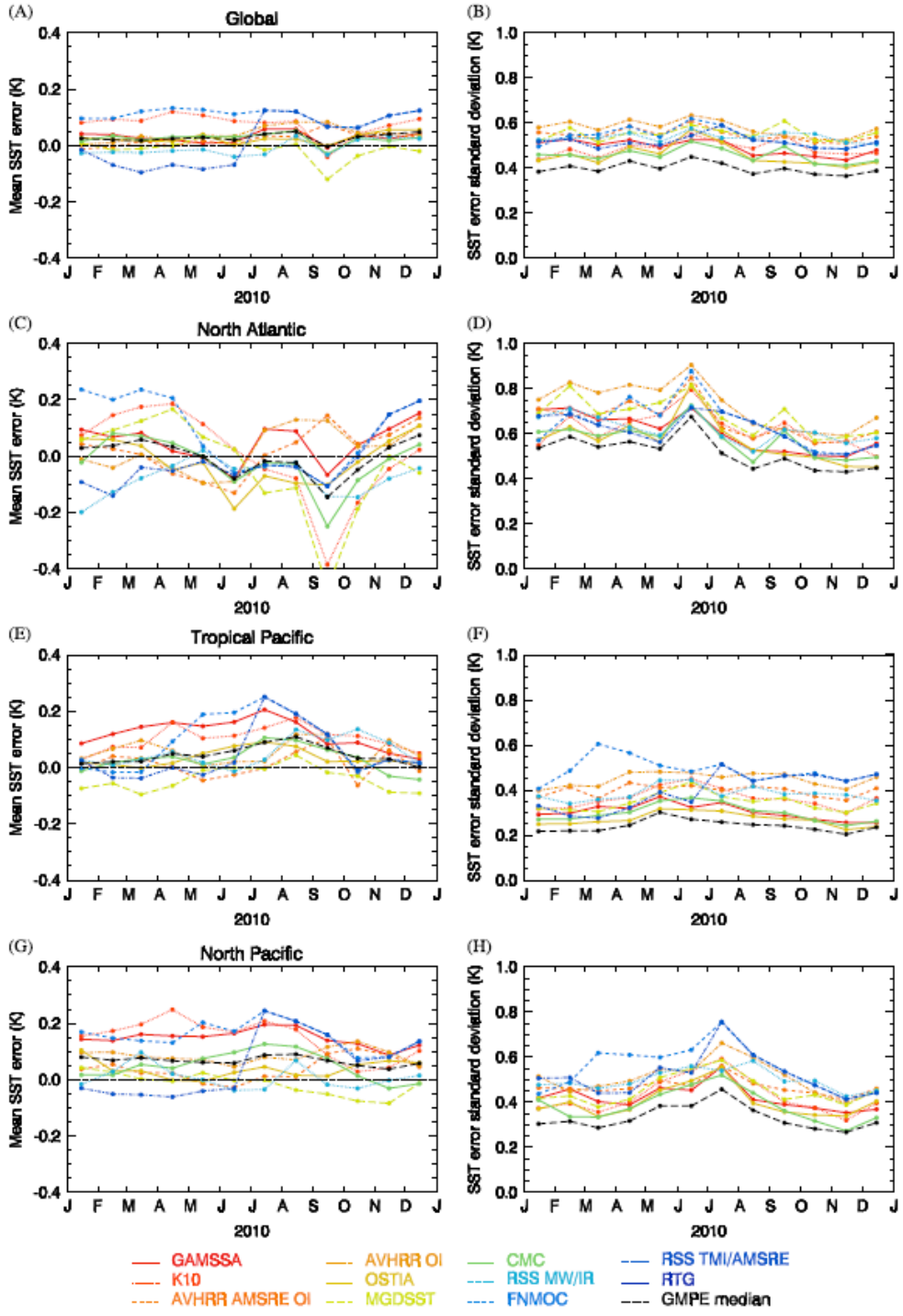
Name of system	*In situ*	*AATSR/Envisat*	*AVHRR/NOAA*	*AVHRR/MetOp*	*MODIS/Aqua,Terra*	*AMSR-E/Aqua*	*TMI/TRMM*	*SEVIRI/MSG*	*GOES*	*MTSAT-2*
CMC	X	X	X	X		X				
FNMOC	X		X	X					X	
GAMSSA	X	X	X	X		X				
MGDSST	X		X	X		X				
NAVO K10			X	X		X			X	
OSTIA	X	X	X	X		X	X	X		
POES/GOES		X	X	X		X		X	X	X
OISST.v2:AVHRR	X		X	X						
OISST.v2:AVHRR+AMSR	X		X	X		X				
RSS-MW						X	X			
RSS-MW/IR					X	X	X			
RTG	X		X	X						

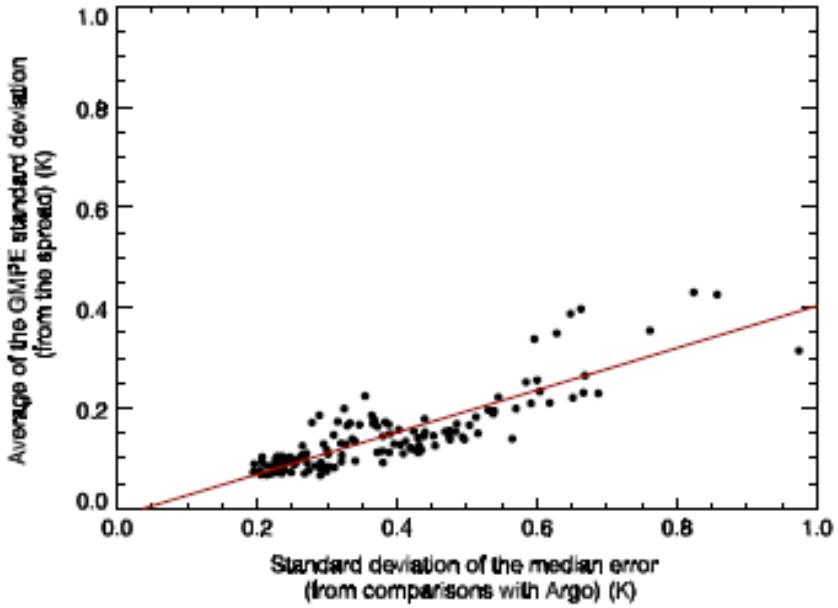
Table 3
Summary of the characteristics contributing to the horizontal and temporal scales resolved by each L4 analysis.

Name of system	*Horizontal grid resolution*	*Minimum horizontal correlation scale*	*Highest input data resolution (after thinning)*	*Temporal correlation scale*	*Update cycle*
CMC	0.2° lat/lon	43 km	44 km	None	Daily by 09:15 UTC for analysis of previous day
FNMOC	~9 km	~10 km	~9 km	None	6 hourly with 7 h delay on each analysis
GAMSSA	0.25° lat/lon	50 km	17 km	0.5 days	Daily by 03:30 UTC for analysis of previous day
MGDSST	0.25° lat/lon	50 km	25 km	5 days	Daily by 00:30 UTC for analysis of previous day
NAVO K10	10 km	10 km	2 km	4 days	Daily by 03:00 UTC for analysis of previous day
OISST.v2: AVHRR, AVHRR+AMSR	0.25° lat/lon	50 km	25 km	3 days	Daily by 12:30 UTC for analysis of previous day
OSTIA	0.05° lat/lon	10 km	~3.5 km	5 days	Daily by 06:30 UTC for analysis of previous day
POES/GOES	0.1° lat/lon	11 km	4 km	None	Daily
RSS MW, MW/IR	25 km, 9.76 km	1°, 1.5°	25 km, ~10 km	4 days, 3 days	Daily
RTG	1/12° lat/lon	50 km	8 km	None	Daily by 21:30 UTC for analysis of day

Table 1
List of L4 SST products monitored or considered in L4-SQUAM. Note that AMSR-E data was an input to most of the L4 SSTs listed here but its production has been suspended on 04 October 2011.

Product	Space/time res. & type	Abbreviation & mode	Reference	Availability period, data format, and ftp source,	Input data				Ice mask
					Infrared	Microwave	*Insitu*	Other	
Products fully implemented in L4-SQUAM									
Optimal interpolation SST	0.25° Daily depth (bulk)	AVHRR_OI NRT; delayed reanalysis	Reynolds et al., 2007	1981 to present, netCDF ftp://eclipse.ncdc.noaa.gov/pub/OI – daily-v2/NetCDF	AVHRR (PF until 2005, then NAVO)	-NA-	√	NCEP ice	√
		AVHRR_AMSR_OI NRT; delayed reanalysis		01-Jun-2002 to 04-Oct-2011, netCDF ftp://eclipse.ncdc.noaa.gov/pub/OI – daily-v2/NetCDF	AVHRR	AMSR-E* (*suspended on 04-Oct-2011)	√	NCEP ice	√
Operational SST & Sea Ice analysis	0.05° Daily foundation	OSTIA NRT	Stark et al., 2007;2008; Donlon et al., 2011	Apr-2006 to present, netCDF ftp://podaac-ftp.jpl.nasa.gov/allData/ghrsst/data/L4/GLOB/UKMO/OSTIA	AVHRR, AATSR, SEVIRI	TMI, AMSR-E	√	O&SI SAF ice	√
		OSTIA_RAN reanalysis		1985-2007, netCDF ftp://data.ncof.co.uk/ostia_reanalysis/ (passwd)	AVHRR PF, (A)ATSR	-none-	√	O&SI SAF ice	√
Real time global SST	0.50° Daily depth (bulk)	RTG_LR NRT	Thiébaux et al., 2003	Dec-2000 to present, gridded binary (grib) ftp://polar.ncep.noaa.gov/pub/history/sst	AVHRR	-none-	√	NCEP ice	X
	1/12° Daily depth (bulk)	RTG_HR NRT	Gemmill, Katz, & Li, 2007	Feb-2007 to present, grib ftp://polar.ncep.noaa.gov/pub/history/sst/ophi (rotated for a year)	AVHRR physical retrievals	-none-	√	NCEP ice	X
NAVOCEANO K10 Analysis	0.10° Daily depth	K10 NRT	http://podaac.jpl.nasa.gov/dataset/NAVO-L4HR1m-GLOB-K10_SST	Apr-2008 to present, netCDF ftp://podaac-ftp.jpl.nasa.gov/allData/ghrsst/data/L4/GLOB/NAVO/K10_SST	AVHRR, GOES	AMSR-E	X	JPL climate	X
NESDIS multi-SST analysis *(formerly called POES-GOES)*	0.10° Daily depth	GOESPOES NRT	Maturi et al., 2008; http://www.nesdis.noaa.gov/mecb/blended_validation/	Feb-2009 to present, HDF ftp://dds.nesdis.noaa.gov/pull/ (passwd)	AVHRR, GOES, MTSAT, SEVIRI,	*Planned: AATSR, AMSR-2*	X	NCEP ice (since May 2010)	√
JPL ultra high resolution G1SST	0.01° Daily, ± 80°lat foundation	G1SST NRT	Chao et al., 2009	Jun-2010 to present, netCDF ftp://podaac-ftp.jpl.nasa.gov/allData/ghrsst/data/L4/GLOB/JPL_OUROCEAN/G1SST/	AVHRR, AATSR, MODIS, GOES, SEVIRI, MTSAT	TMI, AMSR-E	√	Some ice	√
Canadian met. center analysis	0.2° Daily foundation	CMC 0.2° NRT	Brasnett, 1997; 2008	Jan-2002 to present, netCDF (contact CMC for data access)	AVHRR, AATSR	AMSR-E, WindSat	√	CMC ice	√ from Sep., 2011
Australian BoM GAMMSA	0.25° Daily foundation	GAMSSA NRT	Beggs et al., 2011; Zhong & Beggs, 2008	Oct-2008 to present, netCDF ftp://podaac-ftp.jpl.nasa.gov/allData/ghrsst/data/L4/GLOB/ABOM/GAMSSA_28km	AVHRR, AATSR	AMSR-E, WindSat	√	NCEP ice	√
Ocean data analysis, MyOcean/GMES	0.10° Daily foundation	ODYSSEA NRT	Autret & Piollé, 2011	Reinstated Sep-2010 to present, netCDF ftp://eftp.ifremer.fr/cersat-rt/project/myocean/sst-tac/l4/glob/odyssea/ (passwd)	AVHRR, AATSR, GOES, SEVIRI	TMI, AMSR-E	X	O&SI SAF ice	√
GHRSST multi prod. ensemble	0.25° Daily ensemble	GMPE NRT	Martin et al., this issue	Sep-2009 to present, netCDF ftp://data.ncof.co.uk/ (passwd *via* MyOcean)	-NA-	-NA-	-NA-	O&SI SAF ice	X
Products currently being tested									
JPL multi-scale ultra-high res. SST	0.01° Daily foundation	MUR being tested	http://mur.jpl.nasa.gov/multi_resolution_analysis.php	Jan-2009 to present, netCDF ftp://podaac-ftp.jpl.nasa.gov/allData/ghrsst/data/L4/GLOB/JPL/MUR/	MODIS (Terra, Aqua), AHVRR (GAC)	AMSR-E	X	O&SI SAF ice	√
RSS MW OI	0.25° Daily minimum	RSS MISST NRT	http://www.remss.com/	Jun-2002 to present, netCDF ftp://ftp.discover-earth.org/sst/misst/l4/tmi_amsre/nc	-NA-	TMI, AMSR-E	X	-	√
Products potentially being considered to be included									
RSS IR+MW	0.25° Daily foundation	mw_ir_oi NRT	http://www.remss.com/	netCDF ftp://ftp.discover-earth.org/sst/	MODIS	AMSR-E, TMI	X	-	√
JMA merged SST	0.25° Daily foundation	MGDSST NRT; delayed reanalysis	Kurihara et al., 2006	1985 to present, Plain binary http://goos.kishou.go.jp/rrtdb/usr/pub/JMA/mgdsst/ (passwd)	AVHRR (GAC, HRPT)	AMSR-E	√	JMA sea-ice	√
DMI OI SST analysis	0.05° Daily foundation	DMI_OI NRT	Høyer and She, 2007	Jan-2011 to present, netCDF ftp://ftpserver.dmi.dk/GBL005/ (passwd)	AVHRR (GAC, HRPT), SEVIRI, AATSR, MODIS	AMSR-E, TMI	X	O&SI SAF ice	√
Naval res. lab. NCODA analysis	~0.08° 6 hourly depth	NCODA NRT	Cummings, 2005	Jun-2009 to present, IEEE binary, direct access, http://www.usgodae.org/cgi-bin/datalist.pl?summary=Go&dset=fnmoc_ghrsst	AVHRR (GAC, LAC), SEVIRI, GOES, MTSAT-2	AMSR-E, Windsat (coming)	√	6-h SSM/I & SSMIS ice	X





GMPE ensemble median is more **accurate** than individual members (left); GMPE ensemble spread can be used as a **proxy** for the error in its median (up). Suppose we've reduced the number of L4 products to 1 or 2: **GMPE ensemble will disappear!**