#### New Variables and Functions on Giovanni to Enhance Service at GES DISC for NASA Sounder Data Users

Feng Ding<sup>1,3</sup>, Thomas J. Hearty<sup>2,3</sup>, Michael Theobald<sup>1,3</sup>, Andrey Savtchenko<sup>1,3</sup>, Bruce Vollmer<sup>3</sup>, Jennifer Wei<sup>1,3</sup>

- 1. ADNET Systems, Inc.
- 2. SGT, Inc.
- 3. NASA/GSFC Goddard Earth Science Data and Information Services Center, Code 610.2, Greenbelt, MD 20771

NASA Sounder Science Team Meeting Greenbelt, MD October 25, 2017

# Outline

- New plot functions on Giovanni overlay map plot, shapefile for plot and average
- New AIRS variables on Giovanni

AIRS-only products, multi-year monthly mean surface temperature and anomaly

• User cases with new functions and variables on Giovanni

→Comparison of AIRS+AMSU vs AIRS-only product

→Multi-year Monthly Mean Surface Temperature and Anomaly time series plot with Region Of Interest (ROI) using shapefile

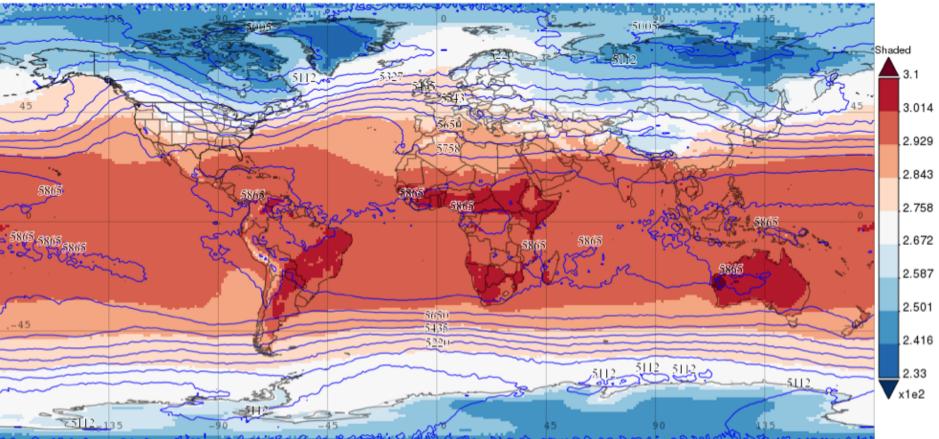
• AIRS V6 L2 and L3 worldwide users in last 12-month

## Giovanni: Time Averaged Overlay Map

ile <u>E</u> dit <u>V</u> iew Hi <u>s</u> tory <u>B</u> ookmarks <u>T</u> ools <u>H</u> elp									_		×
Giovanni X +											
	\vOvMp&starttime=2016-01-01T00:00:00Z&endtime=2016-01-31T23:	59:59Z&data	C C	Q. Sear	ch			i ≜ . ↓	<u>ہ</u>	•	≡
Searth Data Discovery - DAACs -	Community - Science Disciplines -										a) /
GIOVANNI The Bridge Between Data and S	Science v 4.23 Release Notes Browser Compatibility Know	<u>vn Issues</u>									
MODIS OPeNDAP server continuing problem [1 of 3 me Select Plot	ssages] Read More										
		0									н
● Maps: Time Averaged Overlay Map ▼ O Comparisons:	Select      O Vertical: Select      O Time Series: Select	⊖ Miscellar	neous: Selec	t 🔻							н
S Maps Choices O Time Averaged Map Interactive map of average over time at each grid cell	Select Region (Bounding Box or Shape) Format: West, South, East, North										I
Details     Animation     Map animated along the chosen timeline for each grid cell											I
s * Limited to 365 time steps Details	iables: 32 of 1737 Total Variable(s) included in Plot: 2	_									I
O Difference of Time Averaged	Search Clea		TD	0.10	D . D .	E 10 1	11-2	N 1 0			11
Difference of two time averaged variable maps Details		Source	Temp.Res.	Spat.Res.	Begin Date	End Date	Units	Vert. Sli	ce		11
	at surface (Nightime/Descending, AIRS-only) (AIRS3STM v006) ater Vapor (Daytime/Ascending, AIRS-only) (AIRS3STM v006)	AIRS	Monthly Monthly	1° 1°	2002-09-01 2002-09-01	2017-08-31 2017-08-31	K ∨ kg/m2	-			
Accumulation of measurement over time at each grid point	ater Vapor (Nighttime/Descending, AIRS-only) (AIRS3STM v006) ater Vapor (Nighttime/Descending, AIRS-only) (AIRS3STM v006)	AIRS		1°	2002-09-01	2017-08-31	Ū	-			
Details	ater vapor (Nighttime/Descending, AiRS-only) (AiRSSSTW vooo)		Monthly		2002-09-01	2017-00-31	kg/m2	1000			
Time Averaged Overlay Map Interactive Overlay map of average over time at each grid cel	<u>v (Daytime/Ascending, AIRS-only)</u> ( <u>AIRS3STM v006</u> )	AIRS	Monthly	1 °	2002-09-01	2017-08-31	percent	hPa			
Details O User-Defined Climatology	v (Nighttime/Descending, AIRS-only) (AIRS3STM v006)	AIRS	Monthly	1 °	2002-09-01	2017-08-31	percent	1000 hPa			
Quasi Climatology Map	v at Surface (Daytime/Ascending, AIRS-only) (AIRS3STM v006)	AIRS	Monthly	1 °	2002-09-01	2017-08-31	percent	-			
Details	v_at_Surface (Nighttime/Descending, AIRS-only) (AIRS3STM v006)	AIRS	Monthly	1 °	2002-09-01	2017-08-31	percent	-			
	ure at surface (Daytime/Ascending, AIRS-only) (AIRS3STM v006)	AIRS	Monthly	1 °	2002-09-01	2017-08-31	К ~	-			
□ Surface Temperature (4) □ Tropopause	Temperature (Daytime/Ascending, AIRS-only) (AIRS3STM v006)	AIRS	Monthly	1 °	2002-09-01	2017-08-31	К ~	-			
	Temperature (Nighttime/Descending, AIRS-only) (AIRS3STM v006)	AIRS	Monthly	1 °	2002-09-01	2017-08-31	К ~	-			
	idity at Surface (Daytime/Ascending) (AIRX3STM v006)	AIRS	Monthly	1 °	2002-09-01	2016-09-30	percent	-			
▼ Temporal Resolutions	nidity at Surface (Nighttime/Descending) (AIRX3STM v006)	AIRS	Monthly	1 °	2002-09-01	2016-09-30	percent	-			
	Temperature (Daytime/Ascending) (AIRX3STM v006)	AIRS	Monthly	1 °	2002-09-01	2016-09-30	К ~	-			
monthly (32)	Temperature (Nighttime/Descending) (AIRX3STM v006)	AIRS	Monthly	1 °	2002-09-01	2016-09-30	К ~	-			
► Portal	Mass Mixing Ratio (Daytime/Ascending, AIRS-only) (AIRS)				Help Rese	et Feedbac	ĸ	Plot Da	ta		

#### Giovanni: 500hPa GH Overlay on T, Jan. 2016

CONTOUR:Geopotential Height (Daytime/Ascending) monthly 1 deg. @500hPa [AIRS AIRX3STM v006] m over 2015-Jan SHADED:Air temperature at surface (Daytime/Ascending) monthly 1 deg. [AIRS AIRX3STM v006] K over 2015-Jan



# Giovanni: Shapefile

F

ile <u>E</u> dit <u>V</u> iew Hi <u>s</u> tory <u>B</u> ookmai	rks <u>l</u> ools <u>H</u> elp														-	[	) ×
🥶 Giovanni	× +																
🗲 🛈 🖴   https://giovanni.gs	fc.nasa.gov/gio	vanni/					(	C Q Search				☆	Ê	÷	â	•	😣 =
🥶 EARTH <b>DATA</b> Da	ata Discovery <del>-</del>	DAACs -	Comn	nunity <del>-</del>	Science Disc	iplines <del>-</del>											Q
GIOVANNI TH	e Bridge Bet	woon Data ar	nd Scien	CA V 1 23	Dologoo Ni	otas Browser	Compatibil	lity Known Is									
MODIS OPeNDAP server co	ontinuing prol	blem [1 of 3	messages	Read More	Nelease M	<u>DIOWSEI</u>	Jompaubii		<u>50055</u>								
Select Plot	5,		<u> </u>		1												
• Maps: Time Averaged	Map 🗕 🔘 Co	omparisons: Se	lect 🗸	O Vertical:	Select •	O Time Series:	Select •	O Miscellar	neous: S	elect 🔻	)						
Select Date Range (UTC) YYYY-MM-DD. HH:r				-	<b>jion (Bound</b> i st, South, East,	ing Box or Shap	e)										
🛍 🛛 00 :	00 <b>to</b>	🛍	23:59				۵ 🗲										
Valid Range: 1948-01-0		Λ					×										
✓ Disciplines         Aerosols (183)         Atmospheric Chemi:         Atmospheric Dynam         Cryosphere (15)         Hydrology (1000)         Ocean Biology (43)         Oceanography (47)         Water and Energy C     ✓ Measurements         Aerosol Index (3)         Aerosol Index (3)         Aerosol Optical Dep         Air Pressure Anoma         Air Pressure (51)         Air Temperature (87)         Albedo (21)         Aititude (8)         Angstrom Exponent (17)	<ul> <li>Land Only file</li> <li>Sea Only file</li> <li>US States (south the search of t</li></ul>	rrce: <u>HIU, US Sta</u> (source: <u>GES DI</u> (source: <u>GES DI</u> urce: <u>TIGER/Line</u> source: <u>Major Hyr</u> <u>W 90°00W 4</u>	ISC) SC) US Censu drological E	asins, FAO (L	· ·	)) E 135°00'E		arch Clear	l	Cou Lar JS /at	nd, St	/Se at	ea es	5	, )		
Atmospheric Moisture (1 Black Carbon (5)	14)							Help	Reset	Feed	back			Plot I	Data		

## Giovanni: Amazon Watershed

ile <u>E</u> dit <u>V</u> iew Hi <u>s</u> tory <u>B</u> ookmarks <u>T</u> ools <u>H</u> elp							-		$\times$
😁 Giovanni X +									
🗲 🛈 🔒   https://giovanni.gsfc. <b>nasa.gov</b> /giovar	anni/#service=TmAvMp&starttime=&endtime=&sł	hape=watersheds/sh	C Q Search		☆ 自	<b>↓</b> â		8	≡
🥶 EARTH <b>DATA</b> Data Discovery <del>-</del>	DAACs - Community - Science Disc	ciplines <del>-</del>							a) í
GIOVANNI THE DEFENDENT	veen Data and Science v 4.23 <u>Release N</u>								
MODIS OPENDAP server continuing proble		otes Browser Compatib	<u>IIIty</u> <u>Known Issues</u>						4
Select Plot	en [1 of 5 messages] <u>Read More</u>								
● Maps: Time Averaged Map -	nparisons: Select 🔻 🔿 Vertical: Select 💌	O Time Series: Select	O Miscellaneous:	Select •					
Select Date Range (UTC)	Select Region (Bound Format: West, South, East,								
minim to -	· · · · · · · · · · · · · · · · · · ·								
Valid Range: 1948-01-0	- ) ( Watersheus Annazon,	×							
Select Variables Amazon		××							
▼ Disciplines	STZ FOR	≥30°49'S, 172°15'E	arch Clear						
🗆 Atmospheric Chemi: 🔛 🔽 🔪		7 45°00'N							
□ Atmospheric Dynam □ Cryosphere (15)		37.0							
Cryosphere (15)		8 2							
Ocean Biology (43)		00°00'N							
Oceanography (47)		A A SI							
Water and Energy C									
▼ Measurements		45°00'S							
Aerosol Index (3)	·								
		E							
Air Pressure Anoma	V 90°00'W 45°00'W 00°00'E 45°00'E 90°00	'E 135°00'E							
Air Pressure (51)									
Air Temperature Anomaly (2)									
Air Temperature (87)									
Albedo (21)									
Altitude (8)									
Angstrom Exponent (17)			_						
Atmospheric Moisture (114)			Help Rese	et Feedback	F	lot Da	a		

# New AIRS variables on Giovanni

- 92 variables from AIRS-only products
   46 from daily AIRS3STD and 46 from monthly AIRS3STM
- Multi-year monthly mean surface temperature and anomaly

14-year (09/2002 to 08/2016) arithmetic mean of surface air and skin temperature from monthly product AIRX3STM

Anomaly is the difference between a selected month and the multi-year monthly mean, done by http service

# Giovanni: 92 AIRS-only Variables

ile <u>E</u> dit <u>V</u> iew Hi <u>s</u> tory <u>B</u> ookmarks <u>T</u> ools <u>H</u> elp								-	
🥶 Giovanni X +									
🗲 🛈 🔒   https://giovanni.gsfc.nasa.gov/giov	ranni/#service=TmAvMp&starttime=&endtime=&dataKeyword=AIRS-only		C C	Q. Search			☆ 自	7 A 4	<b>,</b> 😵 =
Search Data Discovery -	DAACs - Community - Science Disciplines -								Q
GIOVANNI The Bridge Both	usan Data and Salanaa y 192 Dalaana Nataa Prownar Compatibility Kr		_						
MODIS OPENDAP server continuing prot Select Plot     Maps: Time Averaged Map     Co  Select Date Range (UTC)	mparisons: Select ▼ ○ Vertical: Select ▼ ○ Time Series: Select ▼ ○ N Select Region (Bounding Box or Shape) Format: West, South, East, North 	Viscellaneous		A	IRS	5-01 535 35 <sup>-</sup>			
Atmospheric Dynamics (59)	Keyword : AIRS-only Search (	Clear				<u> </u>			
Water and Energy Cycle (14)         ✓ Measurements         Air Pressure (4)         Air Temperature (12)         Altitude (4)         Atmospheric Moisture (20)         CH4 (8)         CO (8)         Cloud Fraction (4)         Cloud Fraction (4)         OLR (8)         Ozone (8)         Surface Temperature (4)         ▶ Platform / Instrument         ▶ Spatial Resolutions         ▶ Temporal Resolutions         ▶ Portal	Variable         Air temperature at surface (Nightime/Descending, AIRS-only) (AIRS3STM v006)         Ozone Total Column (Daytime/Ascending, AIRS-only) (AIRS3STM v006)         Tropopause Height (Daytime/Ascending, AIRS-only) (AIRS3STM v006)         Tropopause Height (Daytime/Ascending, AIRS-only) (AIRS3STM v006)         Air Temperature at Surface (Nightime/Descending, AIRS-only) (AIRS3STM v006)         Air Temperature at Surface (Nightime/Descending, AIRS-only) (AIRS3STM v006)         Qzone Total Column (Daytime/Ascending, AIRS-only) (AIRS3STD v006)         Ozone Total Column (Daytime/Ascending, AIRS-only) (AIRS3STD v006)         Ozone Total Column (Nighttime/Descending, AIRS-only) (AIRS3STD v006)         Tropopause Height (Daytime/Ascending, AIRS-only) (AIRS3STD v006)         Tropopause Height (Daytime/Ascending, AIRS-only) (AIRS3STD v006)         Tropopause Height (Nighttime/Descending, AIRS-only) (AIRS3STD v006)         Tropopause Height (Nighttime/Descending, AIRS-only) (AIRS3STD v006)         Total Column Water Vapor (Daytime/Ascending, AIRS-only) (AIRS3STM v006)         Cloud Fraction (Daytime/Ascending, AIRS-only) (AIRS3STM v006)         Cloud Fraction (Daytime/Ascending, AIRS-only) (AIRS3STM v006)         Cloud Fraction (Nighttime/Descending, AIRS-only) (AIRS3STM v006)         Cloud Fraction (Daytime/Ascending, AIRS-only) (AIRS3STM v006)         Cloud Fraction (Nighttime/Descending, AIRS-only) (AIRS3STM v006)         Cloud Fraction (Nighttime/Descending, AIRS-only	Source AIRS AIRS AIRS AIRS AIRS AIRS AIRS AIRS	Temp.Res. Monthly Monthly Monthly Monthly Daily Daily Daily Daily Daily Monthly Monthly Monthly Monthly	Spat.Res.           1°	Begin Date           2002-09-01           2002-09-01           2002-09-01           2002-09-01           2002-08-31           2002-08-31           2002-08-31           2002-08-31           2002-08-31           2002-08-31           2002-08-31           2002-08-31           2002-08-31           2002-08-31           2002-08-31           2002-08-31           2002-08-31           2002-08-31           2002-09-01           2002-09-01           2002-09-01           2002-09-01           2002-09-01           2002-09-01           2002-09-01           2002-09-01	End Date 2017-08-31 2017-08-31 2017-08-31 2017-08-31 2017-09-24 2017-09-24 2017-09-24 2017-09-24 2017-09-24 2017-09-31 2017-08-31 2017-08-31 2017-08-31	Units	Vert. Slice	
	Cloud Top Pressure (Nightime/Descending, AIRS-only)         (AIRS3STM V)           Cloud Top Temperature (Daytime/Ascending, AIRS-only)         (AIRS3STM V)				Help Rese	t Feedbac	ĸ	Plot Data	

#### Giovanni: Multi-year Monthly Mean Surface Temperature and Anomaly

🥶 Giovanni X 🕂									
🗲 🛈 🔒   https://giovanni.gsfc.nasa.gov/giov	vanni/#service=TmAvMp&starttime=2002-09-01T00:00:00Z&endtime=2016-07-31T23:59:592	C C	Q Search			☆ 🖻	) 🦊 🏠		🕺 🔳
🥶 EARTH <b>DATA</b> Data Discovery <del>-</del>	DAACs - Community - Science Disciplines -								Q
GIOVANNI The Bridge Betw	ween Data and Science v 4.23 Release Notes Browser Compatibility Known	leenee							
MODIS OPENDAP server continuing prob Select Plot									
● Maps: Time Averaged Map ▼	omparisons: Select • O Vertical: Select • O Time Series: Select • O Miscell	aneous: Seled	ət 🔻						- 1
MM         HH:mm           -09         00         00         to           Valid Range: 2002-09-01 to 2016-08-31	Select Region (Bounding Box or Shape)         Format: West, South, East, North         -07 - □□         23 : 59		AI	RG	iX3	STN	ЛN	/	
i bioipinio	Number of matching Variables: 4 of 1745         Total Variable(s) included in Plot: 4           Keyword : AIRGX3STMMA         Search         Clear		AIF	RG)	X3S	STN	1M	A	
▼ Measurements	Variable	Source	Temp.Res.	Spat.Res.	Begin Date	End Date	Units		
Air Temperature Anomaly (2)	Multi-year Monthly Mean (2002-2016) of Air temperature at surface (Daytime/Ascending) (AIRGX3STMM v006)	AIRS	Monthly	1 °	2002-09-01	2016-08-31	К ~		
Platform / Instrument	Multi-year Monthly Mean (2002-2016) of Air temperature at surface	AIRS	Monthly	1°	2002-09-01	2016-08-31	K v		- 1
Spatial Resolutions     Temporal Resolutions	<ul> <li>(Nightime/Descending) (AIRGX3STMM v006)</li> <li>Multi-year Monthly Mean (2002-2016) of Surface Temperature (Daytime/Ascending) (AIRGX3STMM v006)</li> </ul>	AIRS	Monthly	1°	2002-09-01	2016-08-31	K ~		
► Portal	Multi-year Monthly Mean (2002-2016) of Surface Temperature (Nightime/Descending) (AIRGX3STMM v006)	AIRS	Monthly	1 °	2002-09-01	2016-08-31	K v		- 1
	Anomaly of air temperature at surface (Daytime/Ascending) (AIRGX3STMMA v006)	AIRS	Monthly	1 °	2002-09-01	2016-09-30	<mark>К</mark> ~		- 1
	Anomaly of air temperature at surface (Nightime/Descending) (AIRGX3STMMA v006)	AIRS	Monthly	1 °	2002-09-01	2016-09-30	K ~		- 1
	Anomaly of Surface Temperature (Daytime/Ascending) (AIRGX3STMMA v006)	AIRS	Monthly	1 °	2002-09-01	2016-09-30	<mark>K</mark> ∽		- 1
	Anomaly of Surface Temperature (Nighttime/Descending) (AIRGX3STIMMA v006)	AIRS	Monthly	1 °	2002-09-01	2016-09-30	K v		
Responsible NASA Officia Web Curator: M. Heade	al: Long Pham Powered By:	<u> </u>						<u>Conta</u>	act Us
Privacy Policy and Importa	ant Notices		Hel	Reset	Feedback		Plot Dat	a	

### Use Case

• Comparison of AIRS+AMSU with AIRS-only product using Giovanni

Total Column Water Vapor Daytime Monthly

Jan. to Dec. of year 2015

# **Giovanni: Comparison Function**

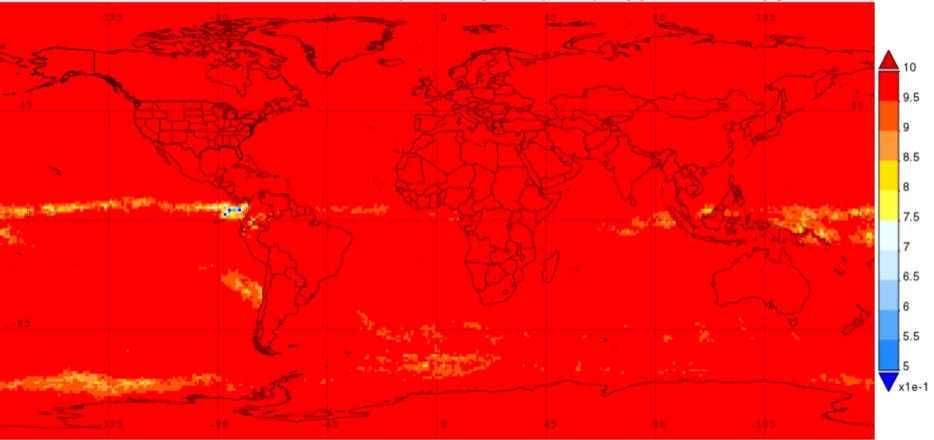
<u>File Edit View History Bookm</u>	arks <u>T</u> ools <u>H</u> elp											_		×
🥶 Giovanni	× +													
🗲 🛈 🔒   https://giovanni.g	sfc. <b>nasa.gov</b> /gio	vanni/	#service=CoMp&starttime=20	015-01-01T00:	00:00Z&endtime	=2015-12-3	1T23 🛄 🕻	e Q Se	arch		☆ 自	🖡 🏦 🤇	<b>y</b> 🔅	≡
🥶 EARTH <b>DATA</b> D	ata Discovery <del>-</del>	C	AACs - Community -	Science Dis	ciplines <del>-</del>									0
	he Bridae Bet	ween	Data and Science v 4.2	3 Release I	lotes Browsei	r Compatib	ilitv Known	Issues						
MODIS OPeNDAP server o	continuing pro	olem	[1 of 3 messages] <u>Read Mo</u>	ore							•			
Select Plot								lap	, Cor	relat	lon			
O Maps: Select ▼	Ocomparisons			Select •	O Time Series:									
Select Date Range (UTC			ices		ng Box or Sha	Scat	tter,	Are	ea Av	/erag	ge (St	atic	)	
YYYY-MM HH:mm 2015 -01 -01 ∰ 00			ssion of 2 variables at each grid	cell	vortn		· · · · ·							<b>, I</b> I
Valid Range: 2002-09-01 t					502	atte	r, Lir	ne	Aver	age	(Inte	racti	ve	
	O Scatter, Are Scatter plot		raged (Static) ring area averaged time series for	or two variables			-			Ŭ	•			1
Select Variables  Disciplines	<u>Details</u>				iable(s) included	in Plot: 2	Sca	tte	r (Int	terac	tive)			
▼ Measurements			eraged (Interactive) eractive X-Y plot of 2 variables			Se	arch Clear	1	•					
Air Pressure (4)	Details					Source	Temp.Res.	Seat Cos	BeunDate	Stat	Units	Vert. Slice		- 11
Air Temperature Anoma	O Scatter (Inter Interactive S		ve)			AIRS	Monthly	1 °	2002-09-01	2016-09-30	kg/m2			
Altitude (4)	Details				ing, AIRS-	AIRS	Monthly	1°	2002-09-01	2017-08-31	kg/m2			- 12
Atmospheric Moisture ( CH4 (8)	O Scatter (Sta Static Scatte											1000 ~		
CO (8)	Details					AIRS	Monthly	1°	2002-09-01	2016-09-30	gm/kg	hPa		
Cloud Fraction (4)			(Nighttime/Descending) (AIR			AIRS	Monthly	1 °	2002-09-01	2016-09-30	gm/kg	1000 ∨ hPa		
Cloud Properties (8)			Water Vapor Mass Mixing Rati (Davtime/Ascending) (AIRX3	o at Surface STM v006)		AIRS	Monthly	1°	2002-09-01	2016-09-30	g/kg	-		н
OLR (8)			Water Vapor Mass Mixing Rati	o at Surface		AIRS	Monthly	1°	2002-09-01	2016-09-30	g/kg	-		
Surface Temperature An			(Nighttime/Descending) (AIR Relative Humidity at Surface	X3STM v006)							0.0			
▼ Platform / Instrument			(Daytime/Ascending) (AIRX3	<u>STM v006</u> )		AIRS	Monthly	1°	2002-09-01	2016-09-30	percent	-		
AIRS (20)			Relative Humidity at Surface (Nighttime/Descending) (AIR	X3STM v006)		AIRS	Monthly	1 °	2002-09-01	2016-09-30	percent	-		
GLDAS Model (12)			Relative Humidity (Daytime/As	cending) (Alf	X3STM v006)							1000		
MERRA Model (7)									Help Rese	f Feedback		Plot Data		
LI WILKINA-2 WODEI (13)			Polativo Humidity (Nighttimo/D	(pacipadina)	AIDV2STN -000									Ŷ

#### Giovanni: Comparison of AIRS+AMSU vs AIRS-only

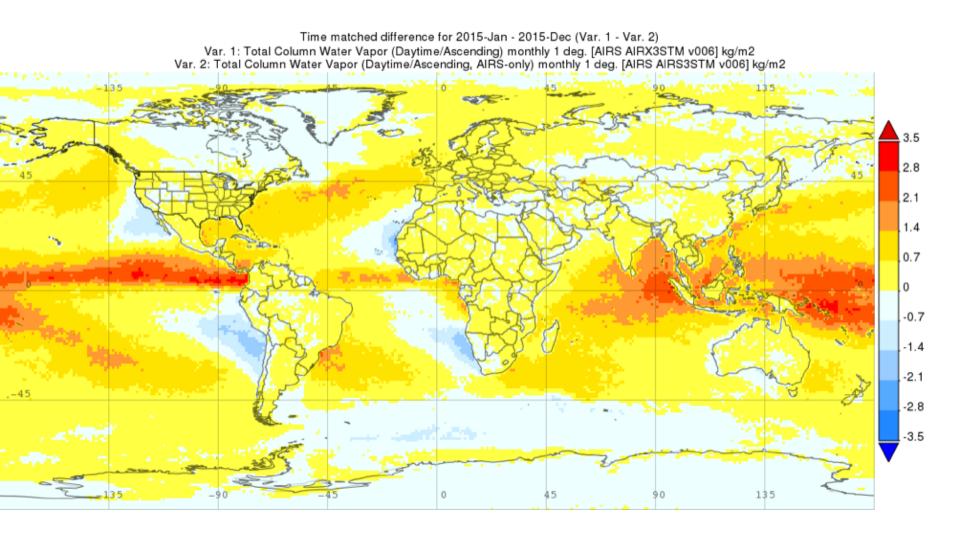
le <u>E</u> dit <u>V</u> iew Hi <u>s</u> tory <u>B</u> ookmarks <u>T</u> ools <u>H</u> elp										-	- r		×
🥶 Giovanni X 🕂													
🗧 🛈 🔒   https://giovanni.gsfc.nasa.gov/giova	anni/≉	#service=CoMp&starttime=2015-01-01T00:00:00Z&endtime=	2015-12-31	T28 🛄 🕻	C Q See	arch		ជ	ê 🦊	â	◙	<b>R</b> :	=
🐨 EARTH <b>DATA</b> Data Discovery <del>-</del>	D	AACs - Community - Science Disciplines -										Q	^
GIOVANNI The Bridge Betw	voon	Data and Science v 4.23 <u>Release Notes</u> <u>Browser</u>	Compatibi	lity Known	laguag								
MODIS OPeNDAP server continuing problem			Compatibl	<u>ity Khowh</u>	155005							·	
Select Plot													
O Maps: Select ▼	Map	o, Correlation ▼ O Vertical: Select ▼ O Time Series: S	Select 🗸	O Miscellan	eous: Sele	ct 🕶							
Select Date Range (UTC)		Select Region (Bounding Box or Shap	e)										
YYYY-MM HH:mm		Format: West, South, East, North											
2015 - 01 - 01 🗰 00 : 00 to 2015 -	- 12 -	Mont	hh	Tot:	al C	olun	nn M	late	$r \lambda$	lar		r	
Valid Range: 2002-09-01 to 2016-09-30		IVIOIII		1010		orun		acc	I V	ah			
Select Variables		er of matching Variables: 20 of 1745 Total Variables	tim		a + c		- of	VOO	r 7	<b>∩1</b>	5		
► Disciplines N	lumbe	er of matching Variables: 20 of 1745 Total Variables in Cludyd i	Pbt 2	z Jai		Dec		year			5		
▼ Measurements K	Keywo	rd :	Sea	arch Clear	]								
Air Pressure (4)	_	Variable	Source	Temp.Res.	Spat.Res.	Begin Date	End Date	Units	V	ert. Slice			
Air Temperature Anomaly (2)		Total Column Water Vapor	AIRS	Monthly	1°	2002-09-01	2016-09-30	kg/m2					
☐ Air Temperature (14) ☐ Altitude (4)		(Daytime/Ascending) (AIRX3STM v006)											E
Atmospheric Moisture (20)		<u>Total Column Water Vapor (Daytime/Ascending, AIRS- only)</u> (AIRS3STM v006)	AIRS	Monthly	1 °	2002-09-01	2017-08-31	kg/m2					
□ CH4 (8)		Water Vapor Mass Mixing Ratio	4100		4.0	0000 00 04	0040 00 00			1000 ~	1		
□ CO (8) □ CO2 (2)		(Daytime/Ascending) (AIRX3STM v006)	AIRS	Monthly	1 °	2002-09-01	2016-09-30	gm/kg		hPa	1		
		Water Vapor Mass Mixing Ratio	AIRS	Monthly	1°	2002-09-01	2016-09-30	am/ka		1000 ~	]		
Cloud Properties (8)		(Nighttime/Descending) (AIRX3STM v006)	74100	wontiny		2002 00 01	2010 03 30	ginnig		hPa			
		Water Vapor Mass Mixing Ratio at Surface (Davtime/Ascending) (AIRX3STM v006)	AIRS	Monthly	1 °	2002-09-01	2016-09-30	g/kg		-			
□ OLR (8) □ Ozone (8)	_	Water Vapor Mass Mixing Ratio at Surface											
Surface Temperature Anomaly (2)		(Nighttime/Descending) (AIRX3STM v006)	AIRS	Monthly	1°	2002-09-01	2016-09-30	g/kg		-			
		Relative Humidity at Surface	AIRS	Monthly	1°	2002-09-01	2016-09-30	percent		-			
▼ Platform / Instrument		(Daytime/Ascending) (AIRX3STM v006)	7	monung		2002 00 01	2010 00 00	percent					
		Relative Humidity at Surface (Nighttime/Descending) (AIRX3STM v006)	AIRS	Monthly	1°	2002-09-01	2016-09-30	percent		-			
FLDAS Model (12)	_									1000	1		
GLDAS Model (4)		Relative Humidity (Daytime/Ascending) (AIRX3STM v006)				lelp Reset	Feedback		Plo	t Data			
MERRA-2 Model (13)		Polativo Humidity (Nighttimo/Dosconding) (AIDV39TH 200											v

#### Giovanni: Correlation Map Plot AIRS+AMSU vs AIRS-only

Correlation for 2015-Jan - 2015-Dec 1st Variable: Total Column Water Vapor (Daytime/Ascending) monthly 1 deg. [AIRS AIRX3STM v006] kg/m2 2nd Variable: Total Column Water Vapor (Daytime/Ascending, AIRS-only) monthly 1 deg. [AIRS AIRS3STM v006] kg/m2

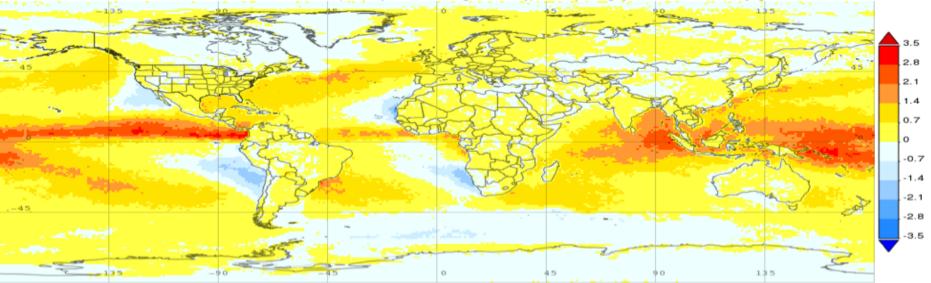


### Giovanni: Time Matched Difference Plot AIRS+AMSU vs AIRS-only

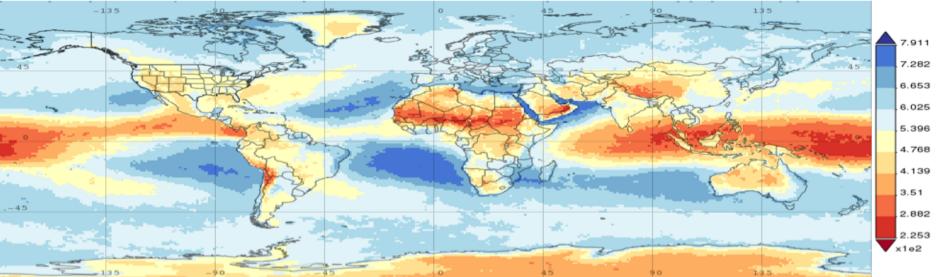


#### high clouds regions: IR-Only drier than AIRS+AMSU low clouds regions: IR-Only wetter than AIRS+AMSU

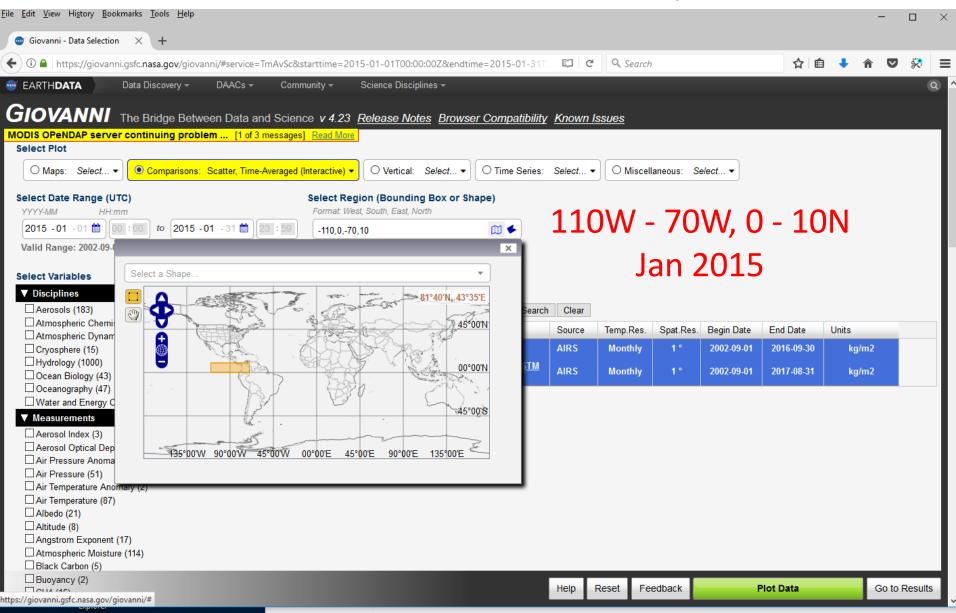
Time matched difference for 2015-Jan - 2015-Dec (Var. 1 - Var. 2) Var. 1: Total Column Water Vapor (Daytime/Ascending) monthly 1 deg. [AIRS AIRX3STM v006] kg/m2 Var. 2: Total Column Water Vapor (Daytime/Ascending, AIRS-only) monthly 1 deg. [AIRS AIRS3STM v006] kg/m2



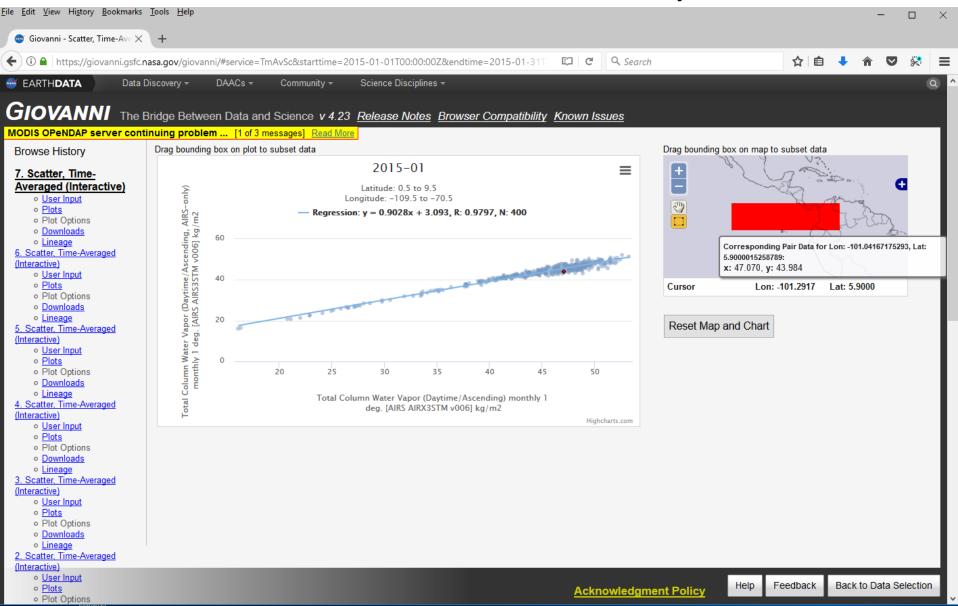
Time Averaged Map of Cloud Top Pressure (Daytime/Ascending) monthly 1 deg. [AIRS AIRX3STM v006] hPa over 2015-Jan - 2015-Dec



#### Giovanni: Time Averaged Interactive Scatter Plot AIRS+AMSU vs AIRS-only



#### Giovanni: Time Averaged Interactive Scatter Plot AIRS+AMSU vs AIRS-only



## Use Case

 Multi-year Monthly Mean Surface Temperature and Anomaly time series plot with ROI using shapefile

Multi-year Monthly Mean Surface Temperature time series plot over Global, Land, and Sea

Surface Air Temperature Anomaly inter-annual seasonal (DJF) time series plot over California from 2008 to 2016

## Giovanni: Time Series

🗲 🛈 🔒 https://giovanni.gsfc.nasa.gov/giovanni/#service=ArAvTs&starttime=2002-0	1-01T00:00:00Z&endtime=2016-12-31T23:59:59Z
👺 EARTH <b>DATA</b> Data Discovery 👻 DAACs 👻 Community 👻 Se	cience Disciplines -
GIOVANNI The Bridge Between Data and Science v 4.23 Revealed and Science v 4.23 Reveal	elease Notes Browser Compatibility Known Issues
Time series area statistics temporarily unavailable [1 of 2 messages] Read № Select Plot	
O Maps: Select ▼ O Comparisons: Select ▼ O Vertical: Select ▼	● Time Series: Area-Averaged ▼ O Miscellaneous: Select ▼
Select Date Range (UTC) Select Regio	n Time Series Choices
YYYY-MM-DD HH:mm Format: West, S	6 ○ Hovmoller, Longitude-Averaged
2002 - 01 - 01 🛍 00 : 00 to 2016 - 12 - 31 🛍 23 : 59	Longitude-averaged Hovmoller, plotted over the selected time and latitude ranges Details
Valid Range: 1948-01-01 to 2017-10-25	
	O Hovmoller, Latitude-Averaged Latitude-averaged Hovmoller, plotted over the selected time and longitude ranges
Select Variables	Details
Disciplines     Number of matching Variables: 0 of 1776	○ Area-Averaged Differences
Aerosols (185) Please select at least 1 variable	<ul> <li>Time series of area averages of differences between two variables at each spatial grid point</li> </ul>
Atmospheric Chemistry (80) Keyword :	– <u>Details</u>
☐ Atmospheric Dynamics (399) □ Cryosphere (15)	Area-Averaged
Hydrology (1004)	Time series of area-averaged values
Ocean Biology (55)	Details Hovmoller, Longitude-Averaged
□ Oceanography (53)	
□ Water and Energy Cycle (1075)	Seasonal (inter annual) time series
▼ Measurements	Hovmoller, Latitude-Averaged
Aerosol Index (3)	Hovmonel, Latitude-Averageu
Aerosol Optical Depth (85)	
Air Pressure (52)	Area-Average Difference
Air Temperature Anomaly (2)	Alea-Average Difference
Air Temperature (88)	
□ Albedo (21) □ Altitude (8)	Area-Averaged
Angstrom Exponent (18)	AICa-AVCIAgeu
Atmospheric Moisture (116)	
Black Carbon (5)	Seasonal/monthly (inter-annual)
	Seasonaly monthly (much annual)
□ CH4 (16) □ CO (21)	
	Help Reset Feedback Plot Data
Canopy Water Storage (6)	hop hood for bala

### Giovanni: Time Series of Multi-year Monthly Mean Surface T Daytime Jan. to Dec. Global Averaged

🥶 Giovanni - Data Selection 🛛 🗙 🕂													
🗧 🛈 🔒 https://giovanni.gsfc. <b>nasa.gov</b> /gio	ovanni/#service=ArAvTs☆	time=2002-01-0*	IT00:00:00Z&endtime=2	2016-12-31T23	:59:59) E	a c	Q Search			☆ ₫	3 🔸	<b>^ ▽</b>	Π
EARTHDATA Data Discovery -	🔻 DAACs 👻 Commu	nity <del>–</del> Scienc	ce Disciplines 👻										Q
GIOVANNI The Bridge Be	etween Data and Science	e v 4.23 <u>Relea</u>	<u>ise Notes</u> <u>Browser</u>	Compatibility	Known I	<u>ssues</u>							
MODIS OPeNDAP server continuing pro Select Plot	oblem [1 of 3 messages]	Read More											
			<u></u>										
O Maps: Select ▼ O Compariso	ons: Select   O Vertical	: Select 🔻	Time Series: Area-Ave	raged •	liscellaneou	s: Selec	ot 🔻						
Select Date Range (UTC)	(	Select Region (B	ounding Box or Shap	e)									
MM HH:mm		Format: West, South	n, East, North										
-01 - 00 : 00 to	- 12 - 23 : 59			₩ ◆									
Valid Range: 2002-09-01 to 2016-08-31													
Select Variables													
V Disciplines	Number of matching Variable	s:0 of 1755 To	tal Variable(s) included in I	Plot: 1									
Aerosols (183)	Keyword :			Search	Clear								
Atmospheric Chemistry (79)				Search			To an Doo	On at Data	De sia Deta	End Data	Unite		
Atmospheric Dynamics (394)	Variable	(0000 00.10)			5	Source	Temp.Res.	Spat.Res.	. Begin Date	End Date	Units		
Cryosphere (15)	Multi-year Monthly (Daytime/Ascending)		<u>of Surface Temperature</u> <u>A v006</u> )		A	AIRS	Monthly	1 °	2002-09-01	2016-08-31	К	~	
Ocean Biology (49)													
Oceanography (50)													×
□ Water and Energy Cycle (1068)					Select a	Shape						•	
▼ Measurements													
Aerosol Index (3)						- É			150	5000 -8	1°40'N, 94	'13'E	
☐ Aerosol Optical Depth (84) ☐ Air Pressure Anomaly (1)					2			2	435		145	00'N	
Air Pressure (51)					C	- (		· · .	SFREEZ	ST -	33.0		
Air Temperature Anomaly (2)					+	•	e Cor	1 .		N Ra	2		
Air Temperature (88)							- 25	to a	경우가 안	7 . V . S.	2. 00	°00'N	
Albedo (21)					1		5	3 2	- Logi		-AK	3.	
☐ Altitude (8) □ Angstrom Exponent (17)							1	81	Bie		( )		
Atmospheric Moisture (114)											-45	°00'S	
Black Carbon (5)							20						
Buoyancy (2)								5		~~		2	
CH4 (16)						135°00'V	V 90°00'W	45°00'W	00°00'E 45°0	0'E 90°00'E	135°00'E		
□CO (21)													
					_			_			_	_	_
Canopy Water Storage (6)					ŀ	Help	Reset Fe	edback		Plot Data		Go to	Results
Cloud Fraction (32)						- <b>P</b>							

### Giovanni: Time Series of Multi-year Monthly Mean Surface T Daytime Jan. to Dec. Land Only

🥶 Giovanni - Data Selection 🛛 🗙 🕂											
<ul> <li>① A https://giovanni.gsfc.nasa.gov/</li> </ul>	/giovanni/#service=ArAvTs&startt	ime=2002-01-01T00:00:00Z&endtime=2016-12-	-31T23:59:59	C C	Q. Search			☆ ₫	) 🖡 🏠		8
EARTHDATA Data Discover											(C
JOVANNI The Bridge	Between Data and Science	v 4.23 <u>Release Notes</u> <u>Browser Compared</u>	<u>tibility</u> Kno	<u>wn Issues</u>							
ODIS OPeNDAP server continuing	problem [1 of 3 messages]	Read More									
Select Plot											
O Maps: Select ▼ O Compar	risons: Select 🔹 🔘 Vertical:	Select O Time Series: Area-Averaged -	O Miscella	ineous: Selé	ect ▼						
Select Date Range (UTC) MM HH:mm		elect Region (Bounding Box or Shape) Format: West, South, East, North									
-01 - 00 : 00 to	- 12 - 23 : 59	Land Only file Land Only 1800x3600 0.1 x 🖽 🗲									
Valid Range: 2002-09-01 to 2016-08-31			)								
Valid Range. 2002-03-01 to 2010-00-3	1										
Select Variables											
▼ Disciplines	Number of matching Variables:	0 of 1755 Total Variable(s) included in Plot: 1									
Aerosols (183)	Keyword :		Search Cle	ar							
Atmospheric Chemistry (79)			ocarcii oi			0.10		<b>E</b> 18 1			
Atmospheric Dynamics (394)	Variable			Source	Temp.Res.	Spat.Res.	Begin Date	End Date	Units	-	
Cryosphere (15)		lean (2002-2016) of Surface Temperature (AIRGX3STMM v006)		AIRS	Monthly	1°	2002-09-01	2016-08-31	К ~		
Hydrology (1000)	(Dayume/Ascending)										
Ocean Biology (49)										×	Ъ.
☐ Oceanography (50) ☐ Water and Energy Cycle (1068)										_	Т.
			Lar	d Only 1800x	3600 0.1 x 0.1	deg			× •	·	
▼ Measurements				^					43'N, 165°56'V	4	
Aerosol Index (3)				<b>Ö</b>		يعسر ال	1	500 24	45 N, 105 J0 V		
Air Pressure Anomaly (1)			3				445	myne	45.00	N	
Air Pressure (51)				•		· · ·	Critery!	Star -	88.8	-	
Air Temperature Anomaly (2)				+	Var.			NY Kar	44 - L		
Air Temperature (88)					No.		E LAND	F 4 32	💩 00°00	N	
Albedo (21)					33		Phile.		C DR	-	
Altitude (8)				Sec. 201		31		1- 1	11/2	1	
Angstrom Exponent (17)						S	. 2		+5°00	2	
Atmospheric Moisture (114)								•.		-	
Black Carbon (5)						e 👘		~			
Buoyancy (2)				135°00'	W 90°00'W	45°00'W	00°00'E 45°0	0'E 90°00'E	135°00'E <	_	
				100 00	VV 50 00 VV	45 00 00	<u>00 00 - 40 0</u>		100 00 2		
CO2 (2)			_				_		_	_	_
Canopy Water Storage (6)				Help	Reset Fe	eedback		Plot Data		Go to R	esulte
				neip	Reset Te	Cuback		not Data		00 10 K	courts

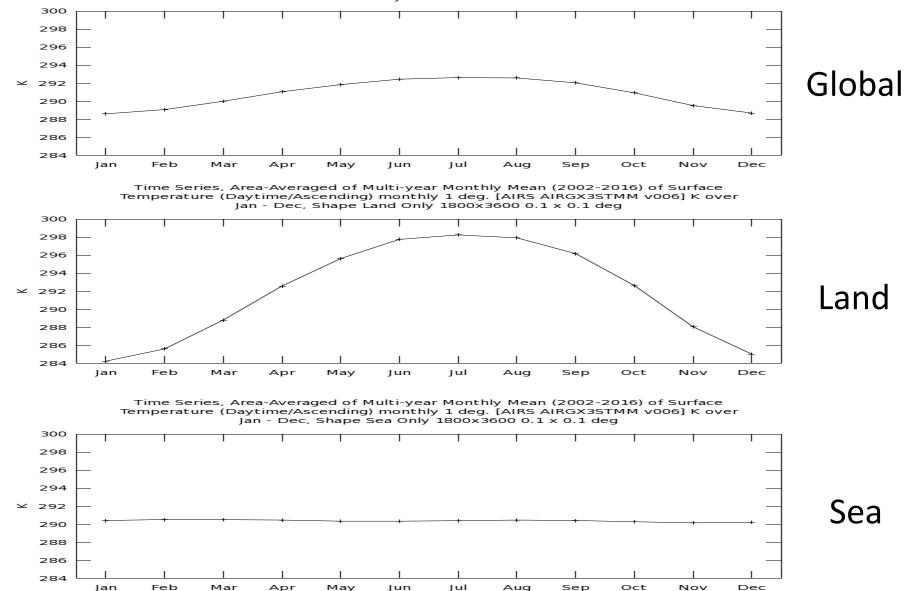
### Giovanni: Time Series of Multi-year Monthly Mean Surface T Daytime Jan. to Dec. Sea Only

Giovanni - Data Selection X +											
🛈 🔒 https://giovanni.gsfc. <b>nasa.gov</b> /g	giovanni/#service=ArAvTs&start	time=2002-01-01T00:00:00Z&endtime=201	16-12-31T23:59:59:	C) C	Q Search			☆ I	â 🦊	<b>r</b> 5	) <u></u>
EARTH <b>DATA</b> Data Discovery	/	nity - Science Disciplines -									
	Between Data and Science	e v 4.23 <u>Release Notes</u> <u>Browser Co</u>	ompatibility Know	n Issues							
DIS OPeNDAP server continuing p	problem [1 of 3 messages]	Read More	<u> </u>								
elect Plot											
O Maps: Select   Comparis	sons: Select 🔻 🔘 Vertical	: Select 🔻 🔍 Time Series: Area-Averag	jed 🗕 🔿 Miscellan	eous: Sele	ct •						
elect Date Range (UTC)		Select Region (Bounding Box or Shape) Format: West. South. East. North									
-01 - 00 : 00 to	- 12 - 23 : 59	Sea Only file Sea Only 1800x3600 0.1 x 0.	J 🖌								
Valid Range: 2002-09-01 to 2016-08-31											
elect Variables											
V Disciplines	Number of matching Variables	s: 0 of 1755 Total Variable(s) included in Plot	t: 1								
Aerosols (183)	Keyword :		Search Clea	r							
Atmospheric Chemistry (79)	Variable			Source	Temp.Res.	Spat.Res.	Begin Date	End Date	Units		
Atmospheric Dynamics (394)				Source	Temp.Res.	Spat.Res.	Degin Date	Life Date	Units	_	
Cryosphere (15)	Multi-year Monthly M (Daytime/Ascending)	Mean (2002-2016) of Surface Temperature ) (AIRGX3STMM v006)		AIRS	Monthly	1°	2002-09-01	2016-08-31	ĸ	< ~	
Hydrology (1000)	100yume/Ascenumy										
□ Ocean Biology (49) □ Oceanography (50)											×



#### Global, Land, Sea Surface Temperature

Time Series, Area-Averaged of Multi-year Monthly Mean (2002-2016) of Surface Temperature (Daytime/Ascending) monthly 1 deg. [AIRS AIRGX3STMM v006] K over Jan - Dec



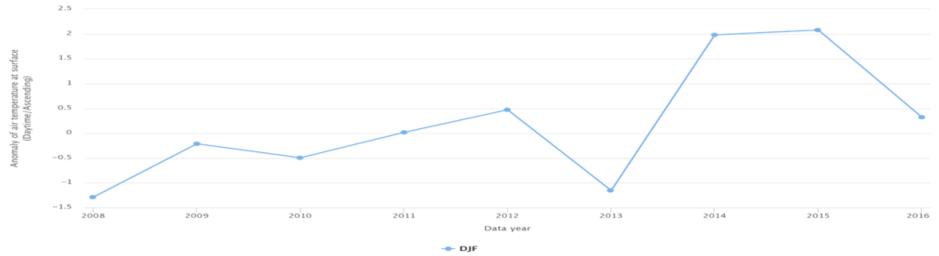
#### Giovanni: Surface Air Temperature Anomaly inter-annual seasonal (DJF) time series plot over California from 2008 to 2016

O	- A (	
		☑ 🕺
		0
BIOVANNI The Bridge Between Data and Science v 4.23 <u>Release Notes</u> Browser Compatibility Known Issues		
ime series area statistics temporarily unavailable [1 of 2 messages] Read More		
Select Plot		
O Maps: Select ▼ O Comparisons: Select ▼ O Vertical: Select ▼ O Time Series: Seasonal ▼ O Miscellaneous: Select ▼		
Select Seasonal Dates     Select Region (Bounding Box or Shape)       Month or Season and YYYY range.     Format: West, South, East, North       DJF     2006 Im to 2016 Im 100 (States California)		
DJF 2008 to 2016 US States California;		
S OMonths @ Seasons		
DJF Number of matching Variables: 0 of 1776 Total Variable(s) included in Plot: 1		
MAM Keyword Search Clear		
JJA     Variable     Source     Temp.Res.     Spat.Res.     Begin Date     End Date     Units		
	К ~	
Hydrology (673)		
□ Ocean Biology (44) □ Oceanography (46)		×
Ucceanography (46)	×-	
V Measurements		
22'37'N, 101	15'W	
	5"00'N	
Air Pressure (35)	0014	
Li ri remperature Anomaly (2)		
□ Air Temperature (58) □ Albedo (11)	0°00'N	
	S	
□ Angeton Exponent (9)	31	
	5°00'S	
Black Carbon (4)		
Buoyancy (2)	->	
CH4 (8) CO (13)	2	
$\Box \cos(2)$		
Canopy Water Storage (5)		
	ot Data	
Cloud Fraction (21)	Data	

#### Giovanni: Surface Air Temperature Anomaly inter-annual seasonal (DJF) time series plot over California from 2008 to 2016

#### Interannual time series Anomaly of air temperature at surface (Daytime/Ascending)

monthly 1 deg. [AIRS AIRGX3STMMA v006] K over 2007-Dec - 2016-Feb, Shape California

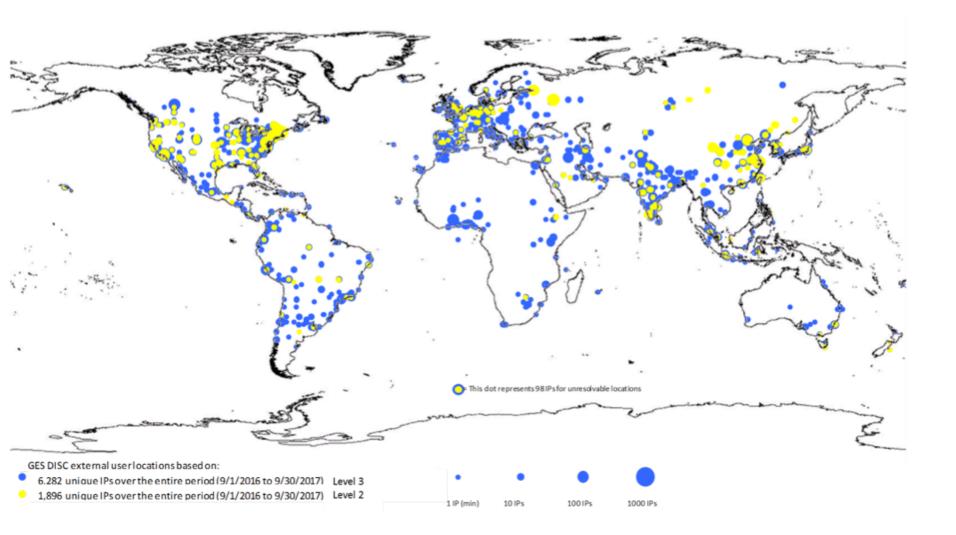


#### Interannual time series Anomaly of air temperature at surface (Nightime/Descending)

approved and the state of the s

- DJF

#### AIRS V6 L2 (yellow) and L3 (blue)users from Sept 2016 to Sept 2017



# Summary

- Overlay map plot and shapefile functions added on Giovanni
- AIRS-only products and multi-year monthly mean surface temperature and anomaly available on Giovanni
- New functions and variables give users more flexibility of analysis
- AIRS products are used worldwide

https://giovanni.gsfc.nasa.gov/ https://disc.gsfc.nasa.gov/ gsfc-help-disc@lists.nasa.gov