High Temporal Resolution Products
from the Goddard EOS Data Assimilation System (GEOS DAS)
(formerly DAO Swath Products)

Beginning in June 1998, the DAO will produce a new set of high temporal resolution products tailored specifically to the needs of the AM1 instruments. Originally, the DAO planned to put these data out in special "satellite swaths" to match the field of view of the AM1 instruments. However, after further study (see appendix A) the DAO has decided to not subset these products geographically but merely put them out on the full global grid.

Table 1 lists the high temporal resolution products to be provided by the DAO. These are based on requirements gathered from the AM1 instrument teams as shown in Table 2. These data will have the following characteristics:

Grid: lat-lon. (Each grid point has an (I,J) index. "I" repersents the longitude, 1 being the dateline and incrementing eastward. "J" represents the latitude, 1 being the south pole and incrementing northward. The grid does not wrap at the dateline. For example, on a 2 X 2.5 grid the I = 144 longitude is 177.5E.)

Horizontal Resolution: 2 X 2.5 degree lat-lon. (This will increase to 1 X 1 degree lat-lon approximately 6 months after launch.)

Vertical Resolution: 24 mandatory pressure levels (1000 mb to .4 mb) or 70 sigma levels (surface to .01 mb) (see appendix B). Some fields are not meaningful above a certain level. For example, the GEOS DAS does not contain accurate cloud or humidity information above 100 mb. Thus, these fields will be reported at only the lowest 12 pressure levels (1000 mb to 70 mb) and/or the lowest 35 sigma levels (surface to approximately 40 mb).

Format: EOS-HDF

Source: Goddard DAAC

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Table 1
High Temporal Resolution Products

Units	Data Type	Time Resloution	1 X 1 deg 1-Day File Size (MB)	2X2.5 deg 1-Day File Size (MB)
	Precip and Moisture			
none (0-1)	Soil Moisture (shallow)	3 hr	2	1
none (0-1)	Soil Moisture (root)	3 hr	2	1
none (0-1)	Soil Moisture (deep)	3 hr	2	1
g/kg	Canopy Air Specific Humidity	10 min	36	7
g/kg	Near-Surface Specific Humidity (2 meters)	10 min	36	7
g/kg	Near Surface Specific Humidity (10 meters)	10 min	36	7
g/kg	Specific Humidity Profile (12 lowest pressure levels)	1 hr	72	15
g/kg	Specific Humidity Profile (35 lowest sigma levels)	3 hr	70	14
gm/cm**2	Precipitable Water	1 hr	6	1
mm/day	Total Precipitation	3 hr	1	1
mm/day	Convective Precipitation	3 hr	1	1
mm	Snow Depth	3 hr	1	1
	Clouds & Radiation			
mb	Cloud Top Pressure	1 hr	6	1
deg K	Cloud Top Temperature	1 hr	6	1
1/m	Cloud Optical Depth (12 lowest pressure levels)	1 hr	72	15
1/m	Cloud Optical Depth (35 lowest sigma levels)	3 hr	70	14
1/m	Low Cloud Optical Depth	1 hr	6	1
1/m	Mid Cloud Optical Depth	1 hr	6	1
1/m	High Cloud Optical Depth	1 hr	6	1
w/m**2	Outgoing SW Radiation	1 hr	6	1
w/m**2	Outgoing SW Radiation, Clear Sky	1 hr	6	1
none (0-1)	Albedo - NIR, Diffuse	1 hr	6	1
none (0-1)	Albedo - NIR, Direct	1 hr	6	1
none (0-1)	Albedo - Vis, Diffuse	1 hr	6	1
none (0-1)	Albedo - Vis, Direct	1 hr	6	1
mg/kg	Cloud Liquid Water (12 lowest pressure levels)	1 hr	72	15
mg/kg	Cloud Liquid Water (35 lowest sigma levels)	3 hr	70	14
	Land & Ocean Surface Temps			
deg K	Skin Temperature	10 min	36	7
	Boundary Conditions			
none	Land, Water, Ice Flags	3 hr	1	1

Units	Data Type	Time Reslolution	1 X 1 deg 1-Day File Size (MB)	2 X 2.5 deg 1-Day File Size (MB)
	Air Temperature			
deg K	Temperature (2 meters)	10 min	36	7
deg K	Temperature (10 meters)	10 min	36	7
deg K	Temperature Profile (24 pressure levels)	1 hr	144	29
deg K	Temperature Profile (70 sigma levels)	3 hr	140	28
deg K	Tropopause Temperature	1 hr	6	1
	Pressure & Heights			
(m/sec)**2	Surface Geopotential Height	1 hr	6	1
mb	Surface Pressure	1 hr	6	1
mb	Sea Level Pressure	1 hr	6	1
m	Upper Air Geopotential Heights (24 pressure levels)	3 hr	48	10
mb	Tropopause Pressure	1 hr	6	1
	Winds			
m/sec	Winds at 2 meters (u component)	1 hr	6	1
m/sec	Winds at 2 meters (v component)	1 hr	6	1
m/sec	Winds at 10 meters (u component)	1 hr	6	1
m/sec	Winds at 10 meters (v component)	1 hr	6	1
	Chemical Constituents			
ppmv	Ozone Profile (24 pressure levels)	3 hr	48	10

Most of the products in the above table have only one vertical level. The exceptions are the profile data. Profile data may be on either mandatory pressure levels or model sigma levels (see Appendix B).

Table 2
EOS Instrument Requirements

Parameter	GEOS-1	AVNIR	ILAS	IMG	NSCAT	OCTS	POLDER	IRIS	TOMS	CERES	LIS	PR	TMI	VIRS	ASTER	CERES	MISR	MODIS	MOPITT	BM1	SAGE III	GLAS	AIRS	AMSU	CERES	MHS	MIMR	MODIS	AIRDLS	MLS	TES	MODIS
Launch Year		96								97					98					99	ALT		'00						02			
Platform		ADEOS								TRMM					AM1					BM1			PM1						CHEM1			
Surface Pressure	●				●	●				●					●	●	●	●					●		●				●			
Surface Winds	●				●	●								●	●		●	●					●		●							
Geopotential Heights	●									●					●	●	●								●						●	
Temperature Profile	●					●				●				●	●	●	●	●	●		●		●		●				●		●	
Surface Air Temperature	◗				◗	◗								●	●		●	●	●				●		●							
Ground Temperature	◗									◗					●	●									●							
Moisture Profile	◗					◗				◗			◗		●	●	●	●	●				●		●				●			
Precipitable Water	◗									◗					●	●									●							
Precipitation	◗																		◗											◗		
Surface Humidity	◗				◗														◗				◗									
Soil Moisture	◗									◗			◗		◗																	
Outgoing SW Radiation	◗																		◗											◗		
Outgoing SW Rad (clear)	◗																		◗											◗		
Cloud Top Pressure	◗																	◗	◗											◗		
Cloud Properties	◗																	◗	◗											◗		
Surface Albedo	X									◗						◗						◗										
Sea Surface Temperature	X				X					X						X		X					X		X			X				
Tropopause	○									●					●																	
Snow/Ice Cover	○														◗		◗	◗	◗				◗	◗								
Ozone Profile	○						○			◗					◗	◗	◗	◗	◗		◗		◗		◗				◗			
Cloud Liquid Water	○													◗	◗															◗		
Aerosols	○						○								○		○	○												◗		
Visibility/ Optical Depth	○									○					○		○										◗		◗			
CO2	○																	○														
Cloud Emissivity	○																	○													○	
Surface Emissivity	○								○																							

KEY
● High quality DAO product available
◗ Medium quality DAO product available
○ No DAO product available
X Available, but from other source

This table lists the products required by the EOS instruments. If there is an entry of any kind, that instrument needs that product. The first column, GEOS-1, is not an instrument but represents the first DAO reanalysis project. This project was a prototype for future DAO reanalyses and has been evaluated extensively by the climate community. The quality values shown for GEOS-1 are based on these scientific evaluations. The quality values shown for subsequent version of the GEOS DAS, the AM1 version for example, are target values based on expected system improvements.

Appendix A

Why Produce Global Gridded Products
Instead of Swath Subsetted Products?

Background. For the past two years the DAO has been "promising" to produce special "swath" products for the AM1 instrument teams. The original idea for this came from Bob Evans of the MODIS Oceans team. He said they had had great difficulty interpolating NCEP 6-hourly low level wind products. He said they needed much higher temporal resolution. Hearing this, the DAO responded that their incremental analysis update (IAU) scheme could produce assimilated data at temporal resolutions up to a few minutes. In fact, at that time, the DAO already had a prototype "fly-through" system that could mimic an aircraft's flight path and pull out the assimilated data closest to the aircraft's location. It would be an easy conversion from this aircraft "fly-through" to a satellite "swath." In fact, the DAO has since developed a prototype swath module.

As the DAO advertised this capability, the other AM1 instrument teams also expressed interest. However, upon further investigation into the actual AM1 orbit, instrument swaths, and the scientific limitations of the GEOS DAS, it is now apparent that there is very little to be gained by geographically subsetting the data to match the satellite swath. Higher temporal resolution still makes sense, but not necessarily on a geographically subsetted grid. Here is how the DAO arrived at this conclusion:

Original Subsetting Design. The AM1 platform has many different sensors, looking forward and aft and sweeping across the satellite track. Rather than try to match the assimilated output to the individual pixel location of all the different sensors the DAO decided to merely put out the data at their normal lat-lon grid. They would leave the pixel interpolation up to the instrument teams. Furthermore, they decided to just draw a rectangle around the limits of the furthest looking instruments and subset the global data to this rectangle. The only problem is when the track goes over the poles. Here the rectangles become split and make for rather cumbersome subsetting. Rather than make thing too complicated, the DAO decided to produce the full latitude bands for any swath that went over the pole. This is the subsetting design in the prototype swath module.

Temporal Resolution Limitations. Although the model time step is on the order of a few minutes, most fields within the system are varying at much slower time scales. Furthermore, it costs 2 1/2 times as much computing time to put data out at every time step verses the current 3 and 6 hourly rates. Because of this high cost, the DAO hypothesized that the lowest reasonable temporal resolution would be about 10 minutes, and this would be only for the few products that vary significantly at this time scale. Tests with the DAO swath module at 10-minute resolution were encouraging, taking only 10% more computing time than the standard 3 and 6 hourly output.

The AM1 Orbit and Swaths. Using 10 minutes as the highest likely temporal resolution, the DAO then estimated the AM1 orbit and swaths to produce a prototype data set. First they considered the orbit period, 98 minutes, based on the satellite elevation, 705 km, which produces a ground track of approximately 400 km/min. Next they looked for the farthest looking instruments on AM1. CERES appeared to be the farthest, looking all the way out to the limb. Using very rough approximations, they determined the limb to

Appendix B

Mandatory Pressure
and
Model Sigma Levels

The World Meteorological Organization (WMO) has established the following mandatory pressure levels:

1000 mb	300 mb	50 mb	3.0 mb
925 mb	250 mb	30 mb	2.0 mb
850 mb	200 mb	20 mb	1.0 mb
700 mb	150 mb	10 mb	.7 mb
500 mb	100 mb	7 mb	.5 mb
400 mb	70 mb	5 mb	.4 mb

The objective analysis within the GEOS DAS is done at these mandatory pressure levels while the general circulation model (GCM) operates on model sigma levels. The GCM sigma levels are based on the following formula:

$$\sigma = (p - p_t) / (p_s - p_t)$$

where: p = pressure of the sigma level,

p_t = pressure at the top of the GCM,

p_s = surface pressure.

The GEOS DAS GCM uses 70 sigma levels from the surface to .01 mb. To aid in converting sigma levels to pressure levels, sigma files will include $(p_s - p_t)$ and p_t.

Proposed

High Temporal Resolution
Products for AM1 Instruments

10/9/96

Units	Data Type	DAS#	Name	Assimilation 10 min Single Level 1 IAU	Assimilation 1 hr Single Level 1 IAU	Assimilation 3 hr Single Level 1 IAU	Assimilation 1 hr Mandatory Press lowest 12 IAU	Assimilation 1 hr Mandatory Press 24 IAU	Assimilation 3 hr Mandatory Pres 24 IAU	Assimilation 3 hr Model Sigma lowest 35 IAU	Assimilation 3 hr Model Sigma 70 IAU
	Temporal Resolution										
	Levels (type)										
	Levels (#)										
	Method of Data Insertion										
	To get 1-day file size [at 1 X 1 deg resolution]: 4 bytes X 180 X 360 X (# times/day) X (# levels)										
	To get 1-day file size [at 2 X 2.5 resolution] divide the above number by 5										
	Precip and Moisture										
none (0-1)	Soil Moisture (shallow)	02	SMSHAL			X					
none (0-1)	Soil Moisture (root)	02	SMROOT			X					
none (0-1)	Soil Moisture (deep)	02	SMDEEP			X					
g/kg	Canopy Air Specific Humidity			X							
g/kg	Near-Surface Specific Humidity	05	Q2M	X							
g/kg		05	Q10M	X							
g/kg	Specific Humidity Profile	05	SPHU				X			X	
gm/cm**2	Precipitable Water	08	QINT		X						
mm/day	Total Precipitation	09	PREACC			X					
mm/day	Convective Precipitation	09	PRECON			X					
mm	Snow Depth	10	SNDPTH			X					
	Clouds, Aerosols, & Radiation										
mb	Cloud Top Pressure		CLDPRS		X						
deg K	Cloud Top Temperature		CLDTMP		X						
1/m	Cloud Optical Depth		TAU				X			X	
1/m	Low Cloud Optical Depth		TAULO		X						
1/m	Mid Cloud Optical Depth		TAUMID		X						
1/m	High Cloud Optical Depth		TAUHI		X						
w/m**2	Outgoing SW Radiation	16	OSR		X						
w/m**2	Outgoing SW Radiation, Clear Sky	16	OSRCLR		X						
none (0-1)	Albedo - NIR, Diffuse	19	ANIRDF		X						
none (0-1)	Albedo - NIR, Direct	19	ANIRDR		X						
none (0-1)	Albedo - Vis, Diffuse	19	AVISDF		X						
none (0-1)	Albedo - Vis, Direct	19	AVISDR		X						
mg/kg	Cloud Liquid Water		LZRAD				X			X	
	Land & Ocean Surface Temps										
deg K	Surface Ground Temperature	35	GTMP	X							
	Boundary Conditions										
none	Land, Water, Ice Flags	01	LWI			X					
	Air Temperature										
deg K	Temperature (2 meters)	20	T2M	X							
deg K	Temperature (10 meters)	20	T10M	X							
deg K	Temperature Profile	20	TMPU					X			X
deg K	Tropopause Temperature	23	TROPT		X						
	Pressure & Heights										
(m/sec)**2	Surface Geopotential Height	34	PHIS		X						
mb	Surface Pressure - PTOP	33	PSPTOP		X						
mb	Sea Level Pressure	33	SLP		X						
m	Upper Air Geopotential Heights	34	HGHT						X		
mb	Tropopause Pressure	23	TROPP		X						
	Winds										
m/sec	Winds at 2 meters	25	U2M		X						
m/sec		25	V2M		X						
m/sec	Winds at 10 meters	25	U10M		X						
m/sec		25	V10M		X						
	Chemical Constituents										
ppmv	Ozone Profile		OZONE						X		
Total 232	Size for one day (MB) (2 X 2.5 deg resolution)			43	25	3	43	29	19	42	28
1162	Size for one day (MB) (1 X 1 deg resolution)			216	126	14	216	144	96	210	140

DAO Products (1998)

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Units	Data Type	DAS#	Name	Assimilation 8 / Single Level / 1 / IAU	Assimilation 4 / Mandatory Pres / 24 / IAU	Assimilation 4 / Model Sigma / 70 / IAU	Increments 4 / Model Sigma / 70 / IAU	Analysis 4 / Mandatory Pres / 24 / Single	First Guess 4 / Mandatory Pres / 24 / IAU + 3 hr Fcst	Observations 4 / Varied / Single	Swath 4 / Mandatory Pres / 24 / IAU	10-Day FCST* 1 / Mandatory Pres / 24 / Fcst
	To get file size [at 1 X 1 deg resolution]: 4 bytes X 180 X 360 X (# times/day) X (# levels)											
	To get file size [at 2 X 2.5 resolution] divide the above number by 5											
	Precip and Moisture											
none (0-1)	Soil Moisture (shallow)	02	SMSHAL	X							X (1 level)	
none (0-1)	Soil Moisture (root)	02	SMROOT	X							X (1 level)	
none (0-1)	Soil Moisture (deep)	02	SMDEEP	X							X (1 level)	
mm/day	Surface Evaporation	04	EVAP	X								
g/kg	Saturation Surface Specific Humidity	03	QS	X							X (1 level)	
g/kg	Near-Surface Specific Humidity	05	Q2M	X						X	X (1 level)	
g/kg		05	Q10M	X						X	X (1 level)	
g/kg	Specific Humidity Profile	05	SPHU		X	X	X			X	X	X
g/kg/day	Moisture Change due to Turbulence	06	TURBQ			X	X					
g/kg/day	Moisture Change due to Moisture	06	MOISTQ			X	X					
(m/sec)(g/kg)	Vertically Integrated U*Q	07	VINTUQ	X								
(m/sec)(g/kg)	Vertically Integrated V*Q	07	VINTVQ	X								
g/kg	Mixing Ratio Profile	05	MIXR					X	X	X		
g/kg	Mixing Ratio Profile (errors)	05	MIXRE					X	X		X	
% (0-100)	Relative Humidity Profile	05	RH					X	X	X		
gm/cm**2	Precipitable Water	08	QINT	X						X	X (1 level)	
mm/day	Total Precipitation	09	PREACC	X						X	X (1 level)	X (1 level)
mm/day	Convective Precipitation	09	PRECON	X							X (1 level)	X (1 level)
mm	Snow Depth	10	SNDPTH	X							X (1 level)	X (1 level)
	Clouds, Aerosols, & Radiation											
none (0-1)	2-D Cloud Fraction	11	CLDFRC	X							X (1 level)	X (1 level)
kg*m/sec**2	Cloud Mass Flux	12	CLDMAS			X						
kg*m/sec	Convective Cloud Detrainment	12	DTRAIN			X						
none (0-1)	Random Overlap Cloud Fraction for LW	11	CLROLW			X					X	X
deg/day	Clear Sky LW Heating Rate	13	LWCLR			X						
deg/day	Clear Sky SW Heating Rates	13	SWCLR			X						
w/m**2	Outgoing LW Radiation	15	OLR	X								
w/m**2	Outgoing LW Radiation, Clear Sky	15	OLRCLR	X								
w/m**2	Incident SW Radiation Top of Atmos	17	RADSWT	X								
w/m**2	Surface LW Flux, Clear Sky	18	LWGCLR	X								
w/m**2	Outgoing SW Radiation	16	OSR	X							X (1 level)	
w/m**2	Outgoing SW Radiation, Clear Sky	16	OSRCLR	X							X (1 level)	
w/m**2	Downward IR	18	LWDNG	X								
w/m**2	Downward Vis	18	VISDNG	X								
none (0-1)	Albedo - NIR, Diffuse	19	ANIRDF	X							X (1 level)	
none (0-1)	Albedo - NIR, Direct	19	ANIRDR	X							X (1 level)	
none (0-1)	Albedo - Vis, Diffuse	19	AVISDF	X							X (1 level)	
none (0-1)	Albedo - Vis, Direct	19	AVISDR	X							X (1 level)	
w/m**2	Surface Flux Sensible Heat	14	HFLUX	X								
w/m**2	Surface SW Flux, Clear Sky	18	SWGCLR	X								
w/m**2	Net Upward LW Radiation at Ground	18	RADLWG	X								
w/m**2	Net Downward SW Radiation at Ground	18	RADSWG	X								

Units	Data Type	DAS#	Name	Assimilation 8 / Single Level / 1 / IAU	Assimilation 4 / Mandatory Pres / 24 / IAU	Assimilation 4 / Model Sigma / 70 / IAU	Increments 4 / Model Sigma / 70 / IAU	Analysis 4 / Mandatory Pres / 24 / Single	First Guess 4 / Mandatory Pres / 24 / IAU + 3 hr Fcst	Observations 4 / Varied / Single	Swath 4 / Mandatory Pres / 24 / IAU	10-Day FCST* 1 / Mandatory Pres / 24 / Fcst
	Data Type / Frequency (per day) / Levels (type) / Levels (#) / Method of Data Insertion											
	Land & Ocean Surface Temps									X	X (1 level)	X (1 level)
deg K	Surface Ground Temperature	35	GTMP	X								
deg K	Time Averaged Ground Temperature	35	GTAVE	X								
deg K	Surface Virtual Temperature	35	TVSFC					X	X			
deg K	Deep Soil Temperature	35	STDEEP	X								
	Greenhouse Gases & Trop Chem											
	N/A											
	Vegetation & Ocean Phytoplankton											
	N/A											
	Global Biological Productivity											
	N/A											
	Radiance & Imagery											
	N/A											
	Boundary Conditions											
none	Land, Water, Ice Flags	01	LWI	X								
	Air Temperature									X	X (1 level)	X (1 level)
deg K	Surface Air Temperature	20	TS	X						X	X (1 level)	X (1 level)
deg K	Temperature (2 meters)	20	T2M	X						X	X (1 level)	X (1 level)
deg K	Temperature (10 meters)	20	T10M	X						X	X (1 level)	X
deg K	Temperature Profile	20	TMPU		X	X	X	X	X	X	X	
deg/day	Temperature change due to turbulence	21	TURBT		X	X						
deg/day	Temperature change due to moisture	21	MOISTT		X	X						
deg/day	Temperature change due to LW rad	21	RADLW		X	X						
deg/day	Temperature change due to SW rad	21	RADSW		X	X						
m/sec deg	Vertically Integrated U*T	22	VINTUT	X								
m/sec deg	Vertically Integrated V*T	22	VINTVT	X							X (1 level)	X (1 level)
deg K	Tropopause Temperature	23	TROPT	X								
	Pressure & Heights								X (1 level)	X (1 level)	X	X (1 level)	
(m/sec)**2	Surface Geopotential Height	34	PHIS	X							X (1 level)	X (1 level)
mb	Surface Pressure - PTOP	33	PSPTOP	X								
mb	Time Average Surface Pressure - PTOP	33	PAVE	X								
mb	Surface Pressure	33	PSFC					X (1 level)	X (1 level)	X (1 level)	X	X (1 level)	X (1 level)
mb	Sea Level Pressure	33	SLP	X				X (1 level)	X (1 level)	X		X (1 level)
mb	Sea Level Pressure (error)	33	PRSE					X (1 level)	X (1 level)			
mb/day	Surface Pressure Tendency	33	DPDT	X								
m	Upper Air Geopotential Heights	34	HGHT		X			X	X	X	X	X
m	Upper Air Geopotential Heights (error)	34	HGHTE					X	X			
m	UA Perturbation Geopotential Heights	34	PHGHT				X				X (1 level)	X (1 level)
mb	Tropopause Pressure	23	TROPP	X								

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Units	Data Type	DAS#	Name	Assimilation	Assimilation	Assimilation	Increments	Analysis	First Guess	Observations	Swath	10-Day FCST*
	Frequency (per day)			8	4	4	4	4	4	4	4	1
	Levels (type)			Single Level	Mandatory Pres	Model Sigma	Model Sigma	Mandatory Pres	Mandatory Pres	Varied	Mandatory Pres	Mandatory Pres
	Levels (#)			1	24	70	70	24	24		24	24
	Method of Data Insertion			IAU	IAU	IAU	IAU	Single	IAU + 3 hr Fcst	Single	IAU	Fcst
		DAS#	Name									
	Winds											
m/sec	Sea Level Winds	24	SLU					X	X	X	X (1 level)	X (1 level)
m/sec		24	SLV					X	X		X (1 level)	X (1 level)
m/sec	Surface Wind Speed	24	WINDS	X							X (1 level)	
m/sec	Vertically Integrated Winds (Barotropic)	27	UBAR	X								
m/sec		27	VBAR	X								
m/sec	Upper Level Winds	25	UWIND		X	X	X	X	X	X		X
m/sec		25	VWIND		X	X	X	X	X	X		X
m/sec	Winds at 2 meters	25	U2M	X						X		X (1 level)
m/sec		25	V2M	X						X		X (1 level)
m/sec	Winds at 10 meters	25	U10M	X						X		X (1 level)
m/sec		25	V10M	X						X		X (1 level)
m/sec	Upper Level Winds (error)	25	UWNDE					X	X			
m/sec		25	VWNDE					X	X			
(m/sec)**2	Turbulent Kinetic Energy	28	QQ		X	X						
m/sec/day	Momentum Changes due to Turbulence	28	TURBU		X	X						
m/sec/day		28	TURBV		X	X						
mb/day	Vertical Velocity	26	OMEGA		X	X						
n/m**2	Surface Stress	29	UFLUX	X								
n/m**2		29	VFLUX	X								
m/sec	Surface Drag	31	CT	X								X (1 level)
m/sec		31	CU	X								X (1 level)
m/sec	U Star	29	USTAR	X								X (1 level)
mb	PBL Depth	32	PBL	X								X
m	Surface Roughness	30	Z0	X								
	Chemical Constituents											
ppmv	Ozone Profile		OZONE					X			X	
ppbv	CO Profile		CO					X				

NOTE: all file sizes based on 1 X 1 deg resolution

Size for one day (MB)				122	373	1,452	291	377	328	500	1100	1,690
Total size for 1 day first-look analysis (GB)			4.54	✔	✔	✔	✔	✔	✔	✔	✔	
Total size for 1 day final platform analysis (GB)			3.44	✔	✔	✔	✔	✔	✔	✔		
Total output for 1 10-day forecast (GB)**			19.47	✔	✔	✔						
Total archive for 1 10-day forecast (GB)			1.69									✔

* This column lists only those 10-day forecast products that are permanently archived.

** The full output from the 10-day forecast is only saved for 30 days.