Level 3 Design and Development Plans

Design : tile approach

tile size : $5° \times 360°$

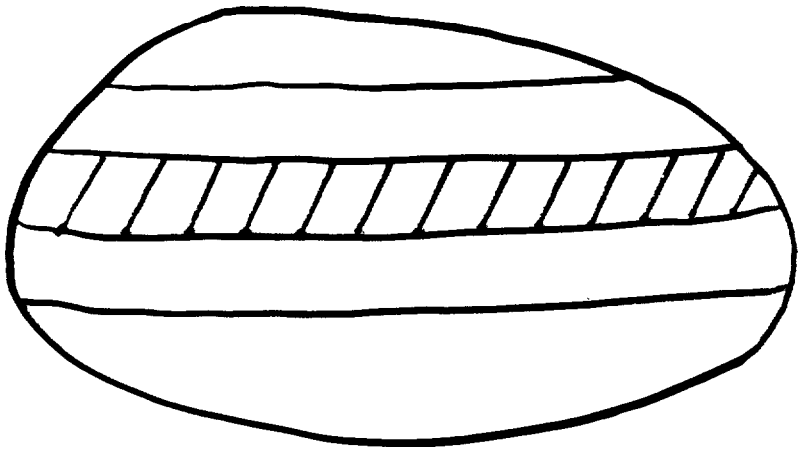


Table 1: MODIS L3 daily, 8-day, and monthly parameters and associated information for 1° x 1° grid cell AT launch. (Version of May 6, 1997)

Description	Unit, Dim.(No.)[5]	Data Format	Range	Scale-factor	L2 QA[4]	Agg. Type[1]	Histo-grams[2]	Simple Statis.[3]	Reg/jpdf
Latitude	Degree, 2	Float	-90 to 90	1.0	–		no	no	
Longitude	Degree, 2	Float	-180 to 180	1.0	–		no	no	
Aerosol Over Land									
Scattering_Angle_Land	Degree, 2	Float	0 to 180	1.0	–	1	–	a,b,c	–
Corrected_Optical_Depth_Land	none, 3(3)	Float	0 to 3	1.0	yes	1	5 levels	a,b,c	4x5 level
Mass_Concentration_Land	$1.0^{-6}g/cm^2$, 2	Float	0 to 103	1.0	yes	1	5 levels	a,b,c	–
Aerosol_Type_Land	none, 2	Integer	0 to 3	1.0	yes	1	4 levels	–	–
Angstrom_Exponent_Land	none, 2	Float	-0.5 to 4	1.0	yes	1	5 levels	a,b,c	reg
Transmitted_Flux_Land	none, 3(2)	Float	0 to 1	1.0	yes	1	5 levels	a,b,c	–
Reflected_Flux_Land	none, 3(2)	Float	0 to 1	1.0	yes	1	5 levels	a,b,c	–
Aerosol Over Ocean									
Scatterin_Angle_Ocean	Degree, 2	Float	0 to 180	1.0	–	1	–	a,b,c	–
Mass_Concentration_Ocean	$1.0^{-6}g/cm^2$, 2	Float	0 to 103	1.0	yes	1	5 levels	a,b,c	–
Effective_Optical_Depth_Average_Ocean	none, 3(7)	Float	0 to 3	1.0	yes	1	5 levels	a,b,c	–
Optical_Depth_Ratio_Small_Ocean	none,2	Float	0 to 3	1.0	yes	1	5 levels	a,b,c	–
Effective_Radius_Ocean	Micron, 2	Float	0 to 5	1.0	yes	1	8 levels	a,b,c	–
Cloud_Condensation_Nuclei_Ocean	N/cm^2, 2	Float	0 to 10^{10}	1.0	yes	1	12 levels	a,b,c	–
Angstrom_Exponent_1_Ocean	none, 2	Float	-0.5 to 4	1.0	yes	1	5 levels	a,b,c	reg
Angstrom_Exponent_2_Ocean	none, 2	Float	-0.5 to 4	1.0	yes	1	5 levels	a,b,c	reg
Asymmetry_Factor_Average_Ocean	none, 3(7)	Float	0 to 3	1.0	yes	1	5 levels	a,b,c	–
Backscattering_ratio_Average_Ocean	none, 3(7)	Float	0 to 3	1.0	yes	1	6 levels	a,b,c	–
Transmitted_Flux_Average_Ocean	none, 3(7)	Float	0 to 1	1.0	yes	1	5 levels	a,b,c	–
Reflected_Flux_Average_Ocean	none, 3(7)	Float	0 to 1	1.0	yes	1	5 levels	a,b,c	–
Water Vapor									
Water_Vapor_Near_Infrared_Clear	cm, 2	Float	0 to 20	1.0	yes	2	45 levels	a,b,c	–
Water_Vapor_Near_Infrared_Cloud	cm, 2	Float	0 to 10	1.0	yes	2	35 levels	a,b,c	–
Cirrus_Reflectance	none, 2	Float	0 to 1.5	1.0	yes	2	30 levels	a,b,c	–
Contrail_Reflectance	none, 2	Float	0 to 1.5	1.0	yes	2	30 levels	a,b,c	–
Cirrus_Area_Fraction	none, 2	Float	0 to 1	1.0	–	2	–	d	–
Contrail_Area_Fraction	none, 2	Float	0 to 1	1.0	–	2	–	d	–
Clouds									
Atmospheric_Water_Vapor_Low	mm, 2	Float	0 to 100	1.0	yes	1	10 levels	a,b,c	–
Atmospheric_Water_Vapor_High	mm, 2	Float	0 to 100	1.0	yes	1	10 levels	a,b,c	–
Cloud_Top_Temperature	K, 2	Float	150 to 350	1.0	yes	1	10 levels	a,b,c	–
Atmospheric_Temperature_Profile	K, 3(4)	Float	150 to 350	1.0	yes	1	–	a,b,c	–
Cloud_Top_Pressure	hPa, 2	Float	1 to 1100	1.0	yes	1	11 levels	a,b, c	–
Cloud_Effective_Emissivity	none, 2	Float	0 to 1	1.0	yes	1	10 levels	a,b,c	–
Cirrus_Probability	%, 2	Float	0 to 100	1.0	yes	1	10 levels	a,b,c	–
High_Cloud_Probability	%, 2	Float	0 to 100	1.0	yes	1	10 levels	a,b,c	–
Cloud_Phase_Infrared	none, 2	Integer	0 to 6	1.0	yes	1	6 levels	a,b,c	–
Water_Cloud_Optical_Thickness	none, 2	Float	0 to 100	1.0	yes	2	45 levels	a,b,c,e	45x25 level
Water_Cloud_Effective_Radius	µm, 2	Float	0 to 100	1.0	yes	2	25 levels	a,b,c	–
Liquid_Water_Path	g/m^2, 2	Float	0 to 1000	1.0	yes	2	40 levels	a,b,c	–
Fraction_Water_Cloud	none, 2	Float	0 to 1	1.0	yes	2	–	d	–
Ice_Cloud_Optical_Thickness	none, 2	Float	0 to 100	1.0	yes	2	30 levels	a,b,c,e	30X25 level
Ice_Cloud_Effective_Radius	µm, 2	Float	0 to 1000	1.0	yes	2	25 levels	a,b,c	–
Ice_Water_Path	g/m^2, 2	Float	0 to 1000	1.0	yes	2	20 levels	a,b,c	–
Fraction_lce_Cloud	none, 2	Float	0 to 1	1.0	yes	2	–	d	–
Ozone and Stability Indices									
Total_Ozone	DU, 2	Float	0 to 500	1.0	yes	1	10 levels	a,b,c	–
Total_Totals	K, 2	Float	0 to 80	1.0	yes	1	8 levels	a,b,c	–
Lifted_Index	K, 2	Float	-20 to 40	1.0	yes	1	12 levels	a,b,c	–
K-Index	K, 2	Float	-5 to 65	1.0	yes	1	7 levels	a,b,c	–

Agg. Type[1]: The "1" indicates that the parameter is to be aggregated directly from its corresponding level 2 parameter; and the "2" indicates that the parameter is to be aggregated based on other level 2 parameters or will use other level 2 parameter info..

Histograms[2]: The numbers indicate the number of levels (i.e., interns) for each parameter. No level 2 run-time QA effects will be included for histograms.

Simple Statistics[3]: The simple statistics: (a) mean, (b) standard deviation, **(c) min. and max.** values, (d) fraction, (e) mean and std. of log. Note that (a), (b), and (e) will be estimated both with and without the inclusion of level 2 run-time QA effects. No L2 run-tire QA will be included for (c) and (d).

L2 QA[4]: The level 2 run-time QA effects will be included in estimating some of the level 3 products.

Dim.(No.)[5]: The "2" indicates that the corresponding parameter is a two dimensional arrary; "3(7)", for example, indicates that the corresponding parameter is a three dimensional **array with length of 7 in the third dimension.**

1. Mean:

① regular mean: $\bar{x} = \frac{1}{n} \Sigma x_i$

where x_i is par. value for the ith pixel.

② mean with level 2 run-time QA:

$$\bar{x}_Q = \frac{\Sigma Q_i \cdot x_i}{\Sigma Q_i}$$

where Q_i is level 2 QA for par. x_i

③ log mean:

$$\bar{x}_{log} = \frac{1}{n} \Sigma \log x_i$$

④ log QA mean:

$$\bar{x}_{log\text{-}Q} = \frac{\Sigma Q_i \cdot \log x_i}{\Sigma Q_i}$$

If Q_i's are the same, then

$$\bar{x} = \bar{x}_Q$$

$$\bar{x}_{log} = \bar{x}_{log\text{-}Q}$$

2. Standard Deviation (or Variance)

① regular variance:

$$X_{var} = \frac{1}{n} \Sigma (x_i - \bar{x})^2$$

② variance with level 2 run-time QA:

$$X_{var\text{-}q} = \frac{\Sigma (Q_i \cdot x_i - Q_i \cdot \bar{x}_q)^2}{\Sigma Q_i^2}$$

③ log variance:

$$X_{var\text{-}log} = \frac{1}{n} \Sigma (\log x_i - \bar{x}_{log})^2$$

④ log QA variance:

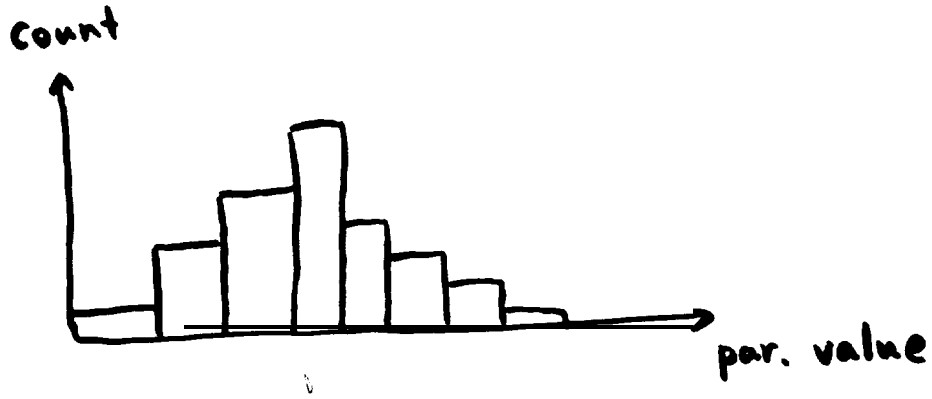
$$X_{var\text{-}log\text{-}q} = \frac{\Sigma (Q_i \cdot \log x_i - Q_i \cdot \bar{x}_{log\text{-}q})^2}{\Sigma Q_i^2}$$

If Q_i's are the same, then

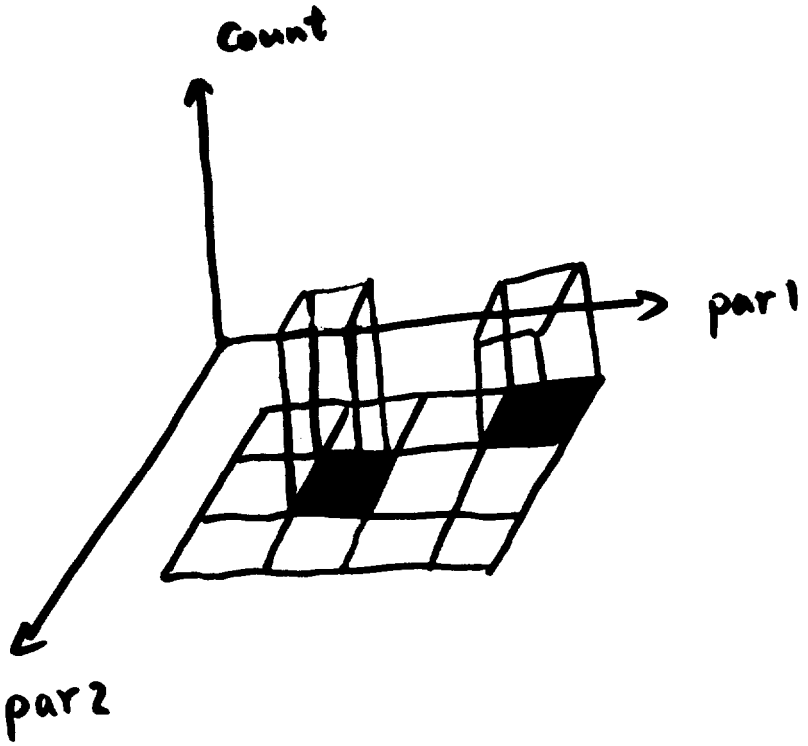
$$X_{var} = X_{var\text{-}q}$$

$$X_{var\text{-}log} = X_{var\text{-}log\text{-}q}$$

3. Histograms:



4. Joint PF



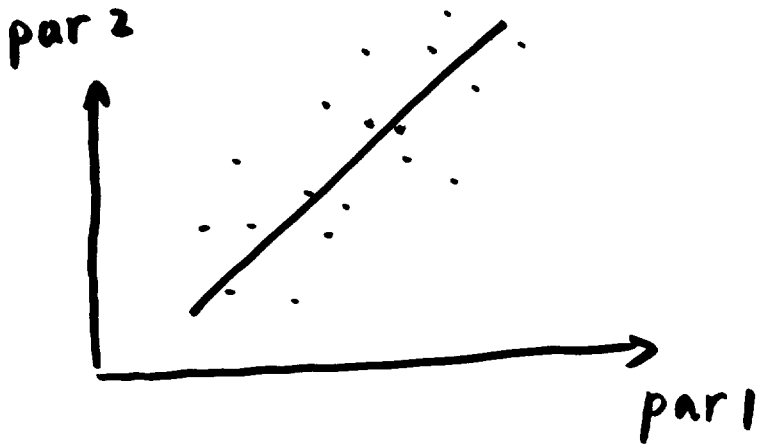
5. Regressions:

① slope

② interception

③ mean-squared-error (MSE)

④ coefficient of determination (R^2)



6. Maximum, minimum, fraction, and total number of pixels.

7. Level 3 QA flags:

- number of marginal pixels
- number of good pixels
- number of very good pixels

Level 3 outputs (21 attributes):

mean, std, max., min., QA_mean, QA_std, log_mean, log_std, log_QA_mean, log_QA_std, fraction, histogram_counts, joint_histograms, slope, interception, MSE, R^2, #_marginal, #_good, #_very_good, and #_total_pixels.

(500 – 900)

Monthly Products:

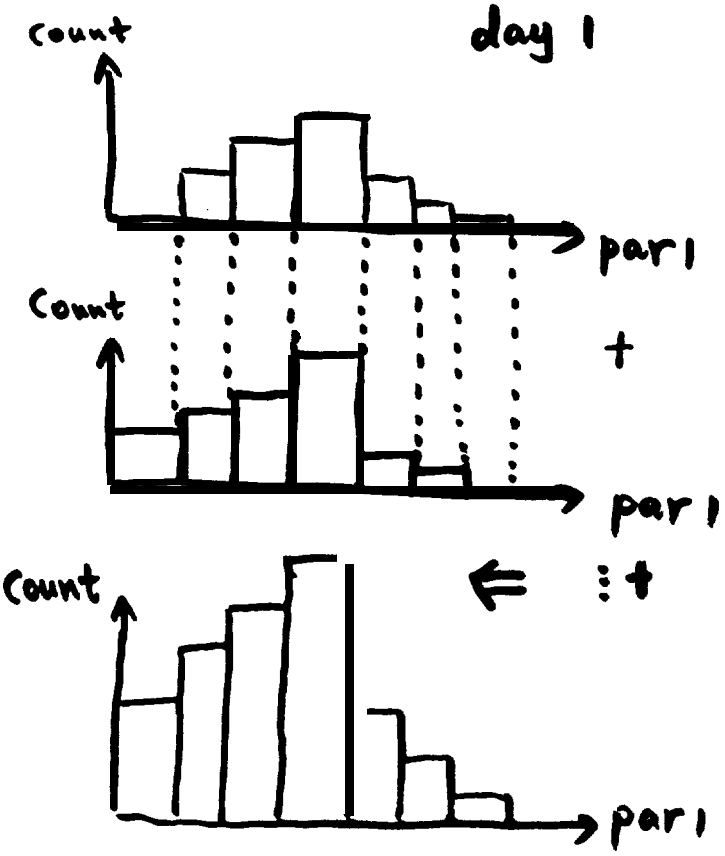
- based on daily products.

Examples:

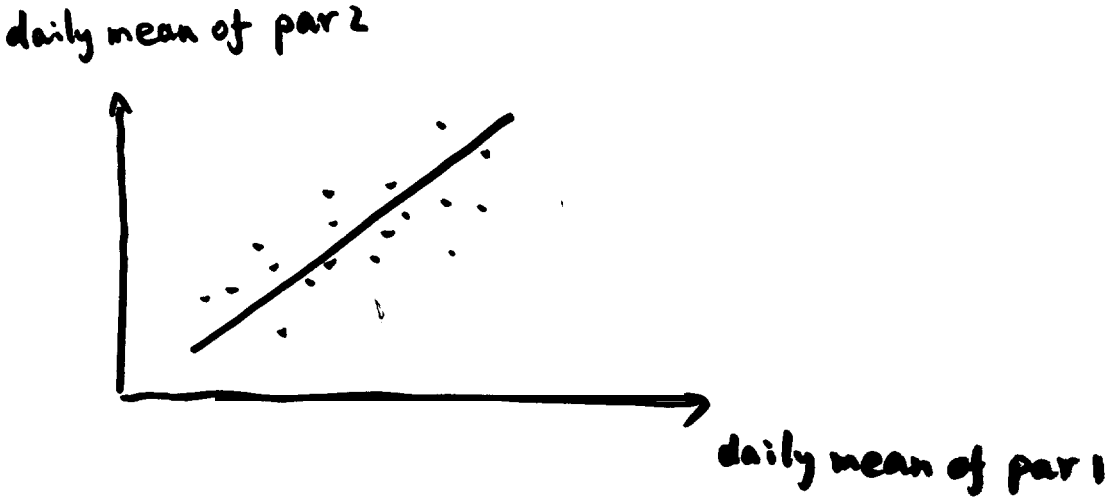
1. mean: $\bar{x}_{mon} = \frac{1}{m} \sum_{day} \bar{x}_{day}$

2. variance: $x_{var\text{-}mon} = \frac{1}{m} \sum_{day} x_{var\text{-}day}$

3. histograms:



4. Regression:



Level 3 Status:

Level 3 Development/Delivery Schedule (from Hucek, March 1997):

Develop L2 product ingest/sort modules	team/Hucek	4/15-5/15/97
Develop L3 processing modules	Liang	4/01-7/01/97
Level 3 file specs ready	team	4/15/97
Develop L3 daily "structure" files	Hucek/Liang	5/01-5/15/97
L3 QA	Liang/Chu	6/01-7/31/97
Develop monthly aggregate code	no assignment yet	6/15-7/31/97

Current status and plan:

Develop L2 product ingest/sort modules	Hucek Pincus (*done*)	4/15-5/15/97
Develop daily L3 processing modules	Liang	4/01-7/01/97
Level 3 file specs ready	Hubanks/Liang/Pincus	5/23/97
Output of L3 daily product	Pincus/Liang/Hubanks	6/01-6/30/97
Develop L3 daily "structure" files	Hucek/SDST	5/01-5/23/97
L3 QA	Liang/Chu	6/01-7/31/97
Develop monthly aggregate code	Liang/Pincus/Hubanks	7/01-7/31/97