CERES Software Bulletin 95-03 - Release 1 Grid

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Purpose:

This bulletin is to announce the CERES grid for release 1 software development.

1. The reference grid is the 1.25 deg equal-area with equal-angle subgrids.
2. MOA and CRH data should be in one of the above grids.
3. The ERBE-like grid for release 1 will be the usual 2.5 deg equal-angle.

Introduction:

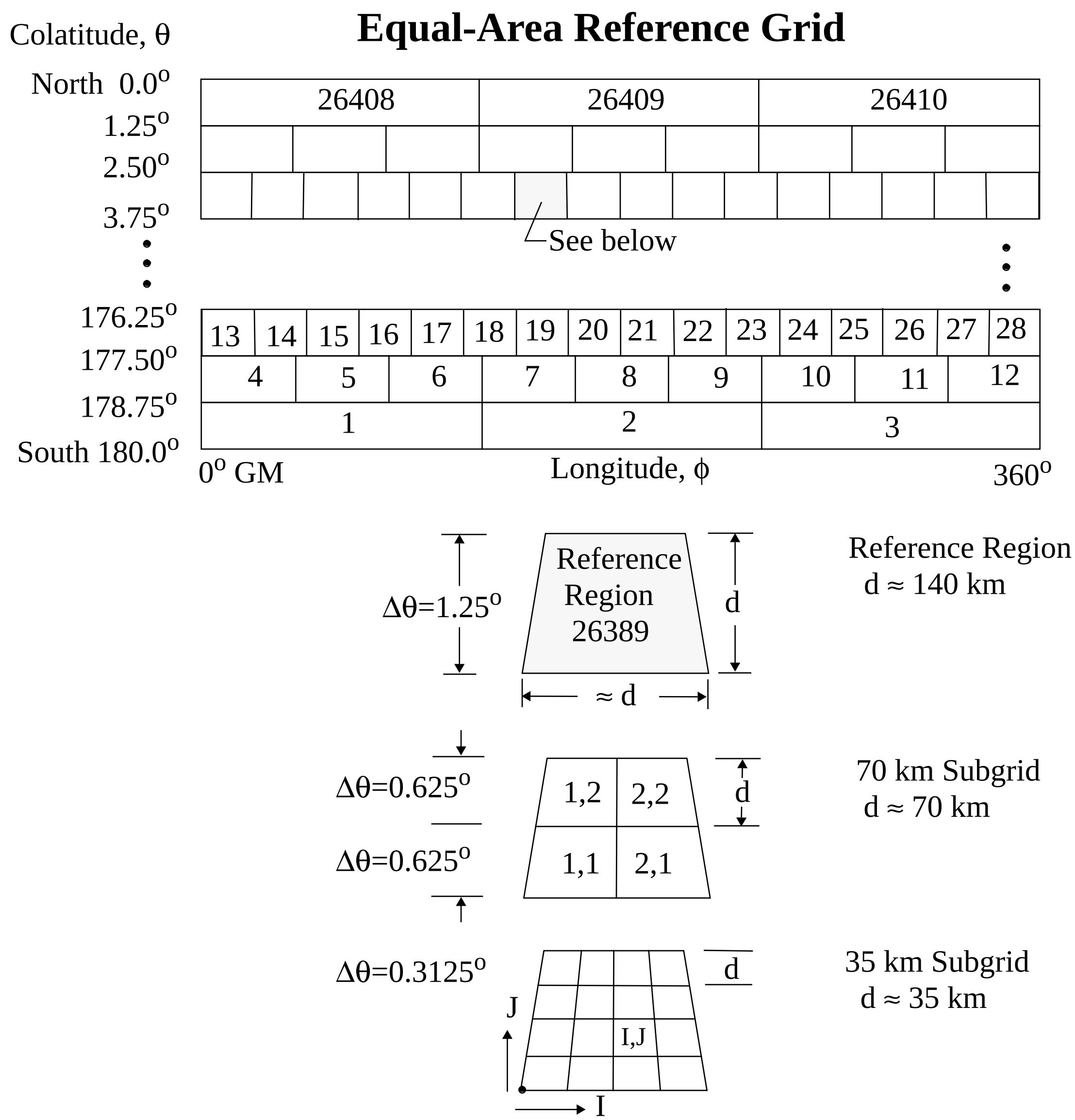
The selection of an EOS Standard Grid is still an open issue. I had hoped that this selection would have been made by now and that we could base our release 1 software on the EOS Grid. However, this has not happened so that we will have to go with the most probable grid. Below is a description of the grid. I would like to emphasize that we all need to follow the grid region count as given in Table 1 and the ordering of regions.

Description of Grid:

The 1.25 deg equal-area Reference Grid is constructed by dividing the latitude into 1.25 deg zones and then dividing each zone into an integer number of longitude increments so that the reference regions have nearly equal area. The reference regions at the equator are defined by 1.25 deg increment in both latitude and longitude. Other zones are divided into an integer number of regions that produce approximately the same area as at the equator. Table 1 gives the number of reference regions in each zone from the South Pole to the equator.

Table 1: Number of Reference Grid Regions in Each Zone

South - 3	10 - 59	19 - 113	28 - 163	37 - 206	46 - 241	55 - 267	64 - 283
2 - 9	11 - 65	20 - 119	29 - 168	38 - 210	47 - 245	56 - 270	65 - 284
3 - 16	12 - 72	21 - 125	30 - 173	39 - 214	48 - 248	57 - 272	66 - 285
4 - 22	13 - 78	22 - 130	31 - 178	40 - 219	49 - 251	58 - 274	67 - 286
5 - 28	14 - 84	23 - 136	32 - 183	41 - 223	50 - 254	59 - 276	68 - 287
6 - 34	15 - 90	24 - 141	33 - 188	42 - 227	51 - 257	60 - 277	69 - 287
7 - 41	16 - 96	25 - 147	34 - 192	43 - 230	52 - 260	61 - 279	70 - 288
8 - 47	17 - 101	26 - 152	35 - 197	44 - 234	53 - 262	62 - 280	71 - 288
9 - 53	18 - 107	27 - 157	36 - 201	45 - 238	54 - 265	63 - 282	Eq. - 288



The Reference Grid is symmetric about the equator and contains a total of 26,410 regions. By convention each reference region contains its southern and western boundary. The one exception is at the North Pole where regions contain both their northern and southern boundaries. We start at the South Pole and divide the colatitude zone from 180 deg to 178.75 deg into 3 regions. The first region is at the South Pole and has the Greenwich Meridian as its western boundary. Successive regions are numbered eastward and northward. This construction preserves the Greenwich Meridian and the Earth Equator as regional boundaries, but does not preserve the International Date Line. Another convention that will be helpful is to define the colatitude and longitude of a region at the “center” of the region.

The subgrid regions are constructed by equal angle divisions in steps of 2. Thus, each subgrid has four times the number of regions of its parent grid. The boundary rules for subgrids are the same as for the reference regions. Table 2 gives some characteristics of the Reference Grid and its 7 subgrids. These grids are defined by increments of longitude and latitude so that a grid region is defined by geocentric angles. The names of these grids, however, are poorly served by its characteristic angle or by its depth such as the 5th subgrid. A characteristic length is much more natural to identify a particular grid. At sea level the 1.25 deg Reference Grid region at the equator is approximately 140 by 140 km. Using this notation, we refer to the first subgrid as the “70 km grid”. The smallest subgrid is a “1 km grid.” These characteristic lengths are a useful notation but have little physical merit. For example, we refer to the Reference Grid as a 140 km grid independent of whether we are expressing data at the top of the atmosphere or at sea level. Another grid characteristic is the area distortion for subgrids which can be expressed as the ratio of the largest subregion area to the smallest subregion area within a reference region. We see that the area ratio increases toward the poles and with subdivisions. For latitude between ±60 deg (87% of the globe), the area distortion is less than 4%.

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Table 2: Characteristics of EOS Grids

Grid	Char. length, km	Char. angle, deg	Number of divisions	Subregions per Ref. region	Total number of regions	Subregion Ratio (largest/smallest)		
						Mid-lat. lat. = 30^o	High-lat. lat. = 60^o	Near Polar lat. = 85^o
Ref.	140	1.25	1	1	26,410	-	-	-
1	70	0.625	2	4	105,640	1.0062	1.0186	1.1172
2	35	0.3125	4	16	422,560	1.0093	1.0280	1.1812
3	17	0.1563	8	64	1,690,240	1.0103	1.0312	1.2034
4	8	0.0781	16	256	6,760,960	1.0108	1.0328	1.2146
5	4	0.0391	32	1024	27,043,840	1.0111	1.0337	1.2214
6	2	0.0195	64	4096	108,175,360	1.0113	1.0344	1.2260
7	1	0.0098	128	16384	432,701,440	1.0115	1.0348	1.2293

It is also important to define a naming convention for any region and to define the ordering of grid regions. The Reference Grid regions are numbered from the South to North Pole and from the Greenwich Meridian eastward. Within any reference region, subregions are denoted by both a latitude index and a longitude index. The subregion (1,1) is in the southwestern corner of the reference region. The subregion to the east is (2,1) and the subregion directly above (1,1) is (1,2). With this scheme grid regions can be labeled by (N,G,I,J) where N is the 140 km Reference Grid regional number from 1 to 26,410, G denotes the characteristic length in km of the subgrid, I is the longitude index from West to East, and J is the latitude index from South to North. An example is (13206,70,1,1) which is the 70 by 70 km subregion with the equator as its southern boundary and the Greenwich Meridian as its western boundary. These labels are not an indexing system, but a regional label that can be used in presentations and documentation.

For data transfer and access it is important to define the ordering of the grid regions. We will use tile ordered. Tile ordering is by 140 km reference regions and by the latitude and longitude indices within the reference region. With tile ordering all subregions within a reference region are grouped together so that the data for a local area is together and easy to access. An example of ordering by tiles for the 70 km Subgrid is as follows: (1,70,1,1) (1,70,2,1) (1,70,1,2) (1,70,2,2) (2,70,1,1) (2,70,2,1) (2,70,1,2) (2,70,2,2) (3,70,1,1) ... (26410,70,2,2).

Ordering of Grid Regions