

## GLA10 Records: Release 33

GLA10 contains the optical inversion results from 532 nm backscatter and extinction cross sections, separated into cloud and aerosol components. It contains top and bottom heights of all the layers that were optically processed. These are the same heights detected by the 532 nm channel that were reported in GLA08 and GLA09. Cloud products such as backscatter, extinction, extinction-to-backscatter ratio (S), and cloud layer tops and bottoms, are reported at a 1 sec sampling rate, while aerosol products are reported at a 4 sec rate only. Polar stratospheric clouds (PSC) are part of the aerosol category.

To obtain the complete vertical optical structure, you should merge the aerosol and cloud components. For every atmospheric layer detected by 532 nm, an extinction-to-backscatter ratio (S) value is calculated or estimated, which reflects the current multiple scattering condition. This calculation is essential to complete the optical inversion. "True S" indicates conditions with no multiple scattering. The Aerosol True S Values flag ("i\_aer4\_sval1") refers to whether the calculated (flag = 2) or estimated (flag = 1) S value was used in the optical inversion process.

The "ground detection" parameter refers to the height where the lidar sensed the ground. If the ground was not sensed, this parameter is set to "invalid." This parameter is useful for determining whether the last layer bottom sensed was a true bottom or if it marks the time when lidar signal was extinguished. All layer locations are referenced from the geoid, and all extinction profiles were corrected for multiple scattering. The multiple scattering correction factor is not stored in GLA10, but rather in GLA11. Each GLA10 record is 4 sec long and contains one group of aerosol products and four groups of cloud products (one for each second). The time stamp refers to the J2000 time of the first shot of the record. J2000 time refers to the number of seconds since 01 January 2000 at 12:00 UTC.

Cloud cross-section data from the 532 nm channel are stored as 1 sec average profiles from 20.4 km (bin 1) to -1 km (bin 280) above the geoid. The 532 nm channel aerosol cross section data are stored as 4 sec average profiles from 41.0 km (bin 1) to -1.0 km (bin 548). Each vertical bin is 76.8 meters thick. The extinction-to-backscatter ratio (S) values are recorded one value per layer. There are up to 10 cloud layers in each cloud profile (obtained from the 1 sec cloud layers detected by GLA09 using the 532 channel) and up to 9 aerosol layers in each aerosol profile (obtained from the 4 sec aerosol layers detected by GLA08 using the 532 channel). Active layers are not necessarily packed toward the front of the array sequence. For aerosols, the top three layer positions are reserved for layers above 20.4 km and the last (ninth) position is reserved for the PBL.

All the backscatter and extinction profiles have an associated composite flag variable that represents conditions in each layer that makes up the profile. The composite flag is made up of two main components: the layer quality flag and layer usage flag. In all cases, the quality flag is a

categorized value of the percent error calculation. For backscatter cross section, the usage flag gives saturation status. For extinction cross section, the usage flag designates layer type category.

See the [GLAS Atmosphere Data Dictionary](#) for details of each record, including units and scaling factors. The GLAS science team created this dictionary. Units and scaling factors with a "d" indicate double-precision constants; for example, a value of "1.0d5" is equivalent to 100,000. The variable "pe/bin" represents photo electrons per bin.

The following codes denote data types throughout the remainder of this document.

i1b: 1-byte integer

i2b: 2-byte (short) integer

i4b: 4-byte (long) integer

r4b: 4-byte real

r8b: 8-byte real

Values in parentheses indicate the record size, for example:

i2b (39): 39 records of 2-byte integers

i1b (48,40): 48-record x 40-record array of 1-byte integers

Nearly all integers are signed. Exceptions are noted in the following record table.

Name	Short Description	Byte Offset	Data Type	Total Bytes
i_rec_ndx	GLAS record index	0	i4b	4
i_UTCTime	Transmit time of first shot in frame in J2000 (referenced from noon on 01 January 2000)	4	i4b (2)	8
i_beam_coelev	Co-elevation	12	i4b (4)	16
i_beam_azimuth	Azimuth	28	i4b (4)	16
i_pad_angle	PAD angle	44	i4b (4)	16
i_spare0	Spares	60	i1b (40)	40
i_AttFlg1	Attitude flag	100	i2b (4)	8
i_lat	Profile location, latitude	108	i4b (4)	16
i_lon	Profile location, longitude	124	i4b (4)	16
i_OrbFlg	Orbit flag	140	i1b (2,4)	8
i_surfType	Region type	148	i1b (4)	4
i_LidarQF	Lidar frame quality flag	152	i2b (4)	8

Name	Short Description	Byte Offset	Data Type	Total Bytes
i_cld1_bs_prof	Cloud backscatter cross section profile	160	i4b (280,4)	4480
i_cld1_ext_prof	Cloud extinction cross-section profile	4640	i4b (280,4)	4480
i_aer4_bs_prof	Aerosol backscatter cross-section profile	9120	i4b (548)	2192
i_aer4_ext_prof	Aerosol extinction cross-section profile	11312	i4b (548)	2192
i_cld1_sval1	Cloud true S values from table	13504	i2b (10,4)	80
i_cld1_sval2	Cloud true S values from equation calculation	13584	i2b (10,4)	80
i_aer4_sval1	Aerosol true S values from table	13664	i2b (9)	18
i_aer4_sval2	Aerosol true S values from equation calculation	13682	i2b (9)	18
i_cld1_bot	Medium-resolution cloud bottom	13700	i2b (10,4)	80
i_cld1_top	Medium-resolution cloud top	13780	i2b (10,4)	80
i_cld1_grd_det	Medium-resolution ground detection	13860	i2b (4)	8
i_aer4_bot	Low-resolution aerosol layer bottom	13868	i2b (9)	18
i_aer4_top	Low-resolution aerosol layer top	13886	i2b (9)	18
i_pbl4_grd_det	Low-resolution aerosol layer ground detection	13904	i2b	2
i_spare2	Spares	13906	i1b	2
i_cld1_sval_uf	Cloud true S values use flag	13908	i1b (20)	20
i_aer4_sval_uf	Aerosol true S values use flag	13928	i1b (5)	5
i_spare3	Spares	13933	i1b (3)	3
i_cld1_bs_flag	Cloud backscatter flag	13936	i1b (40)	40
i_cld1_ext_flag	Cloud extinction flag	13976	i1b (40)	40
i_aer4_bs_flag	Aerosol backscatter flag	14016	i1b (10)	10
i_aer4_ext_flag	Aerosol extinction flag	14026	i1b (10)	10
i_spare4	Spares	14036	i1b	1
i_AttFlg3	Attitude flag 3	14037	i1b	1
i_timecorflg	Time correction flag	14038	i2b	2
i_SolarAngle	Solar angle	14040	i4b (4)	16

Name	Short Description	Byte Offset	Data Type	Total Bytes
i_MRg_cldtop_temp	Medium resolution 532 nm cloud top temperature	14056	i2b (10, 4)	80
i_MRg_cldtop_pres	Medium resolution 532 nm cloud top pressure	14136	i2b (10, 4)	80
i_MRg_cldtop_relh	Medium resolution 532 nm cloud top relative humidity	14216	i2b (10, 4)	80
i_MRg_cldbot_temp	Medium resolution 532 nm cloud bottom temperature	14296	i2b (10, 4)	80
i_MRg_cldbot_pres	Medium resolution 532 nm cloud bottom pressure	14376	i2b (10, 4)	80
i_MRg_cldbot_relh	Medium resolution 532 nm cloud bottom relative humidity	14456	i2b (10, 4)	80
i_Aer_top_temp	Aerosol layers temperature at top of layer at 532 nm	14536	i2b (9)	18
i_Aer_top_pres	Aerosol layers pressure at top of layer at 532 nm	14554	i2b (9)	18
i_Aer_top_relh	Aerosol layers relative humidity at top of layer at 532 nm	14572	i2b (9)	18
i_Aer_bot_temp	Aerosol layers temperature at bottom of layer at 532 nm	14590	i2b (9)	18
i_Aer_bot_pres	Aerosol layers pressure at bottom of layer at 532 nm	14608	i2b (9)	18
i_Aer_bot_relh	Aerosol layers relative humidity at bottom of layer at 532 nm	14626	i2b (9)	18
i_Surface_temp	Surface temperature	14644	i2b (4)	8
i_Surface_pres	Surface pressure	14652	i2b (4)	8
i_Surface_relh	Surface relative humidity	14660	i2b (4)	8
i_Surface_wind	Surface wind speed	14668	i2b (4)	8
i_Surface_wdir	Surface wind direction azimuth from north	14676	i2b (4)	8
i_aod_boht_4s	Cloud free troposphere height	14684	i2b	2
i_spare5	Spares	14686	i1b (290)	290

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