

GLA11 Records: Release 33

GLA11 contains the layer-by-layer optical results of the GLAS 532 nm atmospheric vertical profiles, i.e., the optical depth and multiple scattering factor separated into cloud and aerosol components. Polar stratospheric clouds are part of the aerosol category. To obtain the total column optical depth, you should add the aerosol and cloud components. For every atmospheric layer detected by 532 nm, a multiple scattering flag reflects the current multiple scattering condition.

GLA11 contains top and bottom heights of all the layers that were optically processed, separated into cloud and aerosol. All cloud products, including optical depth, multiple scattering factor, and layer tops and bottoms, are reported at a 1 sec sampling rate. These are the same layers as reported in GLA09. The aerosol products, output to GLA08, are reported at a 4 sec sampling rate.

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 the 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 stored in GLA11. Each GLA11 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.

The 532 nm cloud layer data are stored as 1 sec average values, and the 532 nm aerosol layer data are stored as 4 sec average values. The optical depth and multiple scattering factor values are recorded once per layer. There are up to 10 cloud layers in each cloud profile and up to nine aerosol layers in each aerosol profile; however, for the optical depth product, the nine layers are separated into eight elevated and one PBL height. Active layers are not necessarily grouped toward the front of the array sequence. For aerosols, the top three layer positions are reserved for layers above 20 km.

Optical depths for each layer have an associated composite flag variable that represents conditions in that layer. The composite flag is made up of two main components: a layer quality flag and a layer usage flag. In all cases, the quality flag is a categorized value of the percent error calculation. The usage flag designates layer type category. The "cloud multiple scattering warning flag" is a measure of multiple scattering intensity and is based on the total column optical depth. One value is calculated for each 1 sec profile.

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 are used to 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
i_cld1_od	Cloud optical depth	160	i2b (10,4)	80
i_aer4_od	Aerosol optical depth	240	i2b (8)	16

Name	Short Description	Byte Offset	Data Type	Total Bytes
i_pbl4_od	PBL optical depth	256	i2b	2
i_aer4_msf	Aerosol multiple scattering factor	258	i2b (9)	18
i_cld1_msf	Cloud multiple scattering factor	276	i2b (10,4)	80
i_cld1_bot	Medium resolution cloud bottom	356	i2b (10,4)	80
i_cld1_top	Medium resolution cloud top	436	i2b (10,4)	80
i_cld1_grd_det	Medium resolution ground detection	516	i2b (4)	8
i_aer4_bot	Low-resolution aerosol layer bottom	524	i2b (8)	16
i_aer4_top	Low-resolution aerosol layer top	540	i2b (8)	16
i_aer4_ht	Low-resolution PBL height	556	i2b	2
i_aer4_grd_det	Low-resolution ground detection	558	i2b	2
i_erd	Estimated range delay	560	i2b (4)	8
i_pse	Particle size estimate	568	i2b (4)	8
i_cld1_mswf	Cloud multiple scattering warning flag	576	i1b (2)	2
i_cld1_flag	Cloud optical depth flag	578	i1b (40)	40
i_aer4_flag	Aerosol optical depth flag	618	i1b (8)	8
i_pbl4_flag	PBL optical depth flag	626	i1b	1
i_AttFlg3	Attitude flag 3	627	i1b	1
i_timecorflg	Time correction flag	628	i2b	2
i_rdu	Range delay uncertainty	630	i2b (4)	8
i_spare2	Spares	638	i1b (2)	2
i_SolarAngle	Solar angle	640	i4b (4)	16
i_MRg_cldtop_temp	Medium resolution 532 nm cloud top temperature	656	i2b (10, 4)	80
i_MRg_cldtop_pres	Medium resolution 532 nm cloud top pressure	736	i2b (10, 4)	80
i_MRg_cldtop_relh	Medium resolution 532 nm cloud top relative humidity	816	i2b (10, 4)	80
i_MRg_cldbot_temp	Medium resolution 532 nm cloud bottom temperature	896	i2b (10, 4)	80
i_MRg_cldbot_pres	Medium resolution 532 nm cloud bottom pressure	976	i2b (10, 4)	80

Name	Short Description	Byte Offset	Data Type	Total Bytes
i_MRg_cldbot_relh	Medium resolution 532 nm cloud bottom relative humidity	1056	i2b (10, 4)	80
i_Aer_top_temp	Aerosol layers temperature at top of layer at 532 nm	1136	i2b (9)	18
i_Aer_top_pres	Aerosol layers pressure at top of layer at 532 nm	1154	i2b (9)	18
i_Aer_top_relh	Aerosol layers relative humidity at top of layer at 532 nm	1172	i2b (9)	18
i_Aer_bot_temp	Aerosol layers temperature at bottom of layer at 532 nm	1190	i2b (9)	18
i_Aer_bot_pres	Aerosol layers pressure at bottom of layer at 532 nm	1208	i2b (9)	18
i_Aer_bot_relh	Aerosol layers relative humidity at bottom of layer at 532 nm	1226	i2b (9)	18
i_Aer_ir_top	Elevation of top of aerosol layers detected in 1064 nm	1244	i2b (2)	4
i_Aer_ir_bot	Elevation of bottom of aerosol layers detected in 1064 nm	1248	i2b (2)	4
i_Aer_ir_top_temp	Temperature of top of aerosol layers detected in 1064 nm	1252	i2b (2)	4
i_Aer_ir_top_pres	Pressure of top of aerosol layers detected in 1064 nm	1256	i2b (2)	4
i_Aer_ir_top_relh	Relative Humidity of top of aerosol layers detected in 1064 nm	1260	i2b (2)	4
i_Aer_ir_bot_temp	Temperature of bottom of aerosol layers detected in 1064 nm	1264	i2b (2)	4
i_Aer_ir_bot_pres	Pressure of bottom of aerosol layers detected in 1064 nm	1268	i2b (2)	4
i_Aer_ir_bot_relh	Relative humidity of bottom of aerosol layers detected in 1064 nm	1272	i2b (2)	4
i_MRir_cld_top	Elevation of top of cloud layers detected in 1064 nm at medium resolution	1276	i2b (10, 4)	80
i_MRir_cld_bot	Elevation of bottom of cloud layers detected in 1064 nm at medium resolution	1356	i2b (10, 4)	80
i_MRir_cldtop_temp	Temperature of top of cloud layers detected in 1064 nm at medium resolution	1436	i2b (10, 4)	80

Name	Short Description	Byte Offset	Data Type	Total Bytes
i_MRir_cldtop_pres	Pressure of top of cloud layers detected in 1064 nm at medium resolution	1516	i2b (10, 4)	80
i_MRir_cldtop_relh	Relative humidity of top of cloud layers in 1064 nm at medium resolution	1596	i2b (10, 4)	80
i_MRir_cldbot_temp	Temperature of bottom of cloud layers detected in 1064 nm at medium resolution	1676	i2b (10, 4)	80
i_MRir_cldbot_pres	Pressure of bottom of cloud layers detected in 1064 nm at medium resolution	1756	i2b (10, 4)	80
i_MRir_cldbot_relh	Relative humidity of bottom of cloud layers detected in 1064 nm at medium resolution	1836	i2b (10, 4)	80
i_MRir_QAflag	Medium resolution 1064 nm cloud layer QA flag	1916	i1b (40)	40
i_Aer_PBL_LR_temp	Temperature of low resolution planetary boundary layer top at 532 nm	1956	i2b	2
i_Aer_PBL_LR_pres	Pressure of low resolution planetary boundary layer top at 532 nm	1958	i2b	2
i_Aer_PBL_LR_relh	Relative humidity of low resolution planetary boundary layer top at 532 nm	1960	i2b	2
i_Surface_temp	Surface temperature	1962	i2b (4)	8
i_Surface_pres	Surface pressure	1970	i2b (4)	8
i_Surface_relh	Surface relative humidity	1978	i2b (4)	8
i_Surface_wind	Surface wind speed	1986	i2b (4)	8
i_Surface_wdir	Surface wind direction azimuth from north	1994	i2b (4)	8
i_Aer_ir_OD	Aerosol optical depth at 1064 nm	2002	i2b (2)	4
i_cld_ir_OD	Cloud optical depth at 1064 nm	2006	i2b (10, 4)	80
i_spare6	Spare 6	2086	i1b (202)	202
i_reflect_1064od_40hz_cor	40 Hz 1064 nm total column optical depth	2288	i2b (40,4)	320

Name	Short Description	Byte Offset	Data Type	Total Bytes
i_reflct_1064msf_40hz	40 Hz 1064 nm multiple scattering correction factor	2608	i1b (160)	160
i_reflct_1064od_1hz_cor	1 Hz 1064 nm total column optical depth	2768	i2b (4)	8
i_reflct_1064msf_1hz	1 Hz 1064 nm multiple scattering correction factor	2776	i1b (4)	4
i_reflct_pristine_1hz	1064 nm modeled surface reflectance	2780	i2b (4)	8
i_aod_4s	Total column Aerosol Optical Depth (AOD)	2788	i2b	2
i_aod_flg_4s	AOD use flag	2790	i1b	1
i_spare3	Spares	2791	i1b	1
i_bs_erd	Blowing snow range delay	2792	i2b (4)	8
i_bs_conf	Blowing snow confidence	2800	i1b (4)	4
i_aer4_sval1	Aerosol true S Values from table	2804	i2b (9)	18
i_aer4_sval_ratio	532/1064 aerosol S ratio	2822	i2b (9)	18
i_aer4_aod_ratio	532/1064 aerosol optical depth ratio	2840	i2b (9)	18
i_aer4_sval_uf	Aerosol true S Values use flag	2858	i1b (5)	5
i_spare5	Spare 5	2863	i1b	1
i_reflCor_atm	Reflectivity Correction Factor For Atmospheric Effects	2864	i2b (4)	8
i_spare4	Spares	2872	i1b (160)	160

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