This document briefly describes the 32 new diagnostics that were added in COSPv2.1 concerning the lidar simulator (June 2018). They can be separated in 3 groups.

I – « GOCCP-OPAQ » diagnostics for the CALIPSO simulator (16 variables)

The first group of new diagnostics corresponds to GOCCP v3 observations (OPAQ product [*Guzman et al.* 2017, *Vaillant de Guelis et al*. 2017a]), which allows to separate clouds in 2 types :

- Opaque clouds (visible optical depth > 3~5), which drive to the first order both SW and LW radiation at the Top Of Atmosphere (TOA)
- Thin clouds (visible optical depth < 3~5)

16 new CALIPSO simulator diagnostics in COSPv2.1 correspond to the GOCCP-OPAQ product :

variable name	*variable description*	*dimensions*
clopaquecalipso	CALIPSO Opaque Cloud Cover	(lon, lat)
clthincalipso	CALIPSO Thin Cloud Cover	(lon, lat)
clzopaquecalipso	CALIPSO z_opaque Altitude	(lon, lat)
clcalipsoopaque	CALIPSO Opaque Cloud Fraction	(lon, lat, alt)
clcalipsothin	CALIPSO Thin Cloud Fraction	(lon, lat, alt)
clcalipsozopaque	CALIPSO z_opaque Fraction	(lon, lat, alt)
clcalipsoopacity	CALIPSO opacity Fraction	(lon, lat, alt)
clopaquetemp	CALIPSO Opaque Cloud Temperature	(lon, lat)
clthintemp	CALIPSO Thin Cloud Temperature	(lon, lat)
clzopaquetemp	CALIPSO z_opaque Temperature	(lon, lat)
clopaquemeanz	CALIPSO Opaque Cloud Altitude	(lon, lat)
clthinmeanz	CALIPSO Thin Cloud Altitude	(lon, lat)
clthinemis	CALIPSO Thin Cloud Emissivity	(lon, lat)
clopaquemeanzse	CALIPSO Opaque Cloud Altitude with respect to SE	(lon, lat)
clthinmeanzse	CALIPSO Thin Cloud Altitude with respect to SE	(lon, lat)
clzopaquecalipsose	CALIPSO z_opaque Altitude with respect to SE	(lon, lat)

where SE = Surface Elevation.

II – « GROUND LIDAR » simulator (8 variables)

The second group of new diagnostics corresponds to ground-based lidar observations [*Chiriaco et al.* 2018].

8 variables from the new GROUND LIDAR simulator in COSPv2.1 correspond to these observations :

variable name	*variable description*	*dimensions*
lidarBetaMol532gr	GROUND LIDAR Molecular Backscatter (532 nm)	(lon, lat, alt)
atb532gr	GROUND LIDAR Total Backscatter (532 nm)	(lon, lat, col, alt)
cfadLidarsr532gr	GROUND LIDAR Scattering Ratio CFAD	(lon, lat, alt, SRbin)
clgroundlidar	GROUND LIDAR Cloud Fraction	(lon, lat, alt)
clhgroundlidar	GROUND LIDAR High Level Cloud Cover	(lon, lat)
cllgroundlidar	GROUND LIDAR Low Level Cloud Cover	(lon, lat)
clmgroundlidar	GROUND LIDAR Mid Level Cloud Cover	(lon, lat)
cltgroundlidar	GROUND LIDAR Total Cloud Cover	(lon, lat)

III – « ATLID LIDAR » simulator (8 variables)

The third group of new diagnostics corresponds to future ATLID lidar observations [*Reverdy et al.* 2015] onboard the EarthCare satellite to be launched in 2019.

8 variables from the new ATLID lidar simulator in COSPv2.1 correspond to these future observations :

variable name	*variable description*	*dimensions*
LidarBetaMol355	ATLID LIDAR Molecular Backscatter (355 nm)	(lon, lat, alt)
atb355	ATLID LIDAR Total Backscatter (355 nm)	(lon, lat, col, alt)
cfadLidarsr355	ATLID LIDAR Scattering Ratio CFAD	(lon, lat, alt, SRbin)
clatlid	ATLID LIDAR Cloud Fraction	(lon, lat, alt)
clhatlid	ATLID LIDAR High Level Cloud Cover	(lon, lat)
cllatlid	ATLID LIDAR Low Level Cloud Cover	(lon, lat)
clmatlid	ATLID LIDAR Mid Level Cloud Cover	(lon, lat)
cltatlid	ATLID LIDAR Total Cloud Cover	(lon, lat)

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