Variable	Unit	Description
f_T	Hz	transmitter signal carrier frequency, with elements $f_{\mathrm{T}k}$ (for GPS transmitters $k \in \{1, 2\}$ denoting the L-band frequencies $f_{\mathrm{T}1} = 1.57542\,\mathrm{GHz}$ and $f_{\mathrm{T}2} = 1.22760\,\mathrm{GHz}$).
f_s	Hz	measurement sampling frequency (also called sampling rate); 50 Hz is generally used for the input excess phase profiles.
f_c	Hz	Blackman windowed sinc (BWS) low-pass filter cutoff frequency; set to 2.5 Hz (but noise-dependent for the $f_{\mathrm{T}(1)2}$ filtering for ionospheric correction, with $f_{\mathrm{c}(1)2} \in \{2.5, 2, 10/7, 1, 5/7, 0.5\,\mathrm{Hz}\}$).
t	s	time grid of the measurements at sampling rate f_s, with elements t_i, $i \in \{1, 2, \ldots N\}$, where N is the number of grid points of the RO profile.
a_t	m	impact parameter grid corresponding to time grid t.
z_a	m	common monotonic impact altitude grid, calculated from sorted impact parameters $a_{t,i}$ of the leading channel ($f_{\mathrm{T}1}$) bending angle, via $z_{\mathrm{a},i} = a_{t,i} - h_\mathrm{G} - R_\mathrm{C}$. Used as standard vertical grid after interpolation of all dependent quantities to z_a.
z_t	m	MSL altitude grid corresponding to time grid t, obtained as part of the forward modeling towards α_m, D_m, and L_m (cf. Table 1).
z_aTop	m	impact altitude of the top of the RO profile; it can lie between 70 and 80 km.
z_aBot	m	impact altitude of the bottom of the RO profile; it can lie between 25 km and the Earth's surface. Its value can be different for the different GNSS frequencies (i.e., $z_{\mathrm{aBot},k}$, for $k \in \{1, 2\}$).
z_a^GW	m	impact altitude at the center of the sinusoidal transition range of half-width $\Delta z_\mathrm{a}^\mathrm{GW}$ between the GO and WO bending angle profiles; z_a^GW can lie within 9 and 14 km, depending on GO bending angle data quality.
$\Delta z_\mathrm{a}^\mathrm{GW}$	m	impact altitude transition half-width of the half-sine-weighted transition between the GO and WO bending angle profile. Set to 2 km.
z_aGradr	m	impact altitude at the lower end of the excess phase uncertainty estimation range used in this study, below which the estimated random uncertainties are extended by a linear gradient. Set to 30 km.
z_aGrads	m	impact altitude at the lower end of the range with constant excess phase systematic uncertainty used in this study, below which the estimated systematic uncertainties continue with a linear gradient. Set to 8 km.