Extending the time series data to higher and lower altitudes

The time series data are sampled in the altitude range between 105 and 225 km. Above and below these altitudes there is no turbulence and the only disturbances are due to the underlying 2D gravity wave (GW). If data are required above 225 km or below 105 km, they can be reconstructed from the GW solution:

$$u(x,z,t) = \sqrt{\frac{\bar{\rho}_r}{\bar{\rho}}} A_u(t) \exp[-d(t)(z-z_r)] \cos(kx + m(t)z + \phi_u(t)) \quad (1)$$

$$w(x,z,t) = \sqrt{\frac{\bar{\rho}_r}{\bar{\rho}}} A_w(t) \exp[-d(t)(z-z_r)] \cos(kx + m(t)z + \phi_w(t)) \quad (2)$$

$$\theta(x,z,t) = \sqrt{\frac{\bar{\rho}_r}{\bar{\rho}}} \left(\frac{\bar{\theta}}{\bar{\theta}_r}\right) A_\theta(t) \exp[-d(t)(z-z_r)] \cos(kx + m(t)z + \phi_\theta(t)) \quad (3)$$

$$p(x,z,t) = \sqrt{\frac{\bar{\rho}}{\bar{\rho}_r}} A_p(t) \exp[-d(t)(z-z_r)] \cos(kx + m(t)z + \phi_p(t)) \quad (4)$$

where the subscript r denotes a reference altitude, the overbar indicates the background state, and where the exponential factor accounts for viscous attenuation. The wavenumbers are defined as $k = 2\pi/\lambda_x$ and $m = 2\pi/\lambda_z$. By construction λ_x is constant in space and time during the course of the simulation. λ_z can vary due to transient and refraction effects. The amplitude factors, damping rates, vertical wavenumber, and phase angles have pronounced time dependences above the upper boundary due to the evolution of the GW breaking below. Time histories of these parameters can be downloaded by following the "wave properties for extrapolating above and below the sampled domain" link. The reference altitude for extrapolating above the top of the sampled domain is 225 km. The wave parameters near the lower boundary vary much less in time as compared with those near the upper boundary, but this time dependence should still be taken into account when extending the data. Time histories for the wave parameters at the lower boundary are also contained in the "wave properties for extrapolating above and below the sampled domain" link. The reference altitude for extrapolating below the bottom of the sampled domain is 105 km.