

AE4E08 Homework exercise, lecture 6

Make plots of the different mapping functions for the troposphere dry and wet delays (page 173 Misra and Enge) as function of the elevation angle el (ranging from 0 – 90°)

Mapping functions:

- $m(el) = \frac{1}{\sin el}$
- $m(el) = \frac{1}{\sqrt{1 - (\cos el / 1.001)^2}}$
- $m_d(el) = \frac{1}{\sin el + \frac{0.00143}{\tan el + 0.0445}}; m_w(el) = \frac{1}{\sin el + \frac{0.00035}{\tan el + 0.017}}$
- $m_i(el) = \frac{1 + \frac{a_i}{b_i}}{1 + \frac{a_i}{\sin el + \frac{b_i}{\sin el + c_i}}}$ with $i = d$ or w

For the constants use:

$$a_d = [1.232 + 0.0139 \cos \varphi - 0.0209h + 0.00215(T - 10)] \times 10^{-3}$$

$$b_d = [3.1612 - 0.16 \cos \varphi - 0.0331h + 0.00206(T - 10)] \times 10^{-3}$$

$$c_d = [71.244 - 4.293 \cos \varphi - 0.149h - 0.0021(T - 10)] \times 10^{-3}$$

$$a_w = [0.583 - 0.011 \cos \varphi - 0.052h + 0.0014(T - 10)] \times 10^{-3}$$

$$b_w = [1.402 - 0.102 \cos \varphi - 0.101h + 0.0020(T - 10)] \times 10^{-3}$$

$$c_w = [45.85 - 1.91 \cos \varphi - 1.29h + 0.015(T - 10)] \times 10^{-3}$$

Where φ is the latitude (choose 0°, 45° and 90°), and h is the height of the user in km (use 0), and T is the surface temperature in °C.

Compare all mapping functions and try to explain why they should be different the way they are.

Also, make a plot of the obliquity factor for the ionosphere (page 164), and compare it with the simplest mapping function for the troposphere, $1/\sin(el)$.