Geophysical Research Abstracts
Vol. 12, EGU2010-7274, 2010
EGU General Assembly 2010

Analysis of zenith tropospheric delay in tropical latitudes

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The paper studies some peculiarities of the nature of zenith tropospheric delay in tropical latitudes. There are shown the values of dry and wet components of zenith tropospheric delay obtained by an integration of the radiosonde data at 9 stations: Guam, Seyshelles, Singapore, Pago Pago, Hilo, Koror, San Cristobal, San Juan and Belem.

There were made 350 atmospheric models for the period from 11^{th} to 20^{th} of January, April, July and October 2008 at 0^h and 12^h UT (Universal Time). The quantities of the dry d_d(aer) and wet d_w(aer) components of zenith tropospheric delay were determined by means of the integration for each atmospheric model. Then the quantities of the dry d_d(SA), d_d(HO) and wet d_w(SA), d_w(HO) components of zenith tropospheric delay (Saastamoinen and Hopfield analytical models) were calculated by the surface values of the pressure P_0, temperature t_0, relative air humidity U_0 on the height H_0 and by the geographic latitude φ.

It must be point out the following from the analysis of the averaged quantities and differences δd_d(SA), δd_d(HO), δd_w(SA), δd_w(HO) between the correspondent components of zenith tropospheric delay obtained by the radiosonde data and by the analytical models:

- zenith tropospheric delay obtained by the radiosonde data amounts to considerably larger value in the equatorial zone, especially, at the expense of the wet component, in contrast to high and middle latitudes. Thus, the dry component of zenith tropospheric delay is equal at the average 2290 mm and the wet component is 290 mm;
- by the results of the analysis of Saastamoinen and Hopfield models the dry component differences δd_d(SA) and δd_d(HO) are negative in all cases and average -20 mm. It is not typical neither for high latitudes nor for middle ones;
- the differences between the values of the wet components obtained from radiosonde data and of Saastamoinen and Hopfield models are positive in general. Therewith the δd_w(HO) values are larger than the correspondent δd_w(SA) ones on $20 \div 30$ mm. This is because of that the tropospheric height, founded in the determination of the wet component by Hopfield model, does not correspond the mean real tropospheric height which is typical for the tropical latitudes;
- there are the considerable differences in the average values of zenith tropospheric delay between the stations of the equatorial zone. By the radiosonde data they can amount to 100 and more millimeters. These differences are caused by different character of the air humidity distribution along a height. Thus, for example, in the lower half of the troposphere the mean partial pressure of the water vapour is about $2 \div 2,5$ times larger at Singapore station than at Hilo one.

The recommendations concerning the modification of Saastamoinen and Hopfield models for the zone of tropical latitudes are given in conclusion of the paper.