Geophysical Research Abstracts
Vol. 21, EGU2019-4698-1, 2019
EGU General Assembly 2019

GNSS Climatology: Origin of Atmospheric Delay Gradients in Japan

Kosuke Heki (1), Ryota Sato (1), and Seiichi Shimada (2)

(1) Dept. Earth Planet. Sci., Hokkaido University, Sapporo, Japan, (2) Dept. Env. Systems, Univ. of Tokyo, Tokyo, Japan

Azimuthal asymmetry of atmospheric delay, coming from hydrostatic delay (dry air) and wet delay (water vapor), makes atmospheric delay gradients (MacMillan, 1995). Those gradients, unless properly treated, may cause GNSS positioning errors of up to a few centimeters, and its spatial and temporal changes help us study dynamics of tropospheric water vapor. We studied average atmospheric delay gradients in winter (January) and summer (July) at ∼1300 continuous GNSS stations in Japan with time resolution of 4 hours using the GAMIT software. Gradients at the coastal stations in summer are dominated by changes in atmospheric water vapor and are made of diurnal landward components and stationary southward components. Those in winter, on the other hand, showed stationary southward components throughout the day. Diurnal landward gradients in summer show maximum in daytime (∼0.5 mm). They correlate well with the strength of sea breeze (2-4 m/s) and would originate from the landward thickening of the atmospheric boundary layer due to landward winds and topographic slopes. We also found those at inland stations often show strong diurnal changes in gradient. They may come from mountain-valley breeze, but their pattern is not so clear as coastal stations. Surface pressure distribution and spatial changes in zenith total delays suggest that the stationary southward components in winter (∼0.26 mm) come ∼70 % from hydrostatic delay and ∼30 % from wet delay. This reverses for stationary southward components in summer (∼0.30 mm), i.e. they come ∼30 % from hydrostatic delay and ∼70 % from wet delay.