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Assessment of the accuracy of the VMF1 mapping functions versus locally built mapping functions from raw Radiosonde data

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The propagation delays induced by the neutral atmosphere are prominent error sources in GNSS, VLBI and deep space Doppler tracking data acquisition. They are modeled through the so-called mapping functions, whose queen is the VMF1 mapping function, which incorporates numerical weather models (NWM) from the ECMWF database. ECMWF gathers worldwide meteorology observations from ground, atmosphere (radiosondes) and space sensors, then combine them in a standardized global grid (typically with a ground resolution of 200 km and a time separation of 6h). Radiosonde measurements are the data of choice to build mapping functions, as they are the only ones that provide in situ observations along the atmospheric column. As VMF1 is based on a gridded data with a medium range resolution both in time and space, some local inaccuracies may occur. In this work, we did a comparison between home-brewed mapping functions (with a continuous fraction expansion similar with the one used by VMF1) build from on-site radiosonde measurements fed on a ray-tracing tool, with respect to the corresponding VMF1 mapping functions. The radiosonde sites are the ones maintained in Wuhan city (Hubei province of China, continental climate) and in Tahiti Island (French Polynesia, tropical climate). We give the statistical analysis of a comparison carried over two years. Some large discrepancies are showing up, mostly related to local storms. We also tried to look for near-to-noise error sources, probably linked to how the mapping functions are constructed.