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Computation of troposphere slant delays on a GPU

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The atmospheric excess path delay is a major contributor to the error budget of space geodetic positioning applications and should therefore be reduced to the maximum possible extent. Numerical weather models are undergoing improvements with regard to their spatial resolution, which enables compensation of troposphere propagation errors by applying corrections obtained from ray-tracing through four-dimensional meteorologic fields. Computation of ray-traced troposphere delays which can be utilized for space geodetic applications is a time-consuming effort when a large number of rays has to be calculated. Whereas computation time can be tremendously reduced when algorithms are capable to support parallel processing architectures. Thus, by the usage of an off-the-shelf Graphics Processing Unit (GPU) it is demonstrated that troposphere slant delays can be computed very efficiently, without loss of accuracy. An adopted ray-tracing algorithm is presented and results from GPU computations are compared with those obtained from calculations on a standard PC's central processing unit (CPU). Moreover, it will be shown how the accelerated computation method helps to establish a ray-tracing service, which allows to correct user's data on the observation level.