Generation of real-time global ionospheric map based on the global GNSS stations with only a sparse distribution

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The Earth's ionosphere is part of the atmosphere stretching from an altitude of about 50 km to more than 1000 km. When the Global Navigation Satellite System (GNSS) signal emitted from a satellite travels through the ionosphere before reaches a receiver on or near the Earth surface, the GNSS signal is significantly delayed by the ionosphere and this delay bas been considered as one of the major errors in the GNSS measurement. The real-time global ionospheric map calculated from the real-time data obtained by global stations is an essential method for mitigating the ionospheric delay for real-time positioning. The generation of an accurate global ionospheric map generally depends on the global stations with dense distribution; however, the number of global stations that can produce the real-time data is very limited at present, which results that the generation of global ionospheric map with a high accuracy is very different when only using the current stations with real-time data. In view of this, a new approach is proposed for calculating the real-time global ionospheric map only based on the current stations with real-time data. This new approach is developed on the basis of the post-processing and the one-day predicted global ionospheric map from our research group. The performance of the proposed approach is tested by the current global stations with the real-time data and the test results are also compared with the IGS-released final global ionospheric map products.