Deformation Monitoring and Analysis Using Regional GPS Permanent Tracking Station Networks

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SUMMARY

Natural disasters are of a problem of global concern and may cause significant human, economic, social and environmental losses and sometimes, threaten geopolitical stability. Natural hazards that have disastrous impacts on us include earthquakes, landslides, floods, storm surges, severe winds, bushfires, and tsunamis. Natural hazards are estimated at an average annual cost of $1.25 billion in Australia and about 15% of the most remarkable natural hazards in the world occurred in the last century in China. The availability of precise and reliable deformation information is critical for the monitoring and analysis of the earth's surface displacement, the movement of faults, landslide and some other deformations. In addition, proper site selection of important structures and their protection against hazards and the ability to analyse and predict natural and non-natural hazards are of great importance in geosciences.

GPS has been recognized as a vital technology for deformation monitoring due to its high-precision, 24 hours availability, operability under all weather conditions and automation. This paper will investigate the feasibility using continuously operating reference stations (CORS) in Victoria (termed GPSnet) for deformation monitoring and analysis. A number of critical issues associated with the suitability, geological stability, data quality of the GPS networks system, the precision and stability of the GPSnet solution are investigated using geological information. Methodologies for GPS data processing and deformation analysis are investigated. The precision and stability of the GPSnet solution are analysed and discussed using the raw observation data, GPS precise data processing software and statitic analysis method. The absolute and relative displacement of selected GPSnet stations are analysed using chronological GPS data and dedicated high precision scientific GPS data processing software packages. Detailed data-processing strategies and results of deformation analyses are presented. It is concluded that high-precision continuous tracking data from GPSnet is a very valuable asset and can provide a technically-advanced and cost-effective geoscientific infrastructure for deformation monitoring analysis.