

A New Reference Frame for Oman, Derived by Precise Processing of the CORS Network

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Key words: Engineering survey; GIM; GNSS/GPS; Positioning; Reference frames; Reference frame; GNSS; CORS

SUMMARY

National Survey Authority (NSA) of Oman established a GNSS network of 46 CORS sites (OMANCORSNET) in 2016. The collected data up to the end of 2022 were used to realize a new reference frame for the Sultanate of Oman. Oman National Geodetic Datum 2023 (ONGD23), derived from OMANCORSNET, is the first reference frame of the country that is based on long-term data.

A continuous data set with the time span of more than 6 years is a perfect database to calculate a new frame that includes velocities in addition to positions of the reference sites. Moreover, the resulting velocities can be implemented in various scientific research projects.

The 30-seconds data of 46 OMANCORSNET and 28 IGS stations were precisely processed. Positions, time series and velocities were obtained in ITRF20. Positions were calculated for epoch 2023.0. "Oman block" was defined by the well-behaved OMANCORSNET sites. A new reference frame was achieved by the application of rotations and rotation rates to ITRF20, so that the velocity of Oman block is minimized. The new reference frame ONGD23 is realized, with positions and sub-millimeter per year velocities of the stations of Oman block.

Velocity field depicts negligible temporal variations of positions within years, surveyors do not need to care about variations of positions in time intervals of a few years.

Precise positioning in ONGD23, similar to every regional frame, is the proper method to study regional deformations. Rigid motion of Oman block is absorbed in the reference frame, while residual velocity field presents the internal deformation

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field.

ONGD23 reveals slow-rate vertical deformations along the northern coast line, as well as central Oman. The former is likely a consequence of Arabia - Eurasia collision, while the latter effect is expected to be the result of oil and gas field operations. Densification of this network in central Oman will enable us to study the effect of oil and gas exploitation.

Results of this project can be applied in multiple scientific investigations, in particular in studying kinematics of the Arabia plate. Oman is located on the oceanic side of the Makran subduction zone. Convergence rate of Arabia and Eurasia plates with spatial variations along the Oman northern coast line can be precisely quantified. In a combination with GNSS networks in Saudi Arabia and east Africa, the divergence of Nubia and Arabia plates across Red Sea can also be precisely monitored.

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