

# DrukRef21 – Defining the Reference Frame of Bhutan in a Deforming Region

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## SUMMARY

Bhutan was one of the first countries in Asia implementing a new geocentric national reference frame based on the modern space-geodetic techniques, namely GNSS (Global Navigation Satellite Systems). DrukRef03 was implemented by observing five points of the classical 0-Order network in campaign mode that was linked to ITRF2000 at the epoch 2003.87.

In the earlier twenty-tens, a network of six Permanent GNSS Reference Stations (PRS) was installed covering the south and central part of Bhutan. This network, DrukNet, was aligned with DrukRef03 through dedicated observation campaigns of the classical network.

Bhutan is located in the deforming region of the tectonic plate boundary between the Indian and Eurasian tectonic plates. The continuous tectonic processes created by the collision of the Indian plate against the Eurasian plate has formed the Himalayan Mountain range that continues to be built up presently. Such internal deformations have been accurately estimated using the PRS observations and are reaching 0.6 cm/yr between the south and central part of Bhutan. This implies an internal deformation of the DrukRef03 reference frame of more than 10 cm since its creation.

Additionally, the use of a network of PRS stations to materialize permanently the national frame is more accurate than its definition using episodic stations. The recent densification of the DrukNet with three more stations also require the estimation of coordinates to these stations with respect to the national reference frame.

Therefore, it was decided to implement a new reference frame, called DrukRef21, that is continuously materialized by the PRS. Although DrukRef21 is a static datum, i.e., with coordinates referred to the reference epoch (2021.8), a velocity field covering Bhutan has been also estimated

that will mitigate the internal deformations caused by the tectonic processes and permit that DrukRef21 will be used for a long period.

In this presentation, we detail the creation of DrukRef21 and its associated velocity field and we evaluate its implementation by presenting some examples demonstrating its usage.

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