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Modernised transformation between the old Dutch national CRS and ETRS89

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Abstract:

There are two ways to modernise a national projected (or state plane) coordinate reference system. The first option is to introduce a new coordinate reference system (CRS). A new, homogeneous national CRS allows straightforward transformation to and from a regional or global CRS. However, the transition to a new national CRS or working with multiple CRSs is complex for many end users of geo-information and professionals from other fields that do surveying or their own GIS data collection, like civil engineering, archaeology, biology, and national statistics.

The second option is to modernise the transformation procedure between the existing national CRS and a homogeneous GNSS-based regional or global CRS. Some national CRSs lack a precise transformation in the EPSG geodetic parameter dataset. This complicates CRS use, as most software only support transformations included in the EPSG dataset. The problem of including the transformation of a national CRS in EPSG is often not the complexity of the CRS. The transformation of any old CRS can be modernised if the distortions in the CRS are spatially correlated and smooth, and if enough data points are available to estimate a distortion correction model and the datum transformation. Furthermore, the scale of the national CRS should be close to 1 and the used map projection must be commonly supported by software.

For example, the over a century old national CRS of the Netherlands was redefined as a transformation of ETRS89 in 2000. This transformation was implemented exactly by the surveying community but not by the GIS community, resulting in inconsistencies of up to 0.25 metre. During a user consultation project between 2014 and 2018, switching to ETRS89 or an ETRS89-based projection was considered. However, the projections for ETRS89 recommended by INSPIRE were found unsuitable as a single national projection. Furthermore, to enable users to migrate their data to a new national CRS, a precise transformation from the existing national CRS to ETRS89 is needed in GIS software. Therefore, the official transformation procedure to ETRS89 was redesigned instead of introducing a new CRS. This new definition of the national CRS is now included in EPSG (IOGP, 2025) and supported by GIS software. It gives within 0.01 metre the same results as the previous official transformation (Lesparre et al., 2022).

With this modernised transformation, users of the surveying and GIS communities can transform between the national CRS and ETRS89 without losing accuracy. As a result, there is no current demand for a new national CRS and no need for a costly and long transition to a new national CRS. The existing national CRS effectively functions as a projection of ETRS89.

This case demonstrates that modernising a national projected CRS does not necessarily require introducing a new CRS.

References

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