Status and Development of EVRF2007

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Outline

I. Status of EVRF2007
II. Extension of the CRS-EU Information System
III. Future Development of EVRF2007
IV. Request to the EUREF Community
I. Status of EVRF2007

Reference Tide Gauges of National Height Systems in Europe

Kind of Heights of National Height Systems in Europe
The classical approach (continental/levelling) \( W_p = W_0 - c_p \) (levelling)
from an adjustment of a levelling network
(only on continents)

**EVRF2007**
- 27 European countries
- 7939 nodal points
- 10347 measurements
- \( s_0 \) (1km): 1.11 kgal·mm
- geopotential numbers, normal heights
- Zero tidal system

**Datum of EVRF2007**
- 13 points have been used fitting to the level of EVRF2000 by

\[ H_n = \frac{c_p}{\gamma} \]
Transformation parameter from national European height reference systems to EVRF2007 in cm
II. Extension of the CRS-EU Information System

- CRS information system is a common project of EUREF / BKG / EuroGeographics, start in 2000
- address www.crs-geo.eu
- information
  - were provided from the National Mapping Agencies (NMA)
  - or prepared / compiled by BKG and agreed with NMA’s
  - always unified and prepared regarding ISO-Standard 19111
- 2010 update of the part for vertical coordinate reference systems: inclusion of EVRF2007
- 2010 extension by offering online transformation for heights
- Information system for European Coordinate Reference Systems

This Information and Service System for European Coordinate Reference Systems was established to support the users of spatial information in Europe.

It is a common project of:

- Bundesamt für Kartographie und Geodäsie (Federal Agency for Cartography and Geodesy), Germany
- EuroGeographics as the central-hub for Europe’s Geographic Information (GI) developments - a unique and diverse network working of all concerned with European GI, National Mapping and Cadastral Agencies (NMCAs), the European Commission and others
- EUREF (European Reference Frame) as Sub-Commission of IAG’s (International Association of Geodesy) Commission X on Global and Regional Geodetic Networks with the main task to established and maintenance of the European Reference Frames

May 2011

Status and Development of EVRF2007
Objectives

- Description of European Coordinate Reference Systems according to ISO
  - national
  - pan-European (ETRS89, EVRF2007)
- Providing of transformation parameters from national systems to pan-European systems
  - position: 7 parameter, NTv2
  - height: 3 parameter
  - quality of transformation (RMS, residual deviation)
  - verification data
- Online Transformation (single points)
News in CRS-EU since 2010

- description of pan-European CRS
  - EVRF2007
e.g. EVRF2007_AMST / NH as PDF
  - transformation parameters from national CRS of height to EVRF2007 for 26 countries
e.g. DE_AMST / NH to EVRF2007 as PDF
  - nevertheless, transformation parameters to EVRF2000 are furthermore contained
  - description of national CRS (height) were added for 7 countries

- possibility of online-transformation of single points for heights
**Online transformation**

### DE_AMST / NH to EVRF2007

<table>
<thead>
<tr>
<th>Source</th>
<th>national height</th>
</tr>
</thead>
<tbody>
<tr>
<td>DE_AMST / NH [m]</td>
<td>102.34</td>
</tr>
<tr>
<td>(DHHN92 EPSG code: 5783)</td>
<td></td>
</tr>
</tbody>
</table>

### ETRS89 position of point

| Latitude [DMS] | 50° 12' 1.8" |
| Longitude [DMS] | 12° 34' 12.2" |

Longitude *wrt* Greenwich and positive to East

### Target

| EVRF2007 [m] | 102.361 |
| RMS of transf. [m] | 0.002 |

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Although we strive for the highest quality of data and data products, we cannot make any warranty for the correctness and for damage from the application of this service. Any liabilities is excluded by the operator of the websites.
in April 2010 TWG sent letters to NMAs with
  – calculated transformation parameters to EVRF2007
  – draft of description of national vertical reference system in
    the case of implementation of a new CRS in the respective
    country
  – ask for verifying the data, supplement missing data and
    details
  – ask for agreement to publish the information in CRS-EU
27 countries were contacted, about half of them replied
<table>
<thead>
<tr>
<th>Country</th>
<th>CRS-Description</th>
<th>CRS-Description (new)</th>
<th>Transformation to EVRF2000</th>
<th>Transformation to EVRF2007</th>
</tr>
</thead>
<tbody>
<tr>
<td>Austria</td>
<td>released</td>
<td>released</td>
<td>released</td>
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<td>Russia</td>
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<td>EVRF2000 not available</td>
<td>EVRF2007 not available</td>
<td>EVRFxx will be available future</td>
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<td>EVRFxx will be available future</td>
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<td>Ukraine</td>
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</tbody>
</table>
### III. Future Development of EVRF2007

<table>
<thead>
<tr>
<th>Country</th>
<th>Year</th>
<th>Status</th>
<th>Data available at EVRS data center</th>
<th>Problems, missing data ...</th>
</tr>
</thead>
<tbody>
<tr>
<td>France</td>
<td>2008</td>
<td>information about zero-order leveling network NIREF</td>
<td>no</td>
<td>tilt between IGN69 and NIREF, N-S bias in IGN69 suspected (23 cm), old border connections</td>
</tr>
<tr>
<td>Spain</td>
<td>2009</td>
<td>new leveling network was observed 2001-2008</td>
<td>only point data</td>
<td>no measurements available</td>
</tr>
<tr>
<td>Russia</td>
<td>2009</td>
<td>European part of 1. O. leveling network provided</td>
<td>yes</td>
<td>border connections incomplete (esp. to Finland)</td>
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<tr>
<td>Ukraine</td>
<td>2009</td>
<td>data preparation in progress</td>
<td>no</td>
<td></td>
</tr>
<tr>
<td>Belarus</td>
<td>2011</td>
<td>data preparation finished</td>
<td>no</td>
<td>border connections have to be found</td>
</tr>
<tr>
<td>Latvia</td>
<td>2011</td>
<td>reobservation of 1. O. leveling network will be finished in summer 2011</td>
<td>no</td>
<td>try for border connection to Belarus</td>
</tr>
<tr>
<td>Germany</td>
<td>2006-2012</td>
<td>reobservation of German 1.O. leveling network</td>
<td>partial</td>
<td></td>
</tr>
</tbody>
</table>

28.10.2011
**EVRF2007**

- 27 European countries
- 7939 nodal points
- 10347 measurements
- $s_0$ (1km): 1.11 kgal·mm
- geopotential numbers, normal heights

**Datum of EVRF2007**

- Several datum points distributed over the stable part of Europe
- 13 points have been used fitting to the level of EVRF2000 by

**condition equation:**

$$\sum_{i=1}^{13} (c_{\text{EVRS2000}} - c_{\text{EVRS2007}}) = 0$$
Future development of EVRF

EVRF2007 is adopted as height reference for pan European geo reference data (INSPIRE)

28.10.2011

Status and Development of EVRF2007
1. Order Leveling Network of Russia

- **Parameter of the network**
  - 109 nodal points
  - 155 observations
  - $a$-posteriori-$s_0$ (1 km): 2.03 mm
  - Problem: no uniform epoch (measurements from 1967 – 2006)

- **Border connections mainly from the 70\textsuperscript{th} to**
  - Estonia (2, 1 already useable, 1 under preparation in Estonia)
  - Latvia (1, useable)
  - Belarus (2 under preparation)
  - Lithuania (2 to Kaliningrad Region, useable)
  - Poland (2 to Kaliningrad Region, useable)
  - possibly some connections can be updated by measurements from new epochs (Poland, Lithuania)
Closing the “Baltic Ring”

- Border connections to Finland
  - 8 connections have been observed between 1989 and 2006
  - 3 connections already useable
  - Finland was asked to provide data to close the remaining connections

- Previously adjustment of the “Baltic Ring”
  - 13 datum points as in EVRF2007
  - zero tide, uplift model NKG2000LU
  - a-posteriori $s_0 = 1.15 \text{ kgal} \cdot \text{mm}$
  - $s_0$ (RU) = 2.23 kgal·mm (variance component estimation)

- Height of point Kronstadt
  - Russian system: $H=0.000 \text{ m}$
  - EVRF2007: 0.231 m (0.197 m in mean tidal system)
UELN - expected new data

- **Spain**
  - new network was observed between 2001 and 2008
  - up to now only point information (136 nodal points) available at UELN data center, measurements are still missing

- **Ukraine**
  - decided to participate in UELN project
  - data preparation is in progress (computation of geopotential differences)
  - asked UELN data and computation center to find border connections to neighboring countries
  - some connections were already found in the UELN data base
  - neighboring countries were contacted and agreed to provide the missing data
Latvia contacted EVRS data center in May 2011
- reobservation of 1. order leveling network since 2000
- finishing of the measurements middle of 2011
- plan to include the new data in the EVRF
IV. Request to the EUREF Community

- No country did explicitly oppose the publishing, but many of them did simply not answer
- Request to the countries that have not released the information about their vertical CRS yet (red highlighted in the table):
  - please
    - verify the information
    - send an e-mail to martina.sacher@bkg.bund.de with
      - supplements or corrections
      - agreement for publishing the data in the CRS information system
- All other countries are invited to participate in the EVRS development