Federal Agency for
Cartography and Geodesy

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

Height System Unification

The classical approach (continental/levelling)

$W_p = W_0 - c_p$ *(levelling)*

from an adjustment of a levelling network

(only on continents)

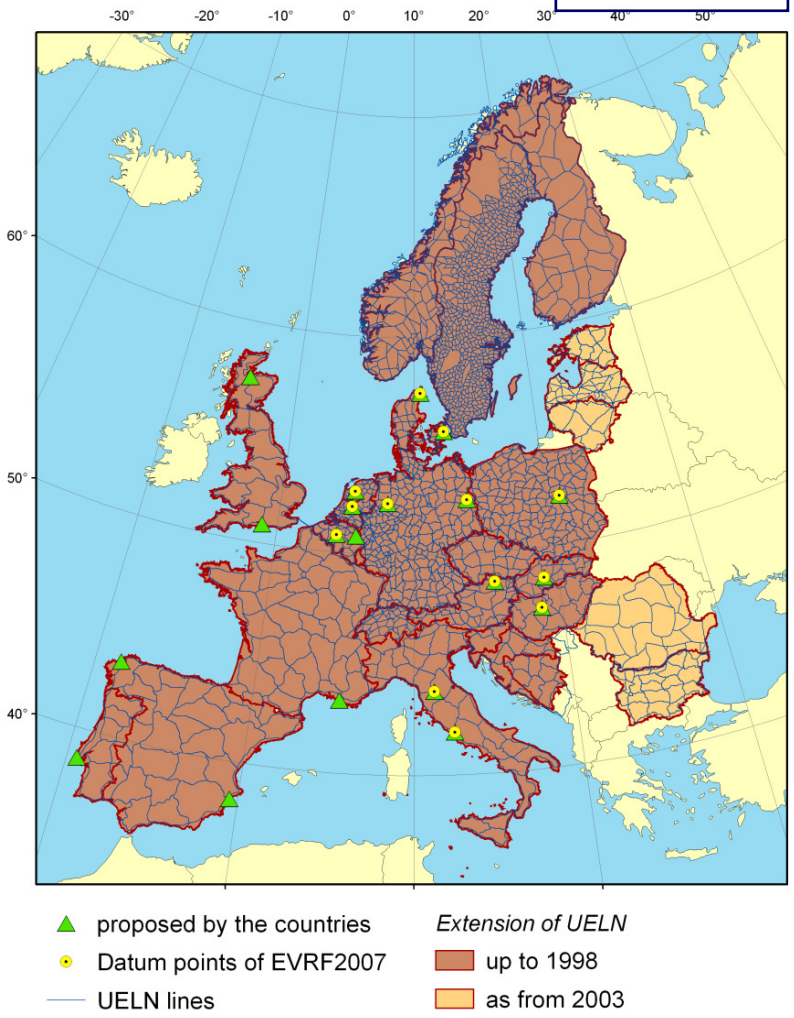
$$H_n = \frac{c_P}{\bar{\gamma}}$$

EVRF2007

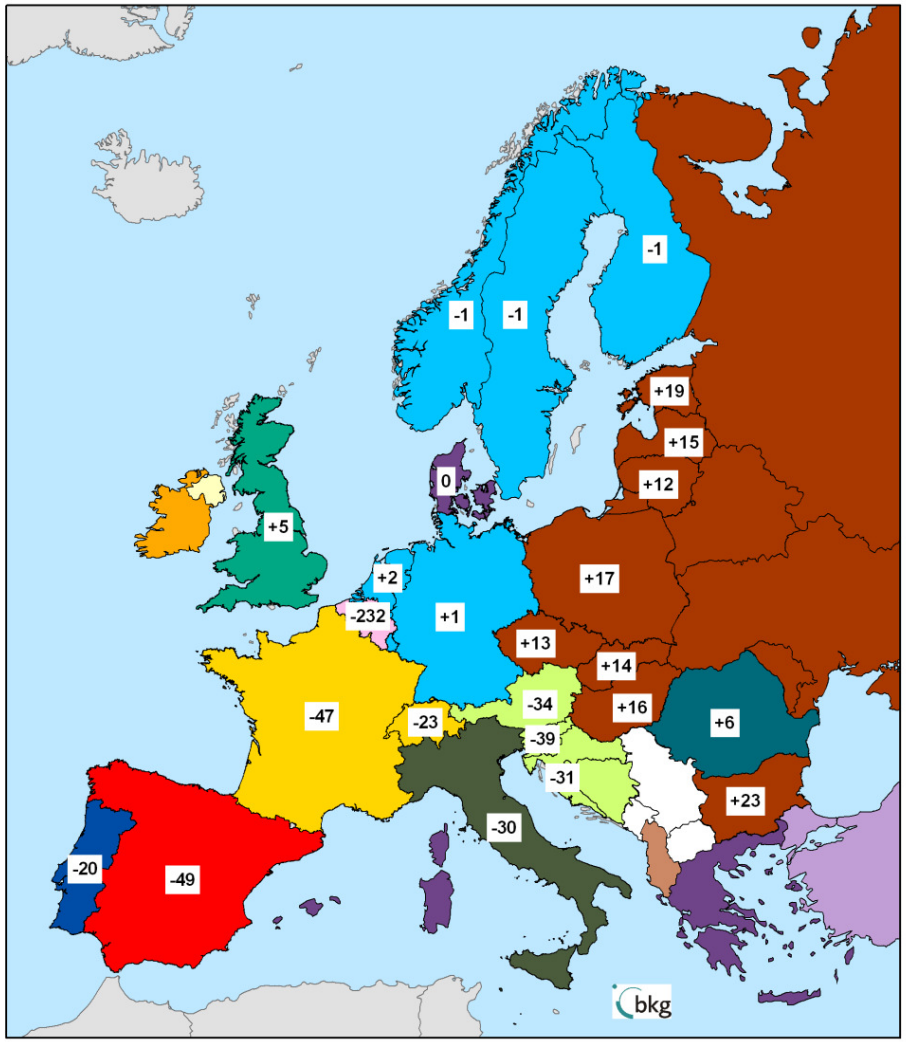
- **27 European countries**
- **7939 nodal points**
- **10347 measurements**
- **s0 (1km): 1.11 kgal·mm**
- **geopotential numbers, normal heights**
- **Zero tidal system**

Datum of EVRF2007

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



Transformation parameter from national European height reference systems to EVRF2007 in cm



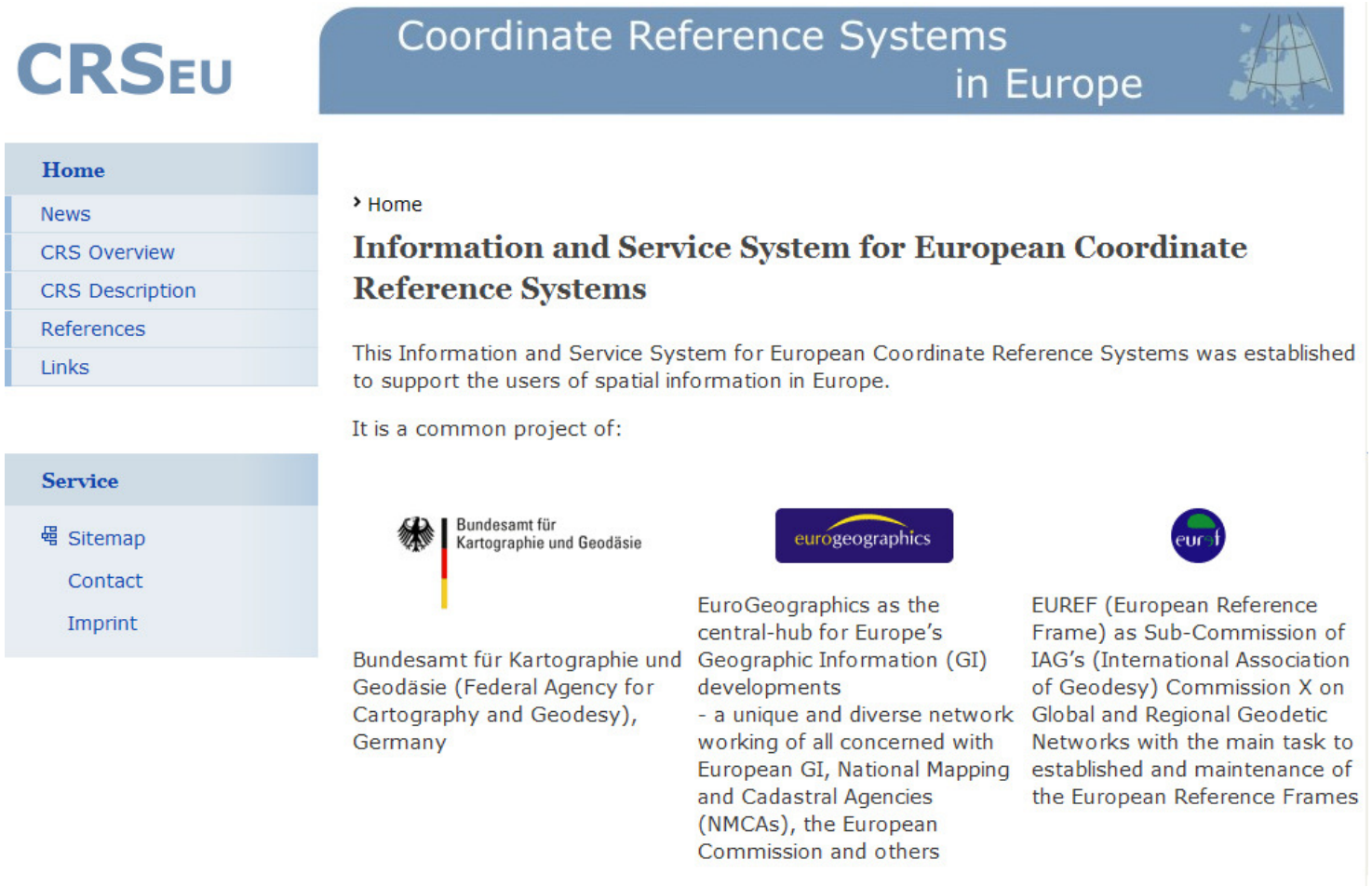
Bezugspegel

- Alicante
- Amsterdam
- Antalya
- Belfast
- Cascais
- Constanta
- Durres
- Genova
- Kronstadt
- Malin Head
- Marseille
- Newlyn
- Ostend
- Trieste
- other
- no information

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

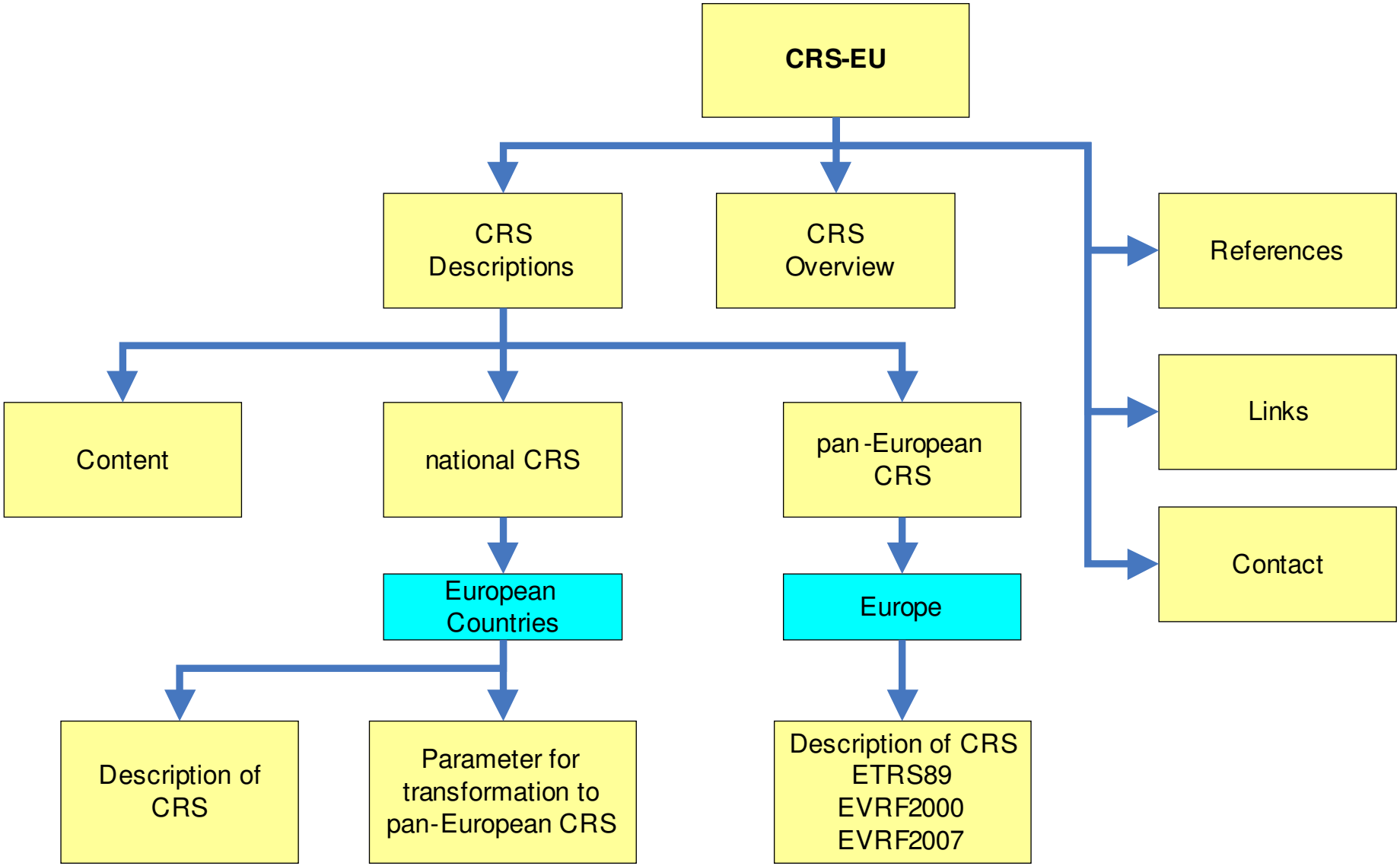
- Information system for European Coordinate Reference Systems



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
  - heigth: 3 parameter
  - quality of transformation (RMS, residual deviation)
  - verification data
- Online Transformation (single points)

CRS-EU Structure



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

CRS-EU Online-transformation Heights

Online transformation

DE_AMST / NH to EVRF2007

Source
national height

DE_AMST / NH [m] (DHHN92 EPSG code: 5783)	102.34		

ETRS89 position of point

Latitude [DMS]	50	12	1.8
Longitude [DMS]	12	34	12.2

Longitude wrt Greenwich and positive to East

Target
pan-European height

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

Compute

Publishing of new information

- 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

Status of the information in CRS-EU (height)

Country	CRS-Description	CRS-Description (new)	Transformation to EVRF2000	Transformation to EVRF2007
Austria	released		released	existing
Belgium	released		released	released
Bosnia / Hercegovina	existing		existing	existing
Bulgaria	released		released	released
Switzerland	released		released	released
Czech Republic	released		released	released
Germany	released		released	released
Denmark	released		released	existing
Estonia	released		released	released
Spain	released		released	existing
Finland	released	existing	released	existing
France	released		released	existing
Great Britain	released		released	existing
Croatia	released	released	released	released
Hungary	released		released	existing
Italy	released		released	released
Lithuania	released		released	released
Latvia	released		released	released
Netherlands	released	existing	released	existing
Norway	released	existing	released	existing
Poland	existing	existing	existing	existing
Portugal	released		released	existing
Romania	released		released	released
Russia	existing		*EVRF2000 not available*	*EVRFxx will be available future*
Sweden	released	released	released	released
Slovenia			released	existing
Slovak Republic	released	released	released	released
Turkey	released		*EVRF2000 not available*	*EVRF2007 not available*
Ukraine	existing		*EVRF2000 not available*	*EVRFxx will be available future*

III. Future Development of EVRF2007

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

EVRF2007

EVRF2007

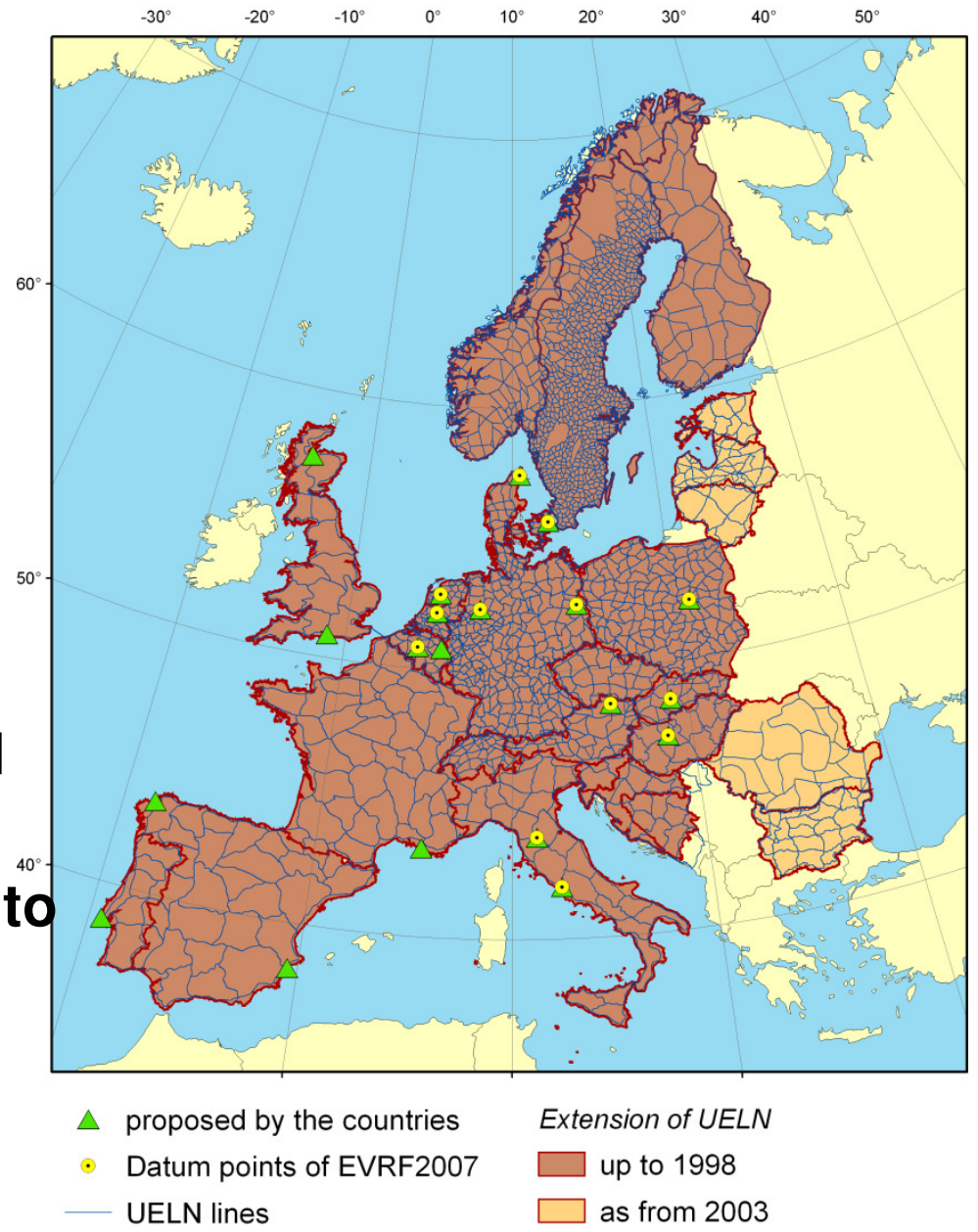
- 27 European countries
- 7939 nodal points
- 10347 measurements
- s_0 (1km): 1.11 kgal·mm
- geopotential numbers, normal heights

Datum of EVRF2007

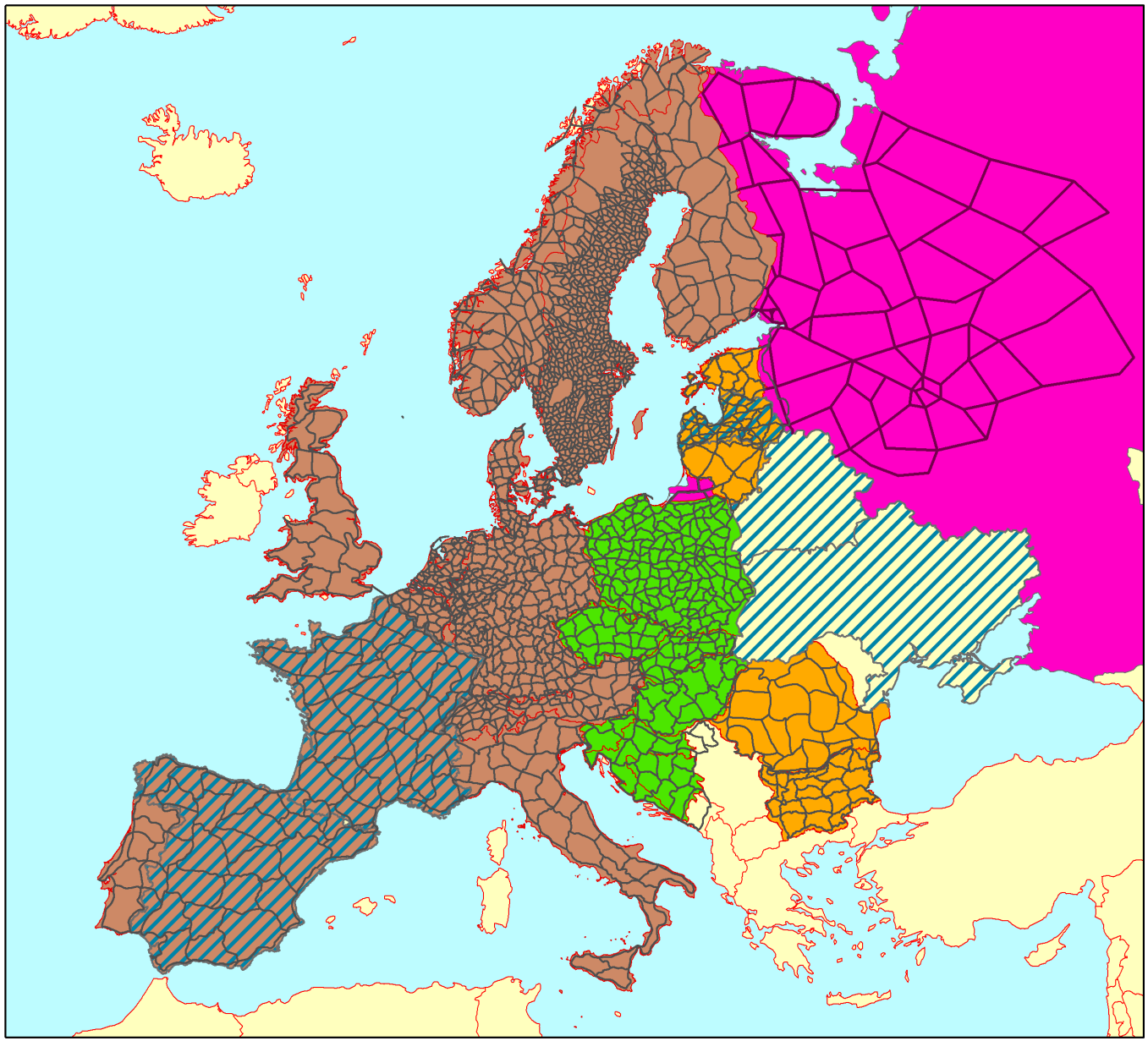
- Several datum points distributed over the stable part of Europe
- 13 points have been used fitting to the level of EVRF2000 by

condition equation:

$$\sum_{i=1}^{13} (c_{EVRS2000} - c_{EVRS2007}) = 0$$



Future development of EVRF



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

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 from1967 – 2006)
- Border connections mainly from the 70th 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 between1989 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 kgal·mm
  - s_0 (RU) = 2.23 kgal·mm (variance component estimation)
- Height of point Kronstadt
  - Russian system: H=0.000 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

UELN - expected new 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 devellopment