Willkommen im

BEV

Bundesamt für Eich- und Vermessungswesen

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Recent Steps Towards the Introduction of new European Reference Systems in Austria

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- European Terrestrial Reference System ETRS89
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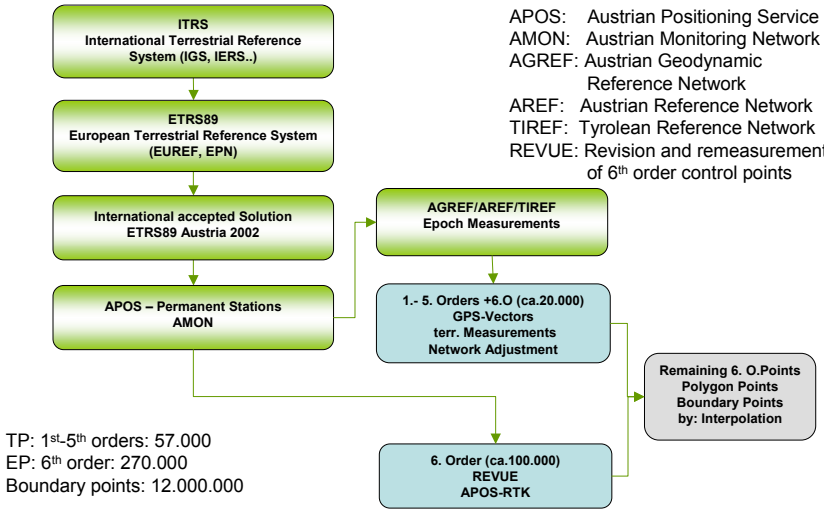
- The legal Base for the new Reference Systems

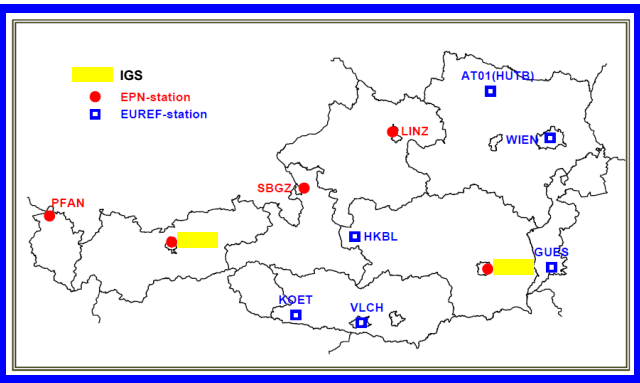
Hierarchic Schema for the Introduction of ETRS89 in Austria



APOS: Austrian Positioning Service
AMON: Austrian Monitoring Network
AGREF: Austrian Geodynamic Reference Network
AREF: Austrian Reference Network
TIREF: Tyrolean Reference Network
REVUE: Revision and remeasurement of 6th order control points

TP: 1st-5th orders: 57.000
EP: 6th order: 270.000
Boundary points: 12.000.000

International Accepted Solution ETRS89 Austria 2002



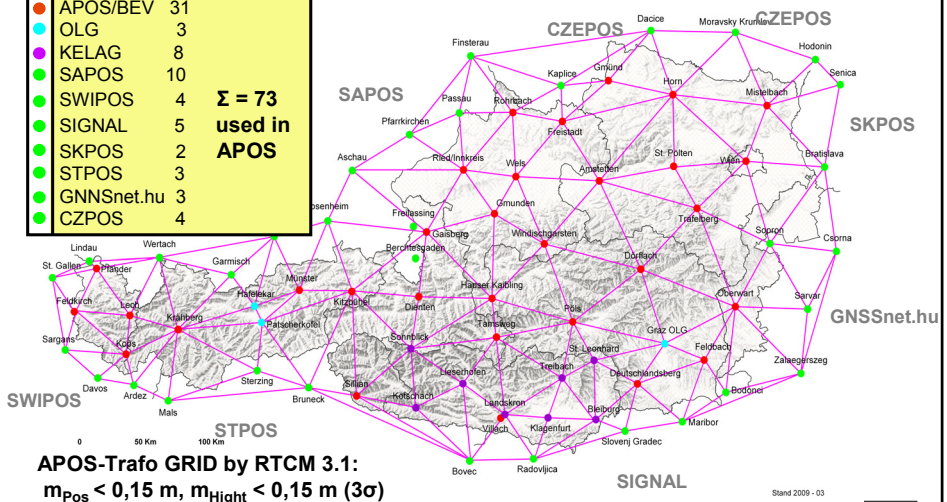
11 Stations

Accepted Solution by the EUREF Symposium 2003 in Toledo

ETRS89 Autria 2002, ETRF2000 Epoch 2002.45

APOS – Austrian Positioning Service

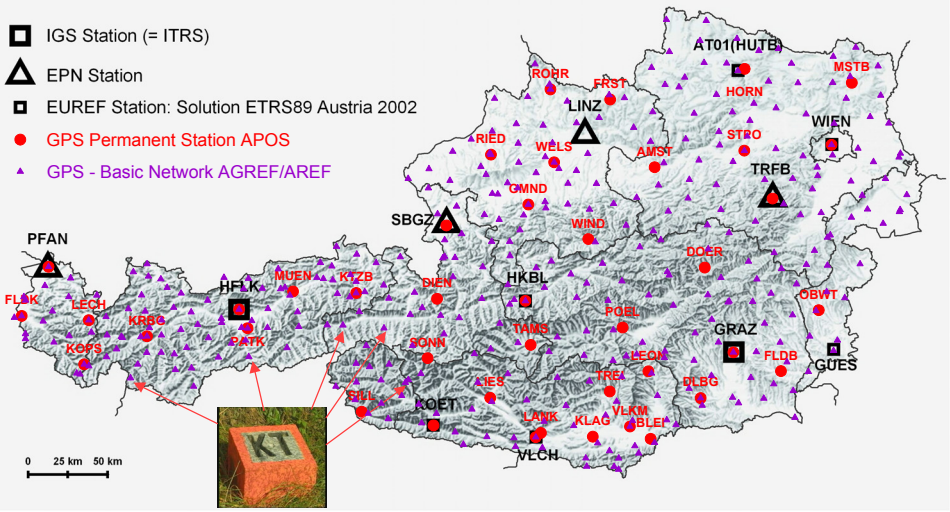
Service	No of Stations	
APOS/BEV	31	
OLG	3	
KELAG	8	
SAPOS	10	
SWIPOS	4	**Σ = 73**
SIGNAL	5	**used in**
SKPOS	2	**APOS**
STPOS	3	
GNNSnet.hu	3	
CZPOS	4	



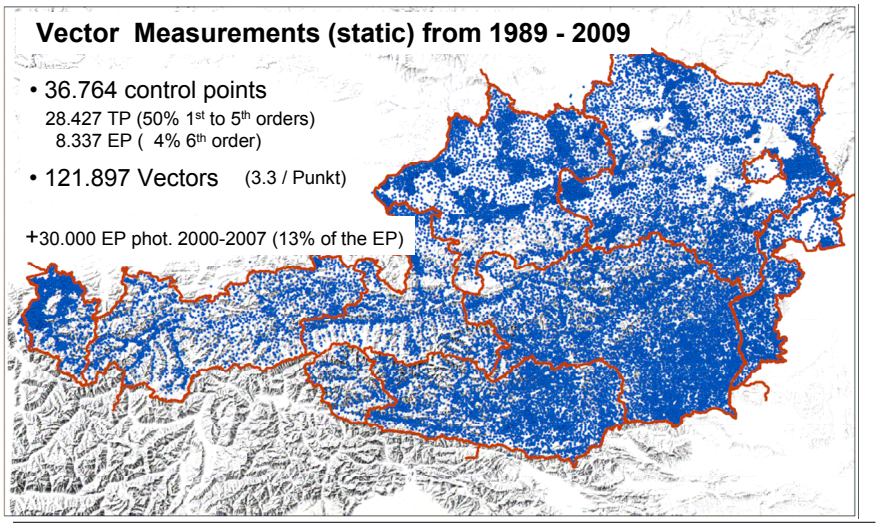
APOS-Trafo GRID by RTCM 3.1:
m_{Pos} < 0,15 m, m_{Hight} < 0,15 m (3σ)
(for the RTK solution)

Stand 2009 - 03

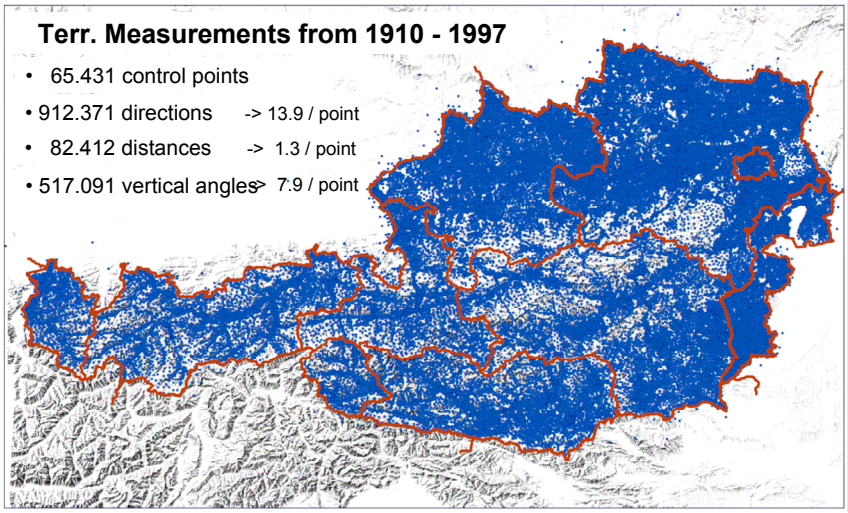
AGREF/AREF/TIREF – GPS Epoch Measurements



1st – 6th Orders Static Vector Measurements

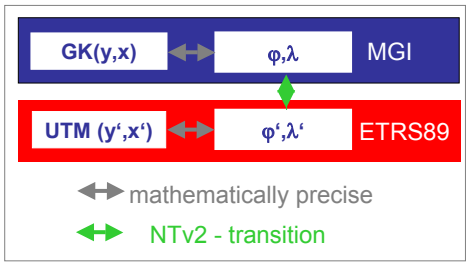


1st – 6th Orders Terrestrial Measurements

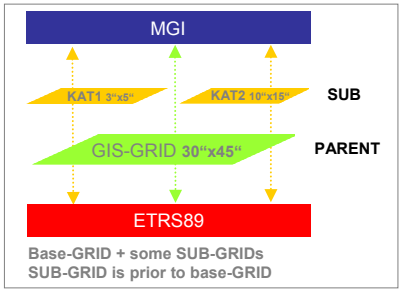


MGI<->ETRS89 Transformation by use of GRID Models

NTv2 (National Transformation version 2 - Canada)



used f. e. in ArcGIS



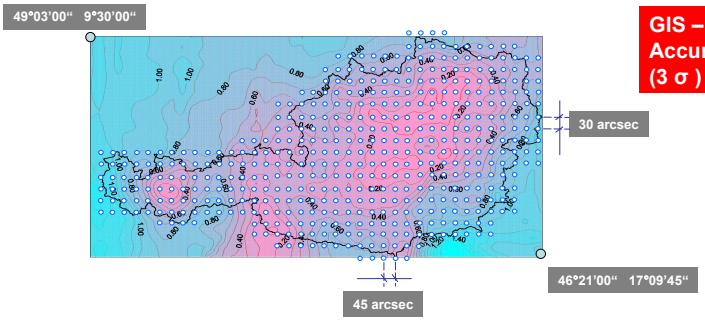
MGI: Militär Geographisches Institut, Vienna
GK: Gauß-Krüger Coordinate System

GIS grid available as download from the BEV portal free of charge

MGI<->ETRS89 Transformation by use of a GRID Model

GRID: ellipsoidal Coordinate System φ, λ,
GRID Distance: 30"x45" (≈ 1x1 km)

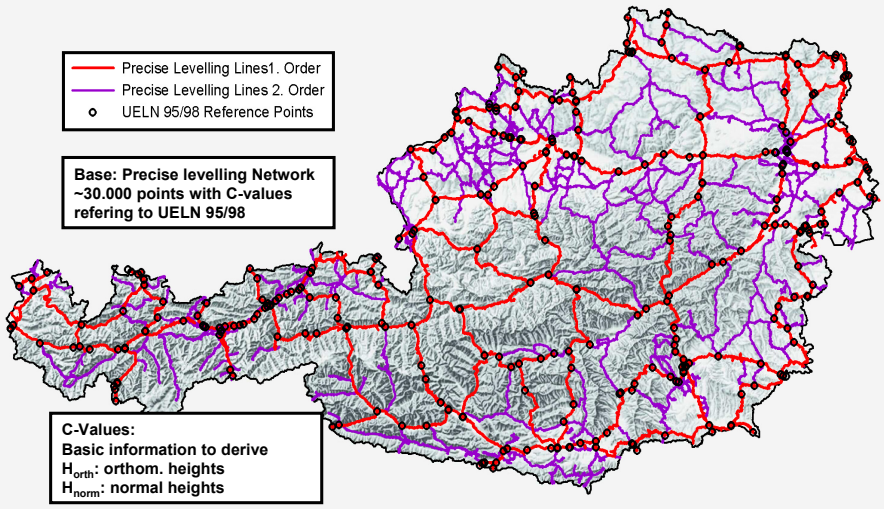
2 Products: GIS GRID NTv2 (only horizontal position)
GIS GRID APOS (3-D)
GRID values dφ, dλ, (dh) depending on the product



GIS – GRID Accuracy < 0.15 m (3 σ)

Base: 28.120 control points

Precise Levelling Network of Austria



BKG Formula for Height Transformation

$$H(II)=H(I)+a_1-a_2 \cdot M_o \cdot (LAT - LAT_o) - a_3 \cdot N_o \cdot (LON - LON_o) \cdot \cos(LAT) \cdot \cos(LAT - LAT_o)$$

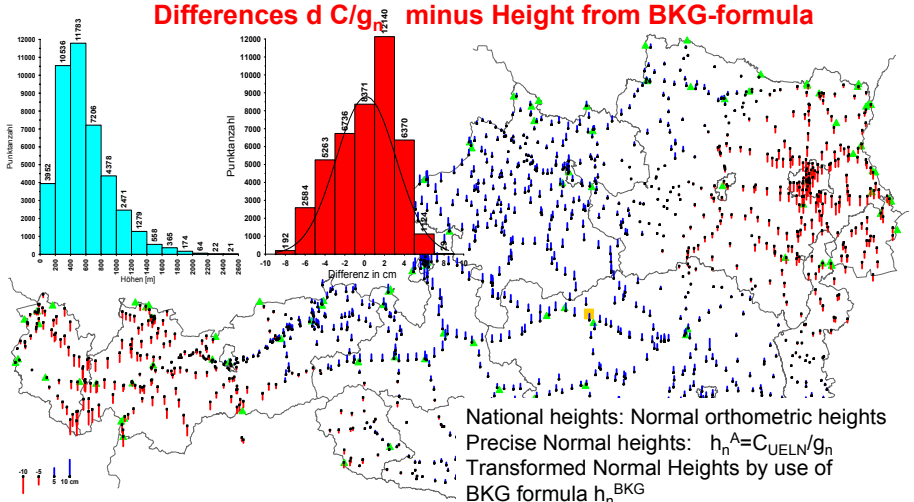
with:

H(I):	height in the source system [m]
H(II):	height in the target system [m]
M_o:	meridian radius of curvature of GRS80 [m]
N_o:	normal radius of curvature of GRS80 [m]
LAT:	latitude in ETRS89 [radian]
LON:	longitude in ETRS89 [radian]
P_o (LAT_o, LON_o):	reference point of the transformation
a_1:	translation in the vertical direction [m]
a_2:	inclination in the latitude [radian]
a_3:	inclination in the longitude [radian]

BKG: Bundesamt für Kartographie und Geodäsie/Germany
BKG Formula for transformation of national heights into EVRS2000
Source: http://www.crs-geo.eu/nn_124226/crseu/EN/CRS__Description/crs-national__node.html?__nnn=true

Transformation of National Heights into Normal Heights of EVRS

Differences d C/g_n minus Height from BKG-formula



National heights: Normal orthometric heights

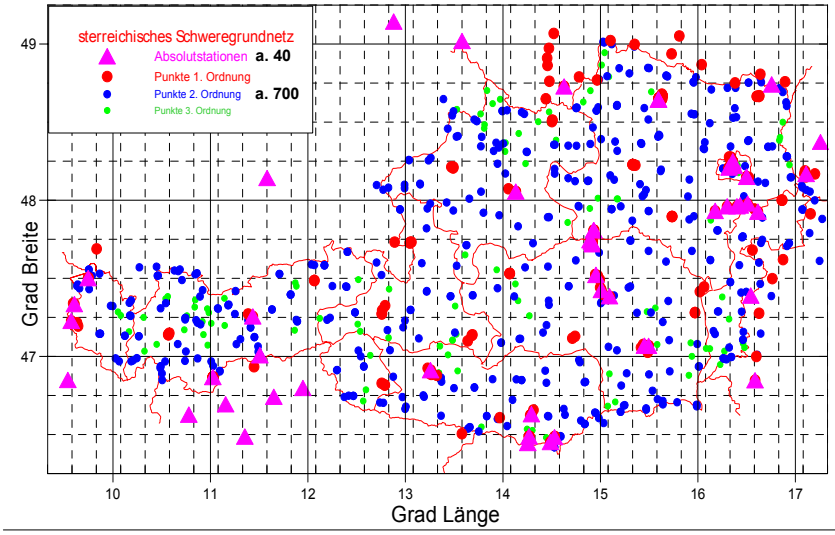
Precise Normal heights: $h_n^A = C_{UELN}/g_n$

Transformed Normal Heights by use of BKG formula h_n^{BKG}

30.000 d-values available

$d = h_n^A - h_n^{BKG}$ $m_d = \pm 3cm$

Austrian Gravity Base-Network

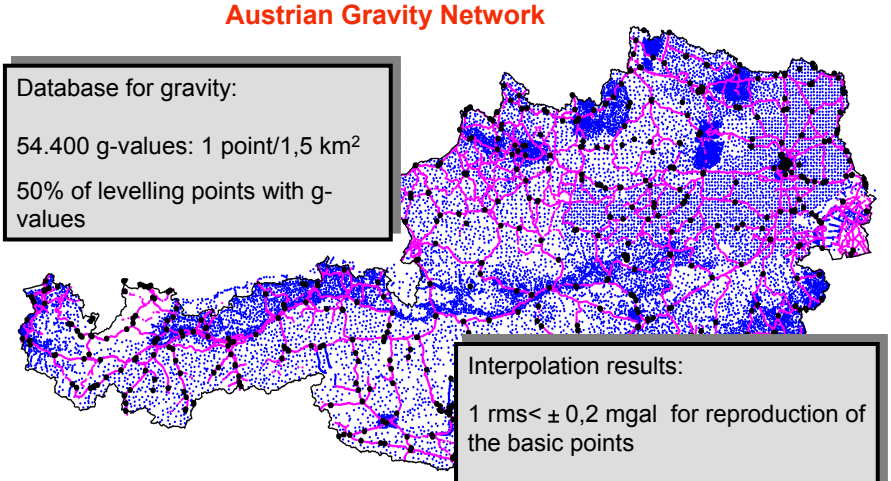


Austrian Gravity Network

Database for gravity:

54.400 g-values: 1 point/1,5 km^2

50% of levelling points with g-values



Interpolation results:

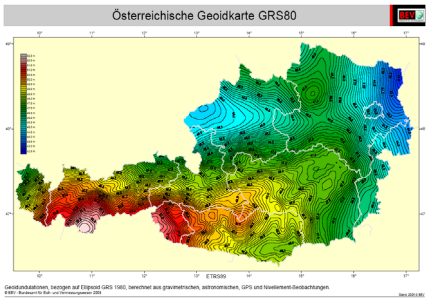
1 rms< ± 0,2 mgal for reproduction of the basic points

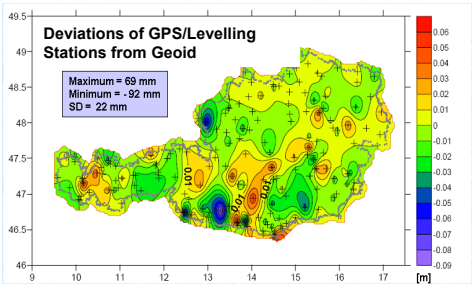
1 rms< ± 1,0 mgal for interpolated points

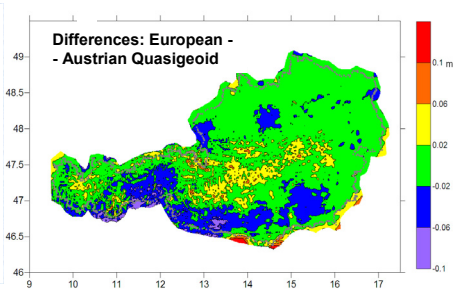
The Austrian Geoid 2008

The Austrian Geoid 2008

- **Global Gravity model: GRACE EIGEN-GL04S**
- **Terrestrial data:**
- **DHM: BEV, Swisstopo, SRTM: 1.4"x2.3"**
- **Gravity-values: grid 4x4 km -> 14.001 points**
- **Deflection of Vertical: 672**
- **Collocation points: GPS/levelling -> 161 points**
- **Comparison with European Quasi-Geoid solution**







Legal Foundations (1)

Survey-Act („Vermessungsgesetz“ 1969):

- Definition of reference system for control points and cadastre (MGI/Gauß-Krüger coordinates)
- Connection between cadastral measurements and the nearest control points is binding (independent of measuring technique)
- GK-coordinates are legally fixed (Grenzkataster) – holds true for about 10% of all parcels in Austria

Legal Foundations (2)

2004: Proclamation of ETRS89 as the official 3-D Coordinate System provided by APOS (Austrian Positioning Service)

2008: Amendment to the legal Act:

- APOS (Austrian Positioning Service) defined as an instrument to realize ETRS89 in Austria

2010: By-law to the legal act (Vermessungsverordnung):

- Use of APOS in combination with ETRS89 coordinates
  Use of another positioning service forces the user to include control points in the field to get the transformation parameters

Thank you for your attention!