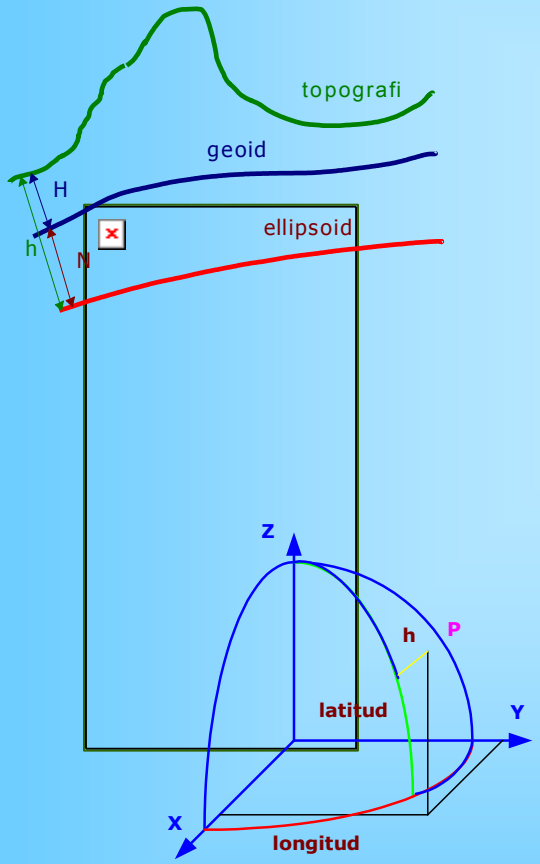
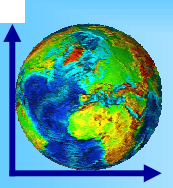



# SWEREF 99 + RH 2000 = TRUE!

Runar Svensson

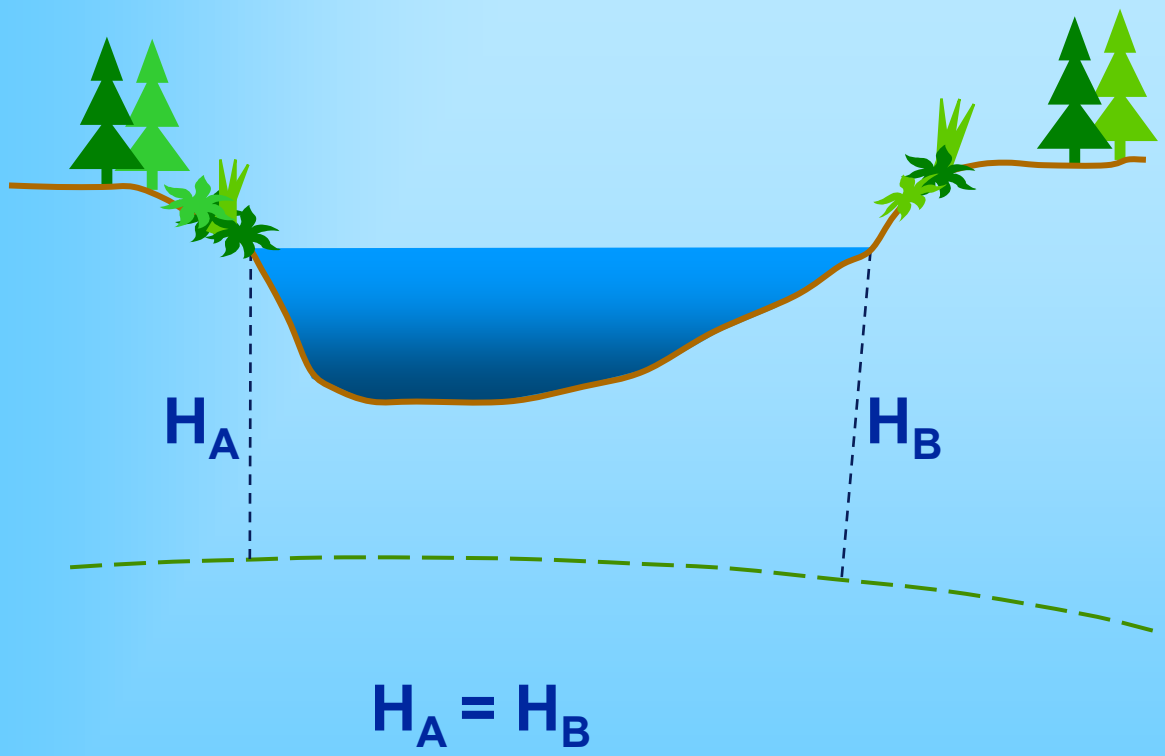
Lantmäteriet
Geodetic Research Division



# SWEN 05LR – a new model for heightcorrections

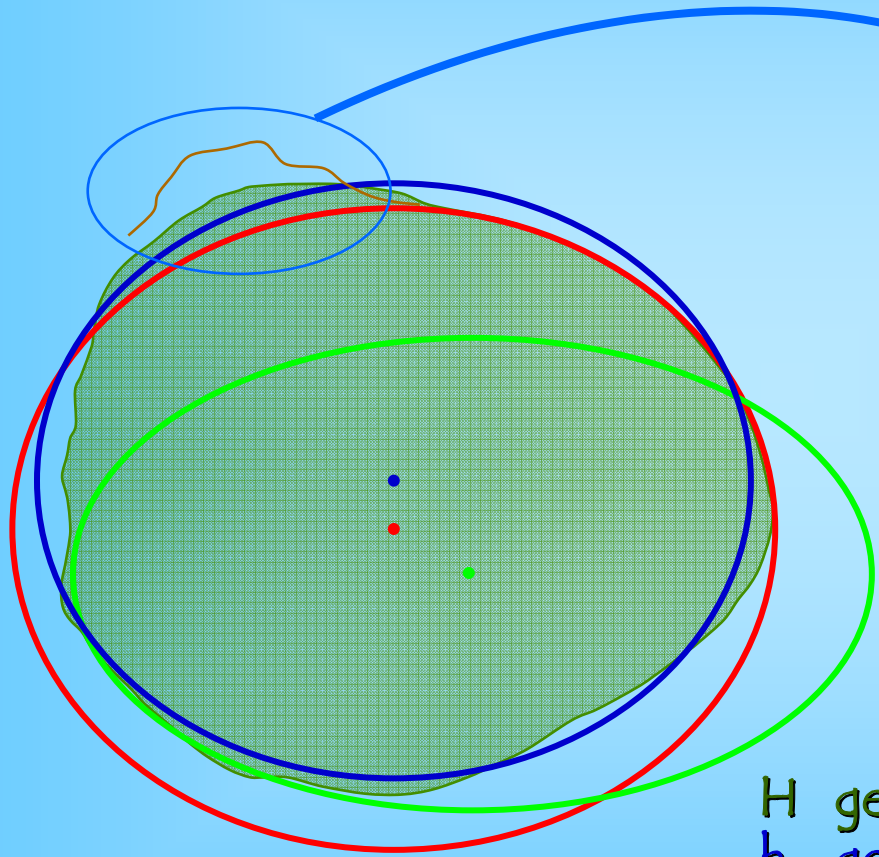
- Introduction
- The height concept
- Heights with GPS
- Geoid-/heightcorrectionmodels
- RIX 95
- RH 2000
- SWEN 05LR
- Consequences for RTK/Network-RTK

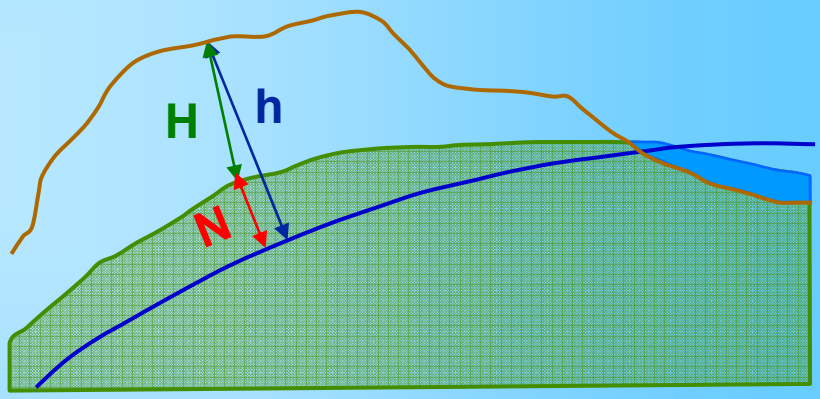
# Heightconcepts




A still water surface has the same height all over the surface

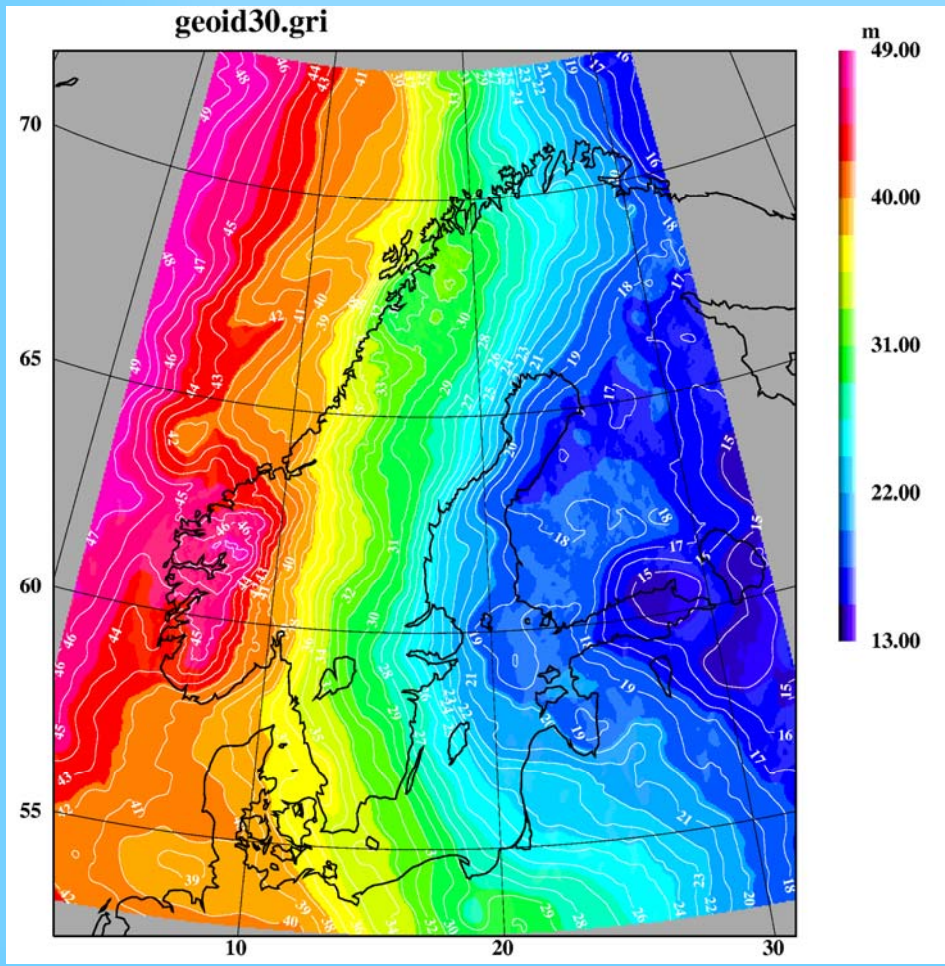
# Models of the Earth






H geophysical height ("over the sea")
h geometrical height (over model)
N height of the geoid ("sea") over the model

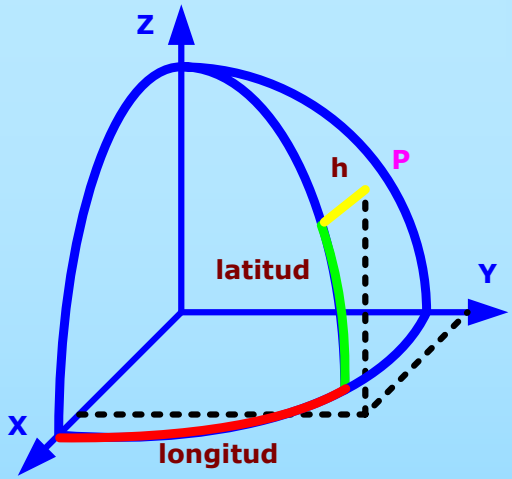
# Geoidmodel – NKG 2004



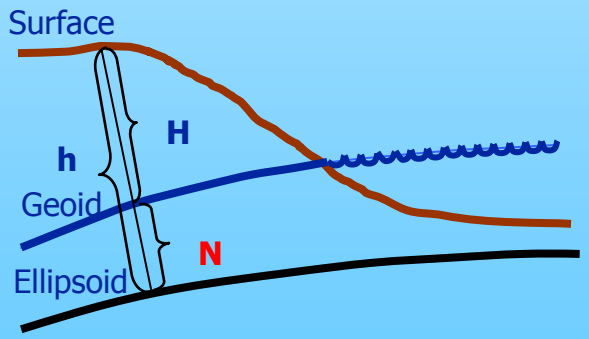

NKG 2004 is a gravimetric geoid!

# Heights with GPS

Primarily we get heights over the ellipsoid …




… with a heightcorrectionmodel we transform them to heights over the sea.



# Local heightcorrectionmodels

$$C = N - (h - H_{local})$$

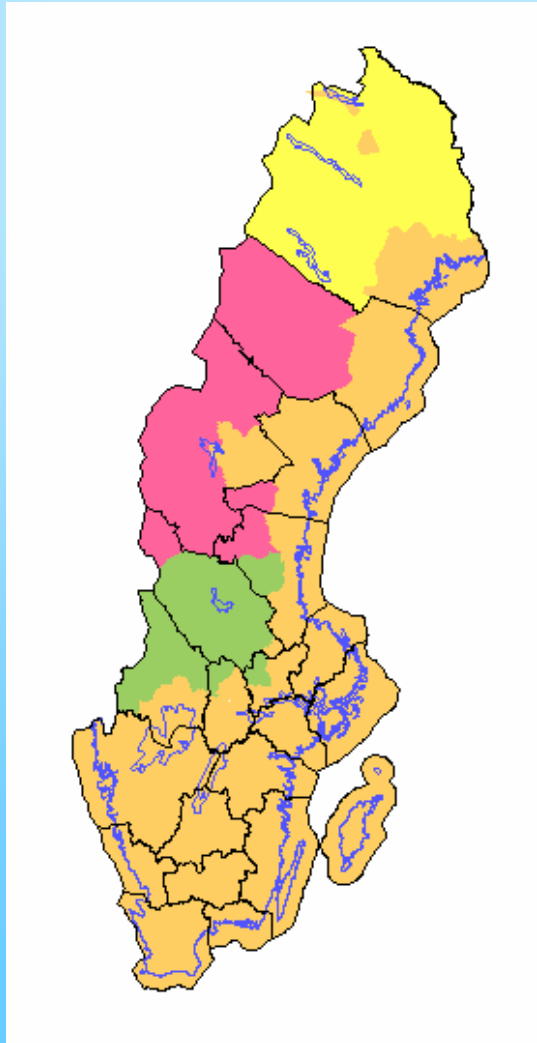
N gravimetric geoid/ given

h(GPS) (antenna, DOP, multipath, observationmethod, sessionlength, processingmethod, atmosphere)

H(lev) (deformation, heightsystem, local tensions)

$$H_{local} = h - N + C$$

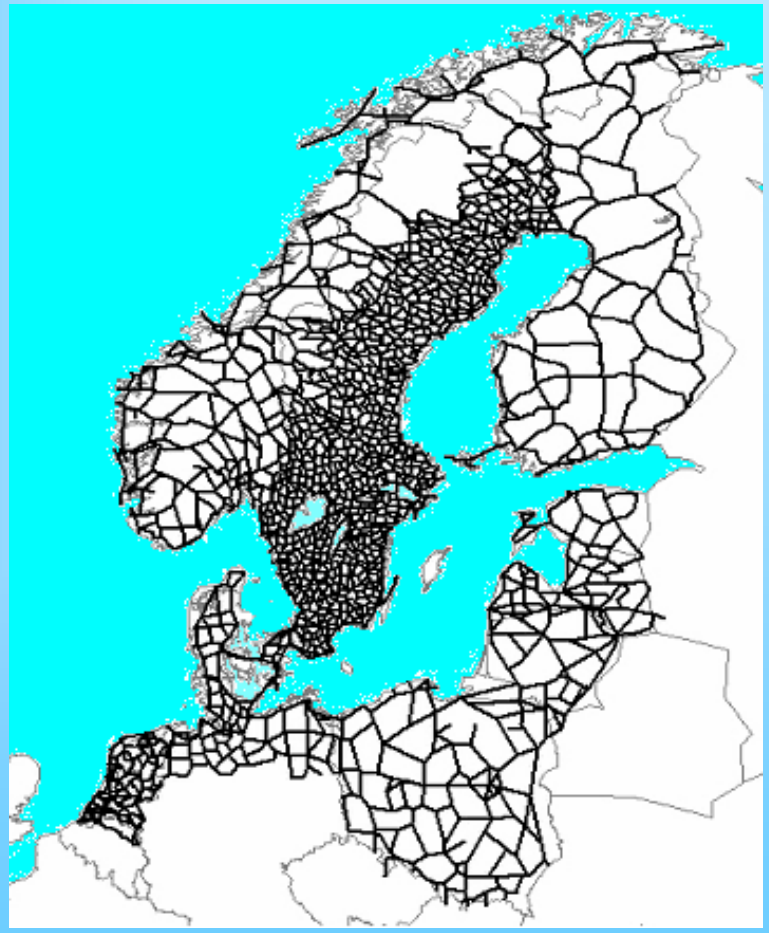
# RIX 95



Productionplan
GPS-observations

Klart
Plan 2004
Plan 2005
Plan 2006

# RH 2000 - Computation



- Observations (geopotentials) have been adjusted with all nodalpoints as unknowns and NAP fixed.

  rms of unit weight ~ 1 mm/√km

- Errordistribution in closed leveling lines

- Computation of open-ended leveling lines

# SWEN 05LR

$$H_{RH\ 2000} = h_{SWEREF\ 99} - f(\varphi, \lambda)$$

where f includes: geoidmodel

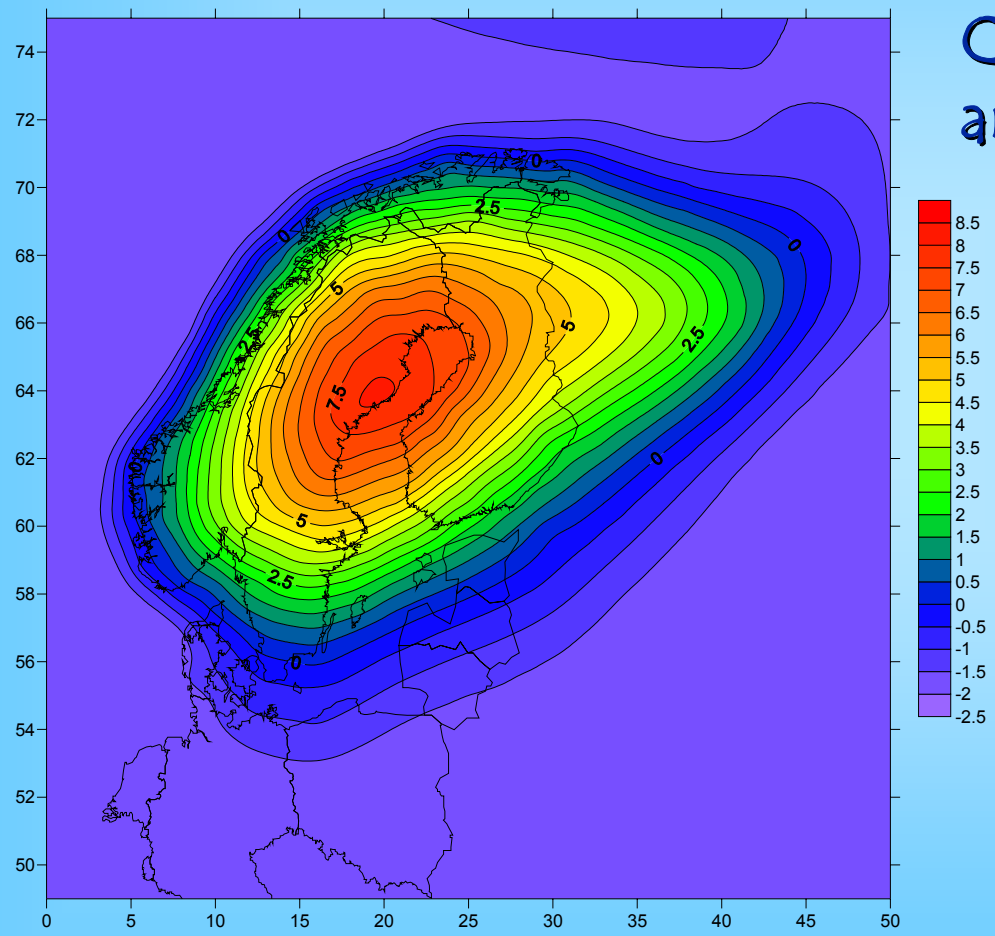
land-upliftcorrection

model of residuals

Expected error in f: $1{,}5 < \sigma < 2$ cm

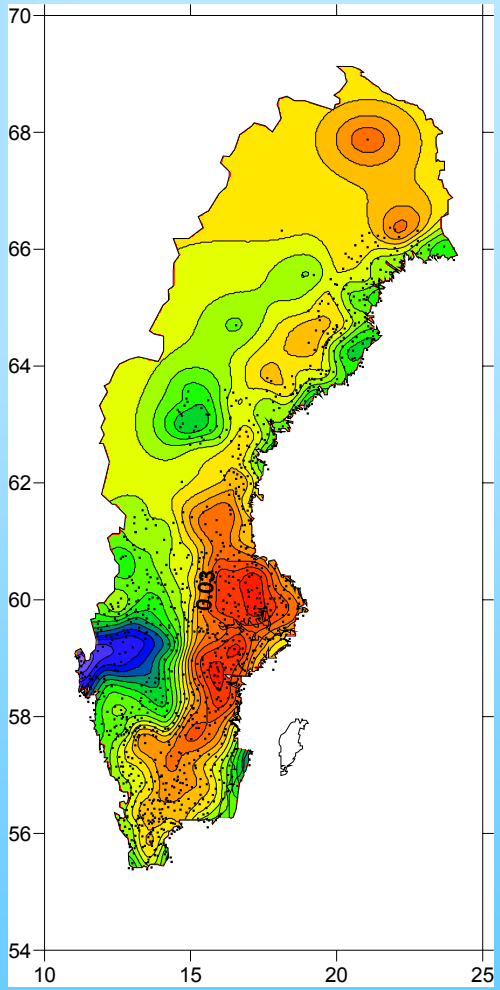
Published 1:st of July, 2005

# Apparent Land-upliftmodel



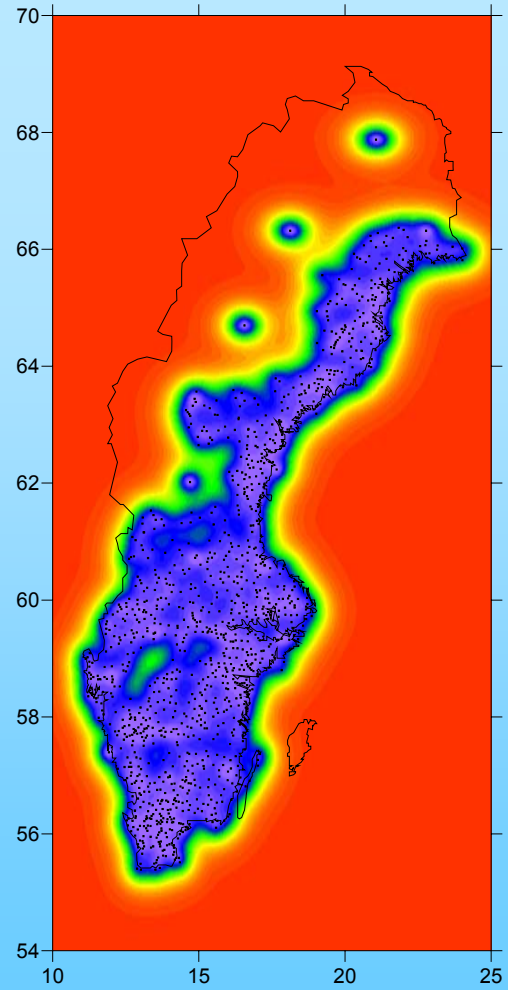

Combination of empirical and geophysical models

# SWEN 05LR – residuals to NKG 2004




Residual (m)

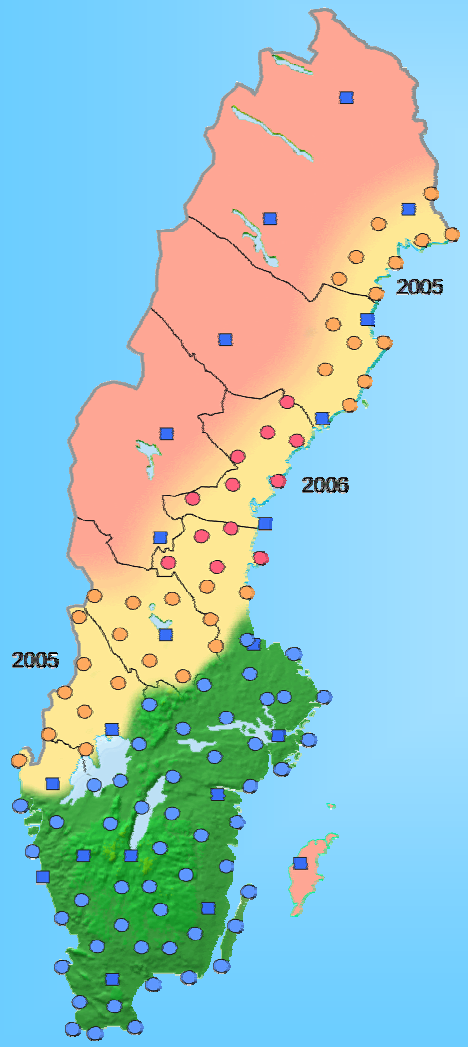
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0
-0.01
-0.02
-0.03
-0.04
-0.05
-0.06
-0.07
-0.08
-0.09
-0.1
-0.11
-0.12




RMS (m)

0.038
0.036
0.034
0.032
0.03
0.028
0.026
0.024
0.022
0.02
0.018
0.016
0.014
0.012
0.01

# SWEPOS Network-RTK-service




- Initiated 1:st January 2004
- Regional coverage of Sweden (distributed via GSM)
- Establishingprojects:
  - 2005: Position-Mitt, Nordost-RTK
- Planned Establishingprojects
  - 2006: Mellan-RTK, Gotland-RTK

# RTK/Network-RTK

Accuracy in vertical component:

$\sigma \sim 25 - 35$ mm

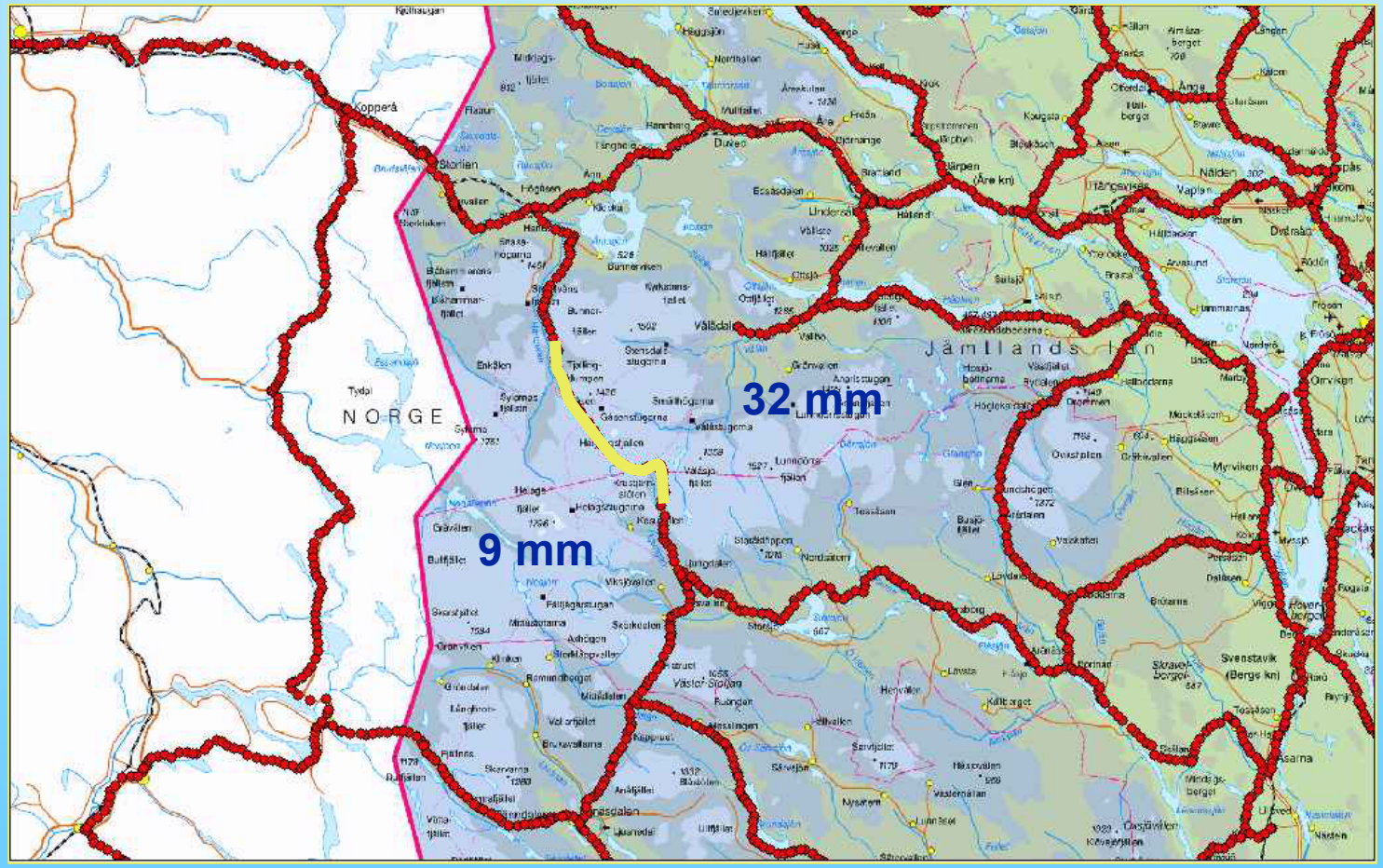
in height over the ellipsoid.

Contribution SWEN 05LR: $\sigma \sim 15 - 20$ mm

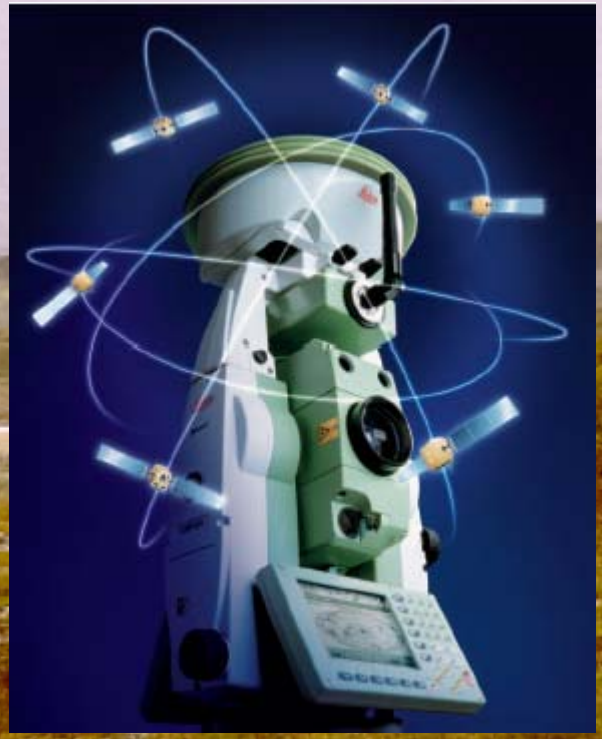
Totally: $\sigma \sim 30 - 40$ mm

in RH 2000

# Trigonometric levelling-line



?!



Thank You for Your attention !