Linking of reference frames, GNSS and CORS networks

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OUTLINE

- Fact sheets
- Introduction
- ITRF and WGS84
- What is CORS?
- Example on how to link CORS to ITRF
- Case study on a CORS: SWEPOS
- Summary

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FACT SHEETS

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INTRODUCTION

- Using "absolute" GPS gives you a position in WGS84.
- Accuracy around or even better than 10 metres (2D, 95 %)
- To improve the accuracy, a common method is to use "known points".
- The "known point" will give the reference frame.
- Known point can be a permanent station linked to ITRF.

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National and International trends

- The need of spatial information is increasing
- Many producers and users, different data sources
- Global techniques as GNSS

To work efficiently we e.g. need to have

- a common, time-valid and cross-boundary geodetic infrastructure

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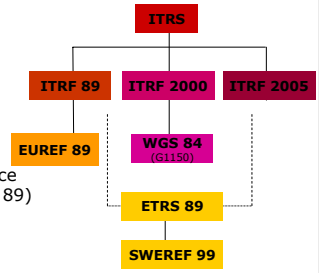
Global 3D REFERENCE FRAME

- International Terrestrial Reference System (ITRS)
  - Realised through International Terrestrial Reference Frame XX (ITRF XX)
- World Geodetic System XX (WGS XX)
- European Terrestrial Reference System 89 (EUREF 89, ETRS 89)
- Swedish Reference Frame 99 (SWEREF 99)



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WHAT IS ITRF?

- Versions: ITRF89, …, ITRF2000, ITRF2005
- Producer: International Earth Rotation Service (IERS)
- Ellipsoid: GRS1980
- Epoch: Updated
  - e.g. ITRF97 1999.5
- Both co-ordinates and velocities
- Methods: VLBI, SLR, LLR, DORIS, GPS
- Application: e.g. Computation of precise orbits (IGS), accurate GPS-calculations, scientific studies

ITRF 2005 co-location sites

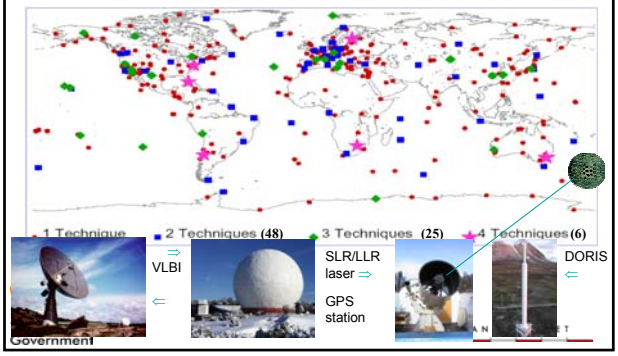
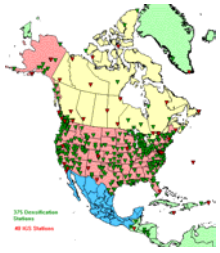


PLATE TECHTONICS

WGS84

- Versions: WGS60, ..., WGS72, WGS84
- Producer: National Imagery and Mapping Agency (NIMA), USA
- Ellipsoid: WGS1984 (~GRS1980)
- Epoch: Since 1994 updated
  - e.g. WGS84(G1150), based on ITRF 2000
- Method: GPS

SIRGAS AND NAREF



http://www.dgfi.badw-muenchen.de/gps/sirgas.html http://www.naref.org/

WHY USING ITRF?

- ITRF based geodetic datum allows for a single standard for collecting, storing and sharing of spatial data
- Compatibility over geographical areas as well as GNSS
- Minimise the need for users to understand datum transformations

ITRF BASED DATUMS

- E.g. GDA94, ETRS89
- These datums uses fixed co-ordinates. Mapping authorities as well as cadastre wants to have ”non-changable” co-ordinates
- WGS84 and ITRFXX changes due to plate techtonics
- Therefore national or regional realizations are needed of ITRF, epoch is determined
- Systems as Fugro and Omnistar gives co-ordinates in WGS84
- Difference between WGS and ITRF based datums are at the level of cms-dms

CORS

- Continuously Operating Reference Station






EXAMPLE OF A CORS NETWORK AND ITS APPLICATIONS

Case study, SWEDEN

SWEPOS

- In total 160 stations, 25 ”stable” monumented
- Governmental agency responsible for operation and development
- GPS and GLONASS

Applications of SWEPOS:

L1 and L2 raw data for post-processing
DGPS and RTK corrections
High-precision control points
Scientific studies of crustal motion

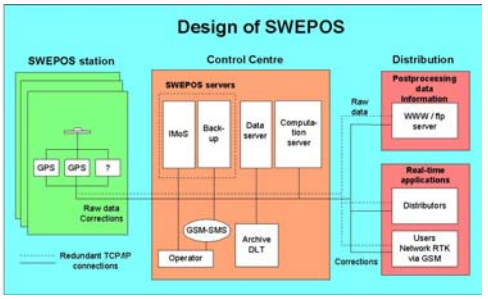
Fiducial SWEPOS-station

- Mounted on bedrock
- Power backup for 48 hours
- Redundant lines for data com.
- Redundant GPS-receivers, backup computers and terminal servers
- Temperature and power monitoring
- Security

SWEPOS-station

- Main objective: Network-RTK
- Antenna mounted on buildings
- Battery backup for 30 minutes
- One line for data com.
- Two GPS-receivers, no backup computer and terminal server*
- Monitored by the 21 fiducial SWEPOS-stations (daily)

The business and data design



The investment is covered by governmental funds and the operation costs mainly by user fees

SWEPOS Real-time Services

DGPS-service (operated by "the market")

1 metre accuracy, RDS-channel on the FM-radio

SWEPOS Network-RTK service (2004-01-01)

Centimetre accuracy, Cellular phone, GSM or GPRS

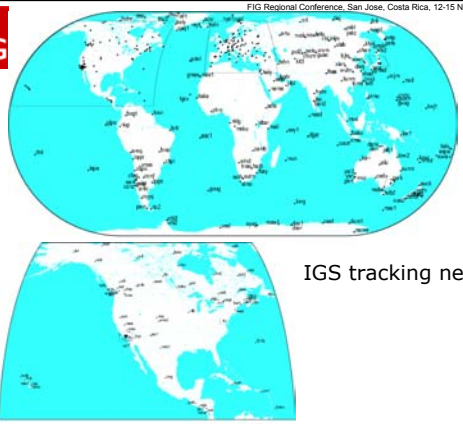
SWEPOS Network-DGPS service (2006-04-01)

0,3 metre accuracy, Cellular phone, GSM or GPRS

SWEPOS Online Processing Service

HOW TO LINK CORS TO ITRF

- Log data minimum 24 hours, preferably several days. 30 sec rate enough
- Download RINEX files from nearest IGS stations
- Process baselines
- Adjust the network
- Result will be co-ordinates in ITRF



IGS tracking network

ON-LINE PROCESSING SERVICES

- Processing software not available or not suitable
- Submit RINEX files for processing
- Automatic processing using data from nearby IGS stations
- Example of on-line processing services
  - Auto Gipsy (JPL) - Service provided by JPL
  - AUSPOS (Geoscience Australia) - Service provided by Geoscience Australia
  - OPUS - Service provided by NGS, USA
  - SCOUT (SOPAC) - Service provided by SOPAC, USA
  - CSRS-PPP (NRCAN GSD) - Service provided by Natural Resources, Canada

SUMMARY

- ITRFXX and WGS84 strong link today
- ITRF2005 latest version
- WGS84 and national realisations of ITRF cms or dms difference
- For the CORS, concern issues as location, communication equipment, business model, users
- Use e.g. on-line processing services or adjust yourself to get good co-ordinates