Minutes
NKG sub working group on Transfer and Height block

Date: 10th of October, 2001
Present: Denmark: Sören West Nielsen and Klaus E Schmidt
Estonia: Harli Jurgenson
Finland: Jaakko Mäkinen and Veikko Saaranen
Lithuania: Eimuntas Parseliunas
Norway: Olav Vestøl
Sweden: Mikael Lilje and Per-Ola Eriksson

1. **Approval of Agenda**
   The meeting approved the proposed agenda.

2. **Conclusions from the discussion during the Geodynamic session.**
   The present land uplift data sources available in the respective country were presented and discussed during the Geodynamic session the day prior to this meeting.

   It was decided that the Danish adjustment program must be able to handle land uplift models in grid format. The land uplift models discussed at the meeting are Bifrost model, Lambeck model and Ekman model.

   It was decided that we should test the Swedish third precise levelling with these three models and study how they affect the heights. This should be done both by Denmark and Sweden. It is therefore needed to distribute the different models between the countries. This is organised by Finland. The format of the grid should be in acceptance with the geoid grid by René Forsberg.

   Olav Vestøl was afraid that these models are not optimal over Norway. He mentioned that Least Squares Collocation should be used over Norway and is interested in testing this method. The other countries are asked to send in data from there 2nd and 3rd precise levellings to Norway.

   It was also decided that Finland should compare the different models with repeated levellings. Olav Vestøl mentioned that land uplift values on the Norwegian GPS reference station has been suspicious and are not published. More investigation is needed and Olav will report on the progress at the next meeting.

3. **Reports on the archives for levelling data in respective countries**
   - **Denmark**: Informix database under UNIX. Database for all types of geodetic observations. The tables in the database concerning levelling data can be found in appendix 1. The height difference in the database is corrected for rods. Other types of information in the database is time, journal number, number of set ups and distance.

     An example of the input datafile to the adjustment program can be found in Appendix 2.

   - **Finland**: Raw height differences are stored in ASCII files with one file for each line or part of line. The different corrections are in the file.

1st and 2nd order precise levellings are in digital format. They are though missing co-ordinates for some benchmarks.

- **Norway:** The bench marks and the observations are in the same database. The height difference is raw and corrections can be applied when necessary. However, no tidal and no refraction corrections can be made. The only time mark that exist is levelling year.

- **Sweden:** Sweden is using ACCESS and MapInfo as the main database programs. In total, Sweden stores approximately 50 different details on each section. Sweden had prepared a short description of their databases. The paper (The production line with special emphasis on the data capture and the structure of the archives used in the third precise levelling of Sweden – Mikael Lilje and Per-Ola Eriksson) ca be retrieved by contacting the authors.

4. A report on the Danish adjustment program, current status

The development started in the late 50's and the program runs currently under UNIX and Denmark is using an Informix database. It will be possible to use Telnet for all countries to have access to the program and the database. The adjustment program is not used only for levelling but for all types of geodetic observations. The adjustment is done on single section runs. The capacity is large and the calculation fast. The Swedish third precise levelling adjusted in Denmark consisted of some 44 000 points and the calculation took about 15 minutes.

Data with different apriori standard deviation can be used in the same adjustment. This is important since the data from the different countries does not all have the same accuracy.

The outlier detection is done using down weighting of observations (Danish method).

The error detection in the respective networks is done by respective country.

The tidal correction is done automatically during the adjustment of geopotential. Data not having any time mark is not corrected. Jaakko Mäkinen made it clear that we should use zero tide. Going from mean to zero tide is though a function of latitude.

The program can not today calculate any refraction correction.

The program can calculate all types of heights.

There was a discussion concerning type of point number since we are using different types of point numbers in respective country. Sören West Nielsen includes in these minutes a list of currently points number types that are accepted, see appendix 3.

5. **What kind of data should be sent to the database? What kind of corrections should be done in advance? How should we treat that the data is based on different error limits during production?**

The data distributed to the Denmark should be single run observations by section corrected for rod calibration and earth curvature.

There is a need to have a strategy to keep the database updated. Sören West Nielsen is responsible that each country sets up a strategy together with our Danish colleagues. The bottom line in the strategy will be that each country is responsible for its own data and is responsible that the data is in good condition as well as complete.

Estonia has already sent in a couple of loops o the database and they are interested in putting in more data in the database.

Lithuania was not convinced of the purpose of Lithuanian levellings in the database. It is only interesting if we can obtain data from the neighbouring countries.

6. **Specification of the file for transfer of data.**
Sweden and Denmark had earlier agreed on a format for the test adjustment of the Swedish third precise levelling. The format was more or less accepted by the other countries. Missing in the format are apriori standard deviation as well as a figure telling the program the number of measurements of that specific section.

The specification looks as follows:
journal number; point_from; point_to;date; hour_from; minutes_from; hour_to; hour_from; height_difference; Distance; Number_of_measurement; apriori_standard_deviation.

An example is found in appendix 4.

7. **Are there any restrictions concerning distribution of the data supposed to be sent to the database?**
Other institutions within or outside the Nordic area might have an interest in the database. If there exist any restrictions of distributing some of the data, this must be addressed during the delivery by the delivering country. Restricted data must be stored in such way that they are easily separated from the rest of the data.

8. **Next meeting**
The next meeting will be during the height determination group meeting in March/April. More information about this meeting will be sent out in due time by Jean-Marie Becker.

The following working items should be done until this meeting:

- Test data from Norway and Finland shall be sent to Denmark.
- On site education for running the database if necessary from respective country.
- Respective country together with Denmark will set up Telnet connections to KMS and the database.
- Sweden and Denmark will adjust the Swedish Third Precise Levelling using three different types of land uplift models (Ekman, Bifrost and Lambeck).
- Denmark will make it possibility to use the Danish adjustment program with a land uplift model.
- Finland will investigate about the different models compared to repeated levellings.

APPENDIX 1: The database tables concerning levelling

19. Table : obs_ni_prs:
########################
Set up for *precision* levelling

1. O_REFNR **SERIAL**/int
2. REFNR int (not null)
3. IDNR smallint (not null) <0-99>
4. O_KIND smallint (not null) <1-999>
5. O_TYPE smallint (not null) <1-999>
6. Q_OBS smallint (not null) <1-9999>
7. YEAR smallint <1800-2099, >
8. SETS smallint (not null) <1-99>
9. JSNR float (not null) <10001-999999999999>
10. O_TPD int (not null)
11. MD float (not null)
12. MD_TPD int (not null)
13. MC float (not null)
14. MC_TPD int (not null)
15. INSTRNR smallint
16. DATUM smallint <1-999, >
17. DATO datetime (year to minute) <year >= 1800, >

20. Table : obs_ni_prs_o:
############################
Observation for *precision* levelling

1. O_REFNR int (not null)
2. REFNR int (not null)
3. IDNR smallint (not null) <0-99>
4. Q smallint (not null) <1-9999>
5. OBS float (not null)
6. S_LENGHT float (not null)
7. SL_TPD int (not null)
8. OBS_DATO datetime (year to minute) <year >= 1800, >
9. SET_UP smallint
10. ETA int

INDEX:
======
obs_ni_prs: 1. O_REFNR : SERIAL = unique index
2. REFNR + 9. JSNR = composite unique index
(same physical point + jsnr)

3. 9. JSNR = duplicate index
4. 17. DATO = duplicate index

obs_ni_prs_o: 1. O_REFNR = duplicate index
2. REFNR = duplicate index

KEYS:
=======
obs_ni_prs: 1. O_REFNR = primary key
2. REFNR = foreign key, see
p_hvd_ref(table 1.)

obs_ni_prs_o :1. O_REFNR = foreign key, see obs_ni_prs
(table 19.)
2. REFNR = foreign key, see
p_hvd_ref(table 1.)

CELL-OUTLINE:
==============
obs_ni_prs:
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1. O_REFNR : New for every set up
2. REFNR : see p_hvd_ref
3. IDNR : from p_hvd_ref/p_sub_ref
4. O_KIND : obs_kind
5. O_TYPE : obs_type
6. Q_OBS : amount of objects
7. YEAR : year of measurement
8. SETS : amount of sets
9. JSNR : journal page
10. O_TPD : type-decimal for obs
11. MD : mean error direction/distance
12. MD_TPD : type-decimal for md
13. MC : mean error centring
14. MC_TPD : typedecimal til mc
15. INSTRNR : instrument number
16. DATUM : code for datum
17. DATO : date of *entry*

obs_ni_prs_o:
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1. O_REFNR : see obs_ni_prs (table 19.)
2. REFNR : see p_hvd_ref
3. IDNR : from p_hvd_ref/p_sub_ref
4. Q : states objektno. 1,..,Q_OBS
5. OBS : observation
6. S_LENGHT :sight length or object height
7. SL_TPD : type-decimal for sight length/object height
8. OBS_DATO : time of observation
9. SET_UP : amount of set ups
10.ETA : *eta value*

Comments regarding individual cells
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obs_ni_prs:
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3. IDNR : is recreated when deleting and re-entering.
5. O_TYPE : also containstype of distance.
15. INSTRNR : instrumentnr. refers to a special instrument table with assorted data incl. parameters for scaling of distances. Design of the instrument table is currently unavailable. The information is currently unavailable !
16. DATUM : is recreated when deleting and re-entering. 17. DATO : do.

obs_ni_prs_o:

Other comments:
SEE under table 10. obs_rg_dir and 11. obs_rg_dir_o.

APPENDIX 2: Input data format for the Danish adjustment program

```
#SV_ni_prs  1.0     0.01

012-1-7711 a    1983     1    0121 771101001
012-1-7709     -0.710100 m     1072.0 m   19830707, 13.18    1

012-1-7709 a    1983     1    0121 771101002
012-1-7807     -0.384000 m      955.0 m   19830708, 10.29    1

012-1-7807 a    1983     1    0121 771101003
012-1-7812      1.404850 m     1265.0 m   19830711, 09.13    1

012-1-7812 a    1983     1    0121 771101004
012-1-7808     -0.960110 m      932.0 m   19830711, 09.46    1

012-1-7808 a    1983     1    0121 771101005
012-1-7809     -0.359350 m     1268.0 m   19830711, 10.21    1

012-1-7809 a    1983     1    0121 771101006
012-1-7810      3.636440 m     1157.0 m   19830711, 10.58    1

-1a
```

APPENDIX 3. Currently possible point number types in the database

"VISUELT"	TYP	RGN	HNR	SNR	LBN	SLT	SUF
Store-højen (max 11 char)	0		< --	--	----	--	-\0 >
111-08-00801	1		111	8	801	0	0
K -75-09347.1993	1		0	75	9347	0	1993
784	2		0	0	784	0	0
784.1	2		0	0	784	46	1
3 487 Ø	2		0	0	3487	-40	0
2 244 K 1	2		0	0	2244	75	1
G.I.2032	3		1	2032	0	0	0
G.I.1647/1648	3		1	1647	1648	0	0
G.M.2032.2	3		2	2032	0	46	2
G.M.1405/1406.1	3		2	1405	1406	46	1
P8623	4		80	8623	0	0	0
P8623.11	4		80	8623	0	0	11
P8623Q6723	4		80	8623	81	6723	0
P8623Q6723.11	4		80	8623	81	6723	11
F72365	4		70	0	72365	0	0
F72365.22	4		70	0	72365	0	22
K- 11- F	5		0	11	0	70	0
K- 11- F.1	5		0	11	0	70	1
K- 01- V.3	5		0	1	0	86	3
2 222	6		0	0	2222	0	0
2 222.1997	6		0	0	2222	46	1997
2500/784	7		2500	0	784	0	0
2500/784.2	7		2500	0	784	46	2
2500/784 K	7		2500	0	784	75	0
2500/784 K 1	7		2500	0	784	75	1
CCCC (Capital letters)	8		CC	CC	0	0	0
CDCD (Capital letters and/or digits on 2. and 4. place)	8		CC	CD	0	0	0

APPENDIX 4. Example of file format for the transfer of data

JournalNumber;PF;PT;Date;HourF;MinF;HourT;MinT;Heightdiff;Distance;NumberOfMeas;RejectionLimit
0121 771101001;012*1*7711;012*1*7709;19830707;13; 0;13;35;-0.7101;1072;2;2

JournalNumber: Any number
PF: Point from
PT: Point to
Date: Date
HourF: Hour from
MinF: Minute from
HourT: Hour to
MinT: Minute to
Heightdiff: Height difference corrected for rod correction and earth curvature
Distance: Distance of section
NumberOfMeas: Number of measurements of the section. Typically 2 (one forward and one backward)
RejectionLimit: RejectionLimit for the forward and backward levelling. E.g. 2 = 2 mm/SQRT(L)

The file should be in ASCII-format.