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Status of GPS meteorology in Finland

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E-GVAP Plenary meeting

16 September 2008

Dubrovnik, Croatia

GPS receiver network in Finland

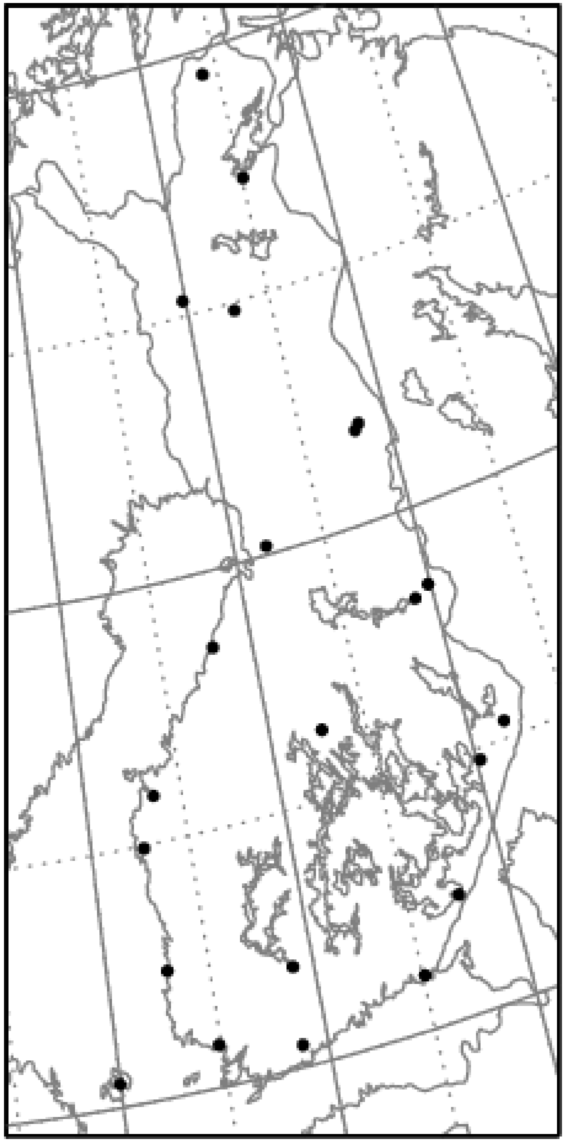
Status

Volume of processed data was increased in May 2008 through inclusion of several Finnish receiver stations in the regular processing at NGAA

Currently data from 22 receiver stations is processed in NRT

Also GFZ, METO and ROB make use of the Finnish measurement data

Permanent network of Geotrim Ltd provides potential to increase the total number of processed receiver stations up to ~100



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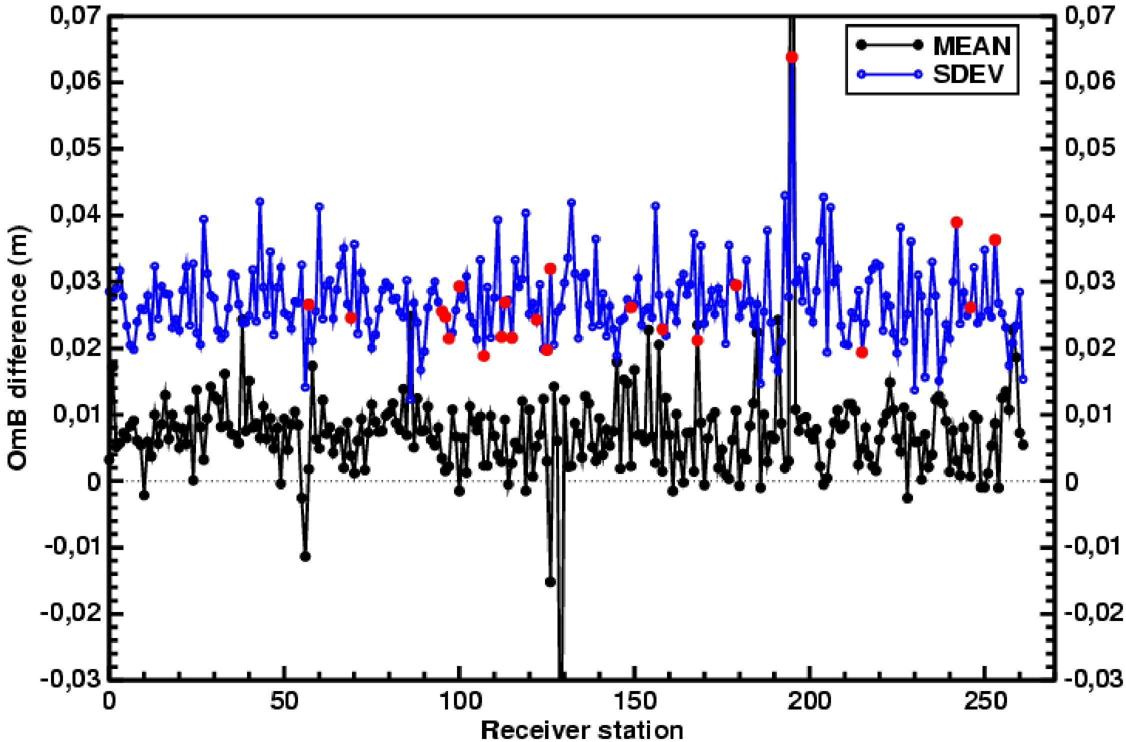
GPS data monitoring

Some remarks

ZTD observations are compared with modelled values obtained from the HIRLAM 6-hour forecasts

One-month test period (May 2008)

OmB statistics at the Finnish stations (red dots) are comparable to those of other stations processed at NGAA

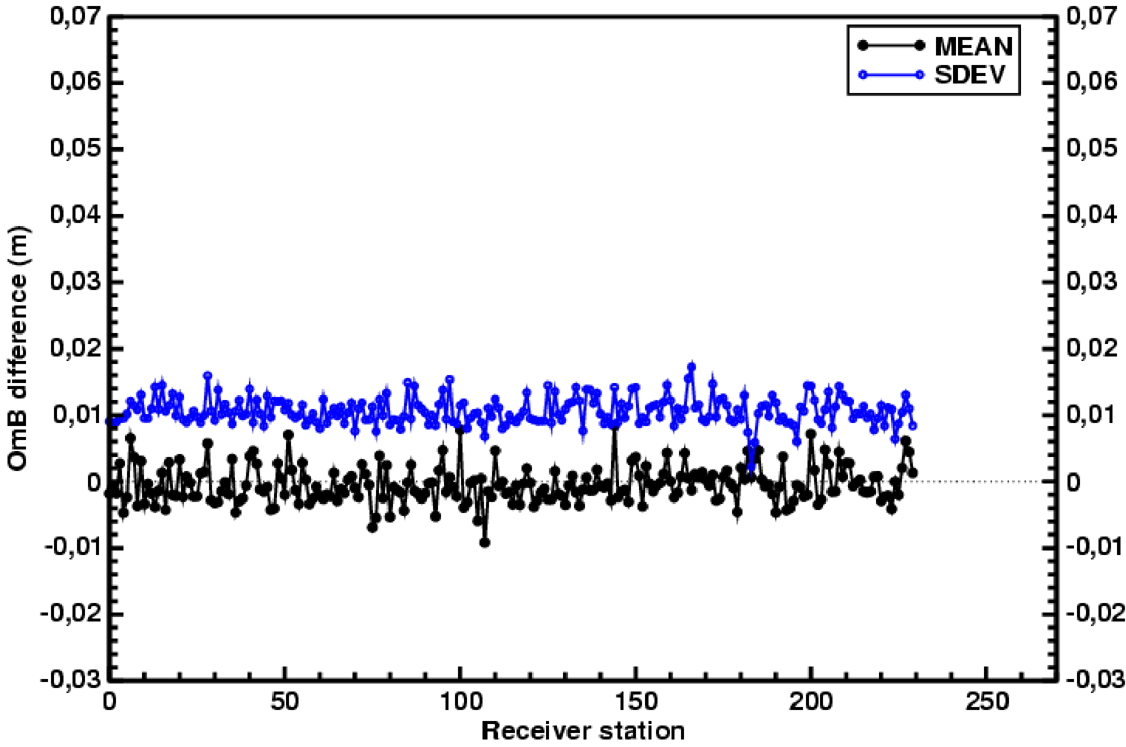


GPS data monitoring

Some remarks

However, NGAA processing in general provides a relatively poor agreement with modelled ZTD

Statistics of e.g. METO processing centre suggest considerably less biased and more accurate ZTD observations



GPS meteorological research

Status and plans

An observing system experiment will be performed during 2008 as part of HIRLAM CIS (Comprehensive Impact Study)

- Focus on summertime convection forecasts
- 4D-Var at ~10 km horizontal grid covering the continental Europe
- In addition to GPS ZTD observations, also radial wind from ground-based radars and geostationary SEVIRI radiances will be investigated

GPS meteorological research

Status and plans

Possibility to apply variational bias correction to GPS data in HARMONIE framework is studied

Development of methodological development for slant delays has been continued; in particular, an alternative observation operator has been studied in the HIRLAM framework

Data assimilation experiments of slant delays in a convective-scale model are planned, but these will be subject to availability of processed data

Use of ground-based GPS receivers for ionospheric monitoring is under investigations at the space research unit of FMI (J-P Luntama et al.)

A ray-tracing operator for slant delay modelling

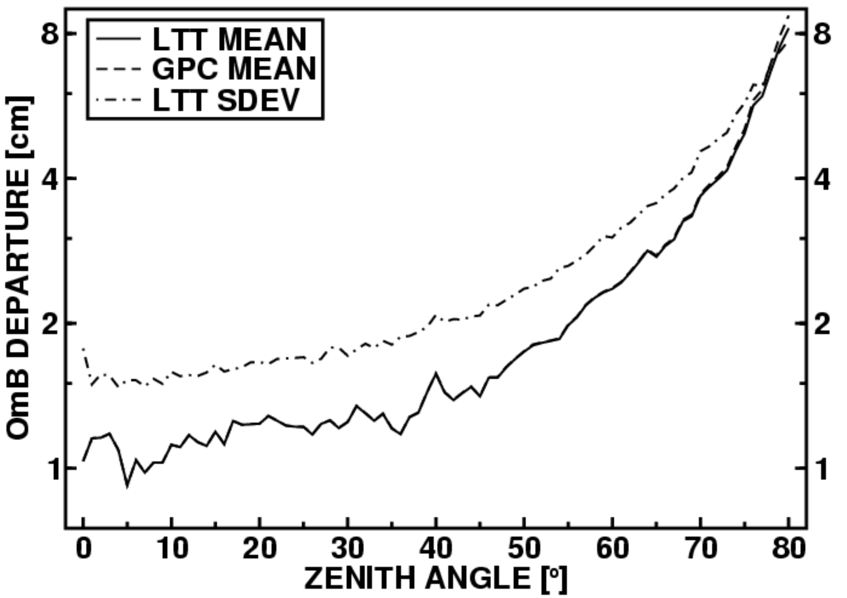
Comparison with a reference operator

The reference operator (GPC; Eresmaa and Järvinen, 2006) is based on relatively simple geometrical considerations

An alternative observation operator (LTT) applies the GPS RO observation operator that is developed by Sean Healy at ECMWF

The new operator solves the GPS signal path following the principle of Least Travel Time in a two-dimensional plane

The two operators perform similarly in terms of OmB statistics



Eresmaa and Järvinen, 2006: An observation operator for ground-based GPS slant delays. *Tellus* **58**A, 131—140.

A ray-tracing operator for slant delay modelling

Computational aspects

The new observation operator performs faster in terms of computational efficiency

However, this relative advantage of the new operator is gradually lost through

- increase of satellite zenith angle
- increase of NWP grid resolution

Since GPS slant delays show most of their potential in convective-scale NWP with large satellite zenith angles, the reference operator is still competitive

Mean computing times of a single SD model counterpart at different satellite zenith angles and NWP grid resolutions

Zenith	11 km		5.6 km		2.8 km	
Angle	LTT	GPC	LTT	GPC	LTT	GPC
10°	1.31	2.01	1.31	2.02	1.35	2.03
20°	1.27	2.02	1.39	2.03	1.43	2.06
30°	1.31	2.02	1.39	2.03	1.50	2.07
40°	1.35	2.10	1.42	2.13	1.65	2.11
50°	1.45	2.14	1.58	2.07	1.89	2.14
55°	1.45	2.03	1.74	2.09	**2.02**	**2.22**
60°	1.49	2.03	1.72	2.10	2.23	2.20
65°	1.56	2.04	1.79	2.19	2.42	2.23
70°	1.62	2.05	**1.94**	**2.12**	2.69	2.22
75°	1.72	2.06	2.18	2.15	3.19	2.35
80°	**1.99**	**2.07**	2.73	2.19	4.33	2.34
85°	2.74	2.10	4.34	2.28	7.44	2.46