Implementation Status of the UNB-VMF1

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1. Introduction

The Vienna Mapping Functions have been:

- shown to be the most precise mapping functions to date (Tesmor et al. 2007);
- recommended for all precise geophysical applications (Boehm & vanDam, 2009), and
- recommended by the IERS in their most recent publication of the *IERS Conventions* (2010).

The University of New Brunswick has created a geodetic corrections service providing tropospheric corrections (atmospheric delays) based on the Vienna Mapping Functions. The creation of the University of New Brunswick's Vienna Mapping Function Service (UNB-VMF1) aims to:

- improve the availability of the VMF1 corrections, thereby mitigating the impact of any existing service disruptions;
- provide greater compatibility with other derived numerical weather prediction model (NWP) products (i.e., atmospheric pressure loading);
- improve robustness of combined products through the generation of the VMF1 from an independent dataset and independent raytracing algorithms.

2. Computational Methods

The UNB-VMF1 follows *Boehm et al.* (2006b) utilizing the same orography, output file format, and grid definition as defined by the existing VMF1 service. The UNB-VMF1 service differs only in its raytracing algorithms and source data (NWP). *Nievinski* (2009) define the raytracing algorithms, and the source dataset for the proposed products are NCEP's Re-Analysis I and the Canadian Meteorological Centre's Global Deterministic Prediction System (GDPS).

3. System Integration

The UNB-VMF1 is produced utilizing the super-computing facilities provided by the Atlantic Canada Computational Excellence Network (ACEnet). The computational aspects have been implemented simultaneously on three independent clusters in the ACEnet network creating a very robust redundant architecture.

Three clusters independently obtain data from its source (Figure 1 shows NOAA, but for the other products the source is the CMC), and then independently perform the UNB-VMF1 computations. Once computations have been verified, the resulting final product files are then uploaded to the web-sever that resides at the University of New Brunswick.

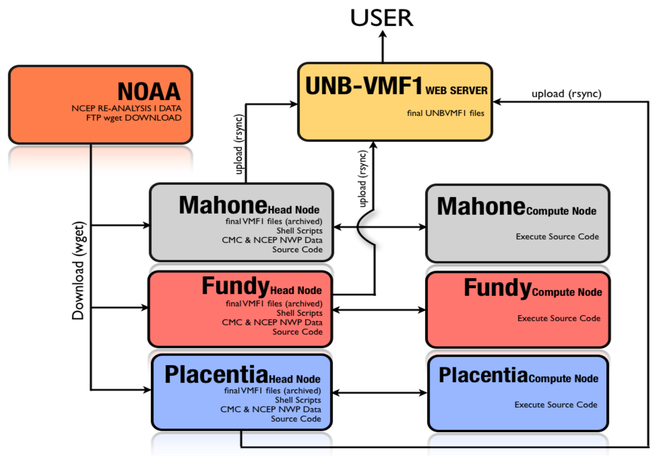
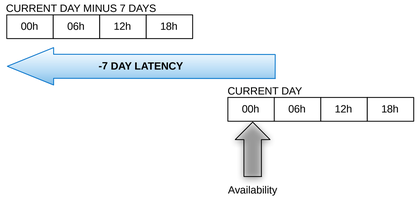


Figure 1: UNBVMF1 System Integration

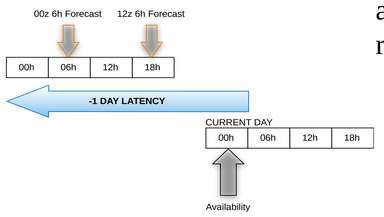
3.1 Summary of Products and Availability

Product Name	Description	Parameters
unbvmfG	2.0x2.5 degree global grid NCEP Re-Analysis 1 7 day latency	aw,ah,zhd,zwd
unbvmfGcmc	2.0x2.5 degree global grid CMC - GDPS 1 day latency	aw,ah,zhd,zwd
unbvmfP	2.0x2.5 degree global grid CMC -GDPS 0 Latency (+1 day)	aw,ah,zhd,zwd

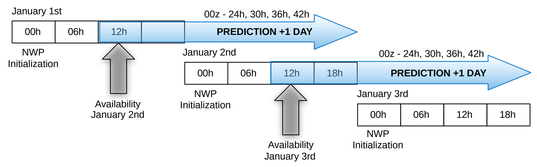
(i) unbvmfG



(ii) unbvmfGcmc



(iii) unbvmfP



The user has access to the datasets through a website located at http://unb-vmf1.gge.unb.ca, which is maintained at the University of New Brunswick in the Department of Geodesy and Geomatics (website is currently operational).

The user can also utilize the "wget" program to automate the retrieval process on a regular basis. A detailed description on how to use "wget" can be found on the website.

4. Going Forward

The next steps in the implementation process involve the validation of operational products. An analysis of a long time series over a 10 year span in the position domain will form the basis of the validation. Utilizing techniques such as GPS-PPP (Precise Point Positioning with the UNB developed GAPS package) and VLBI (joint effort with Johannes Boehm), as well as making a comparison to IGS troposphere products will allow for a comprehensive analysis in both the position and delay domain respectively.

Beyond validation, the service is investigating additional products such as producing a site specific product for the IGS reference network. Further to operational implementation, the UNB-VMF1 service will require some beta testers to evaluate product integration in scientific software packages. Lastly, the service has submitted a proposal to become an official GGOS product provider in April, 2012.

5. Acknowledgements

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References

Boehm, J., B. Werl, and H. Schuh (2006b). **"Troposphere mapping functions for GPS and very long baseline interferometry from European Centre for Medium-Range Weather Forecasts operational analysis data."** Journal of Geophysical Research, Vol. 111, No. B02406, doi:10.1029/2005JB003629.

Boehm, J., T. vanDam (2009) **"Modelling deficiencies and modelling based on external data."** Second GGOS Unified Analysis Workshop, IERS, Grand Hyatt, San Francisco, CA, USA, December 11-12, (Oral Presentation).

Nievinski, F. G. (2009). **Ray-tracing Options to Mitigate the Neutral Atmosphere Delay in GPS.** M.Sc.E. thesis, University of New Brunswick, Dept. of Geodesy and Geomatics Engineering, Fredericton, N.B., Canada, May, 232 pp., Technical Report 262, http: //gge.unb.ca/Pubs/TR262.pdf.

Tesmor, V., J. Boehm, R. Heinkelmann, H.Schuh (2007). **"Effect of different tropospheric mapping functions on the TRF, CRF and position time-series estimated from VLBI."** Journal of Geodesy, Vol.81, pp.409-421, doi:10.1007/s00190-006-0126-9.