FIG Working Week 2012
Rome, Italy 6–10 May
Knowing to: Manage the territory, Protect the environment, Evaluate the cultural heritage

STOKES'S KERNEL MODIFICATIONS

N. Rabehi[1], A. Belhadj[1], M.Terbeche [2]
[1]Centre of Space Techniques, PO Box 13, 31200, Arzew, Algeria
[2]Sciences Faculty of Oran University, Algeria
Email: rabehin@gmail.com

TS04B - Heights, Geoid and Gravity

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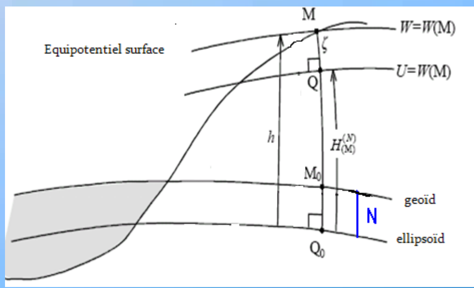
Presentation plan

1. Introduction
2. Modifications of Stokes kernel
3. Comparaison between the two types of modifications
4. Conclusion

Introduction

The geoid is defined as an equipotential surface of the Earth's gravity field, inside the topographical masses on land and more or less coinciding with mean sea level at sea.

$$\boxed{N = \frac{R}{4\pi\gamma}\iint_{\sigma} \Delta g_G S(\psi) d\sigma}$$



Absence of a total gravimetric cover

↓

Truncation of the area

↓

Modification of Stokes kernel

Deterministic modification

- ✓ Minimisation of truncation error.

Stochastic modification

- ✓ Minimisation of truncation error,
- ✓ Minimisation of gravity data error,
- ✓ Minimisation of Earth global Model error.

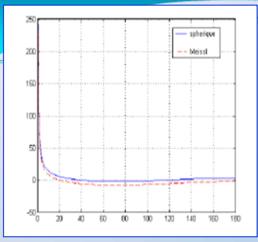


Fig 1: Meissl kernel vs. Stokes kernel

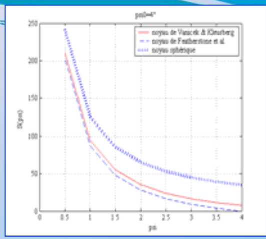


Fig 2: Featherstone and al., Vanïcek and kleusberg kernels vs.Stokes kernel

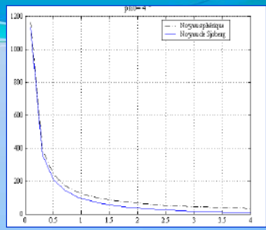


Fig3: Sjoberg kernel vs. Stokes kernel

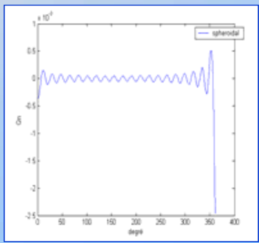


Fig 4: Spheroïdal truncation coefficient

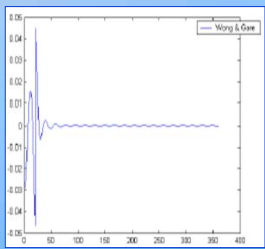


Fig5: Wong and Gore truncation coefficient

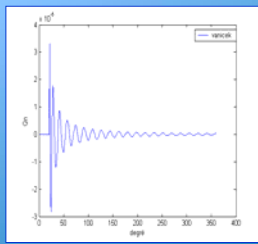


Fig6: Vanicek and Kleusberg truncation coefficient

Comparison between the two types of modifications

- The deterministic modifications are regarded as a particular case of the stochastic modifications.

- The deterministic kernel modifications can be further divided into two categories; modifications that reduce the upper bound of the truncation error, and modifications that improve the rate of convergence of the series expansion of the truncation error.

- The stochastic modifications offer an optimal combination of the data and their errors while adopting known models of variance to be able to model the contribution due to the anomalies of terrestrial gravity as to the geopotential model because they are not very well-known.

Conclusion

In general, all kernel modification approaches are related to each other by making some changes.

However, the lack of information on the errors of the terrestrial gravity data distributed on the Algerian territory, we opt for the use of the deterministic modifications, more precisely the modified kernel by Featherstone and al. in the determination of the geoid for Algeria.

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Thank you

Sphéroïdale	$S^M(\psi) = S(\psi) - \sum_{n=2}^{M} \frac{2n+1}{n-1} P_n(cos\psi)$
Wong et Gore	$S^L(\psi) = S(\psi) - \sum_{n=2}^{M} \frac{2n+1}{n-1} P_n(cos\psi)$
Vanicek et Kleusberg	$S^{VK}(\psi) = S_{WG}(\psi) - \sum_{n=2}^{L} \frac{2k+1}{2} t_k P_k(cos\psi)$
Meissl	$S^{mei}(\psi) = S(\psi) - S(\psi_0)$
Featherstone et al.	$S^F(\psi) = S_{VK}(\psi) - S_{VK}(\psi_0)$