Geophysical Research Abstracts,
Vol. 11, EGU2009-13227-1, 2009
EGU General Assembly 2009

SVD and GSVD as Efficient Tools in Noise-Variance Estimation and Regularization of Discrete Ill-Posed Problems in Downward Continuation

A. Safari (1) and Y. Allahtavakoli (2)

(1) Department of Surveying and Geomatics Engineering, Center of Excellence in Geomatics Engineering and Disaster Management, University of Tehran, Tehran, Iran (asafari@ut.ac.ir), (2) National Iranian Oil Company (NIOC), Exploration Directorate, Survey Department, Tehran, Iran (y_allahtavakoli@yahoo.com)

The main aim of the paper is to answer a question: "Why (ordinary or Generalized) Singular Value Decomposition (SVD or GSVD) are mainly and commonly focused in direct regularization methods of Discrete Ill-Posed problems? While there are various decomposition and factorization methods applied to solving finite dimensional equations in Numerical Analysis and Linear Algebra, such as LU, QR, Cholesky, Gram-Schmidt and etc." At first the purpose maybe seems slightly different from the title but at last, the authors will demonstrate the abilities and efficiency of singular value decomposition in revealing difficulties and properties of Discrete Ill-posed problems and they will show SVD and GSVD as superb tools in Noise-Variance Estimation and Direct Regularization Methods.
First of all, it is performed that the Last Fourier Coefficients of Homoscedastic Uncorrelated Observation Vector have enormous details about Noise-Variance and subsequently these details present Unbiased Noise-Variance Estimators based on the Last Fourier Coefficients of Observation Vector. Then the authors attend to abilities of GSVD in introducing Generalized-Tikhonov regularization strategies in Sobolev Subspace. Also Discrepancy Principle Morozov (DP) Method via the estimated noise-variance is proposed as choice-parameter method.
Finally the mentioned methodologies are utilized in the Downward Continuation of incremental gravity observation by Abel-Poisson integral inversion for Geoid computation in geographical region of Iran as case study.