



## **A GRACE -based Mass Flux Solution in Tibetan Plateau with High Visual Spatial Resolution by Combined Use of TSVD- and Tikhonov Regularization**

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Limited by the Gravity Recovery and Climate Experiment (GRACE) measurement principle and sensors, the spatial resolution of mass flux solutions is limited to about 2-3 degree in mid- latitudes at monthly intervals. In this contribution we attempt to derive the mass flux solution with better 'visual' spatial resolution, of about 1 degree, in the Tibetan Plateau (TP) using GRACE Release 06 data and the Tongji-Grace2018 monthly solution from April 2002 to August 2016. First, the unconstrained GRACE harmonics are represented via 1 degree mass flux parameters. The monthly mass flux parameters resolved at 1 degree are then smoothed to about 2 degree by truncating the eigen-spectrum of the normal equation (TSVD); then Tikhonov regularization is applied to the truncated normal equation. As a result, the terms beyond the spatial resolution of GRACE data are truncated out and the errors in the higher degree and order components are suppressed via Tikhonov regularization. The solved parameters are with the visual spatial resolution of 1 degree, though the independent parameters in the truncated normal equation are approximately equal to those directly parameterized as 2 degree. Our method avoids Gaussian or other filtering techniques. With the mass flux solution in TP at monthly intervals, the secular trend, seasonal and non-seasonal signals are presented, analyzed and compared to previous studies. We find the mass loss over the high mountains and the mass increase in the inner TP, and the overall mass balance is consistent with previous studies.