The full covariance matrices of any product can be reconstructed according to equation (1),

The common eigenvectors , scale factors and fusion weights from the covariance matrices of Tongji-Grace2018 and GFZ-RL06 products (i.e., ) are directly provided as **MAT files** (i.e., **Common\_Eigenvector.mat**, **Scale\_Factor.mat**, **Fusion\_Weights.mat**).

The function relationship between formal errors and eigenvectors of training covariance matrices are obtained by,

where the polynomial coefficients (and time variances are provided in **Fitted\_Coffecients.mat** and **time.mat**.

The fitted eigenvalues and the reconstructed covariance matrices can be derived via “**CR.m**”, respectively.

The **Formal\_Error.mat** include the solutions from ITSG-Grace2018 (April 2002 to March 2016), CSR RL06 (April 2002 to March 2016), JPL RL06 (April 2002 to March 2016), AIUB-RL02 (March 2003 to March 2014), HUST-Grace2020 (January 2003 to July 2016), ITG-Grace2010 (August 2003 to August 2009), SWJTU-RL01 (March 2005 to October 2011), WHU-GPD01s (August 2002 to September 2016) and XISM-Grace01 (April 2002 to March 2016). But you can input the formal errors of any product to derive their reconstructed covariance matrices.

The provided files are toward the SHCs at degree and order 60 (i.e., 3717 SHCs) during April 2002 to March 2016 (i.e., 157 months, without May 2015), but in fact the proposed approach can reconstruct the covariance matrices at any degree (or order) and period, which is associated with the dimensions of training covariance matrices. If you require more, please contact 2011480@tongji.edu.cn.