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Combination of CHAMP and GRACE satellite data for Earth monitoring

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Introduction:

- Concept of energy balance is applied for gravity field recovery.
- The basic characteristic is the use of GPS derived position and velocity data and the correction for non-gravitational forces.
- Time-wise spherical harmonic analysis on a global scale.
- CHAMP monthly solutions depend on groundtrack coverage
- Combination with GRACE satellite data yields more consistent monthly solutions
- Application in geodesy, geodynamics, geology, hydrology, glaciology, sea level, geophysical prospecting

Method:

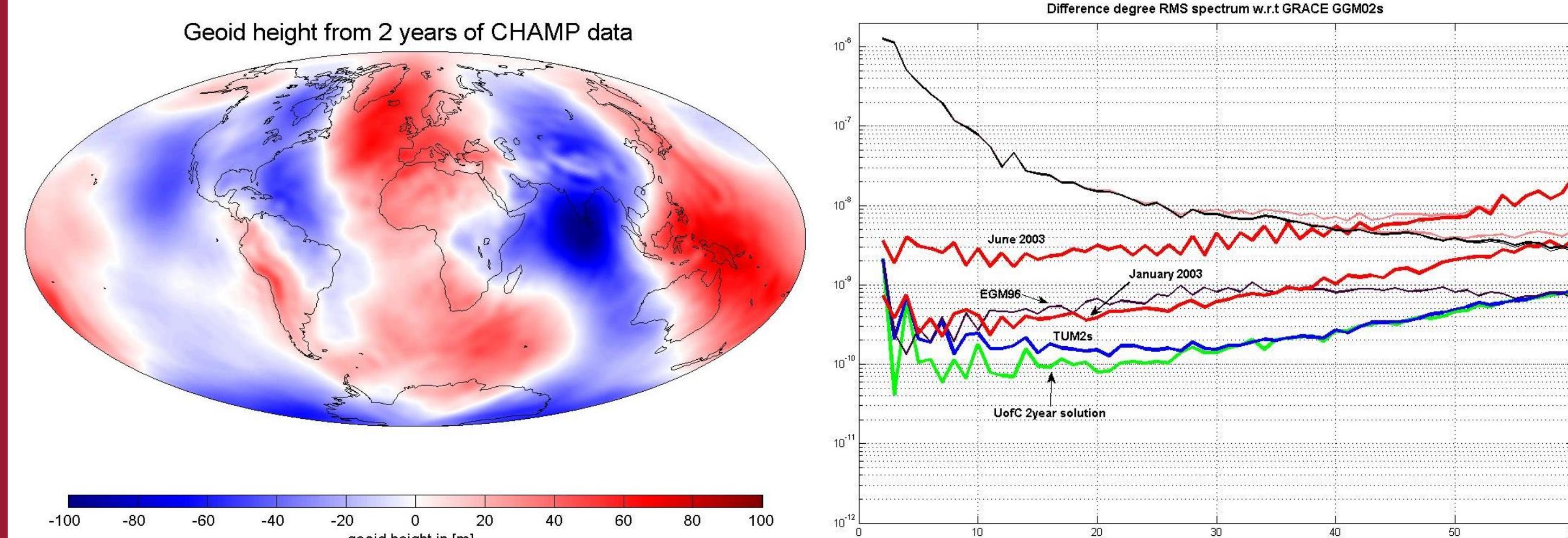
- The energy integral approach is connecting position, velocity and accelerometry to the disturbing potential.

$$T + c = E_{kin} - U - Z - \int \left(f + \sum_k g_k \right) dx$$

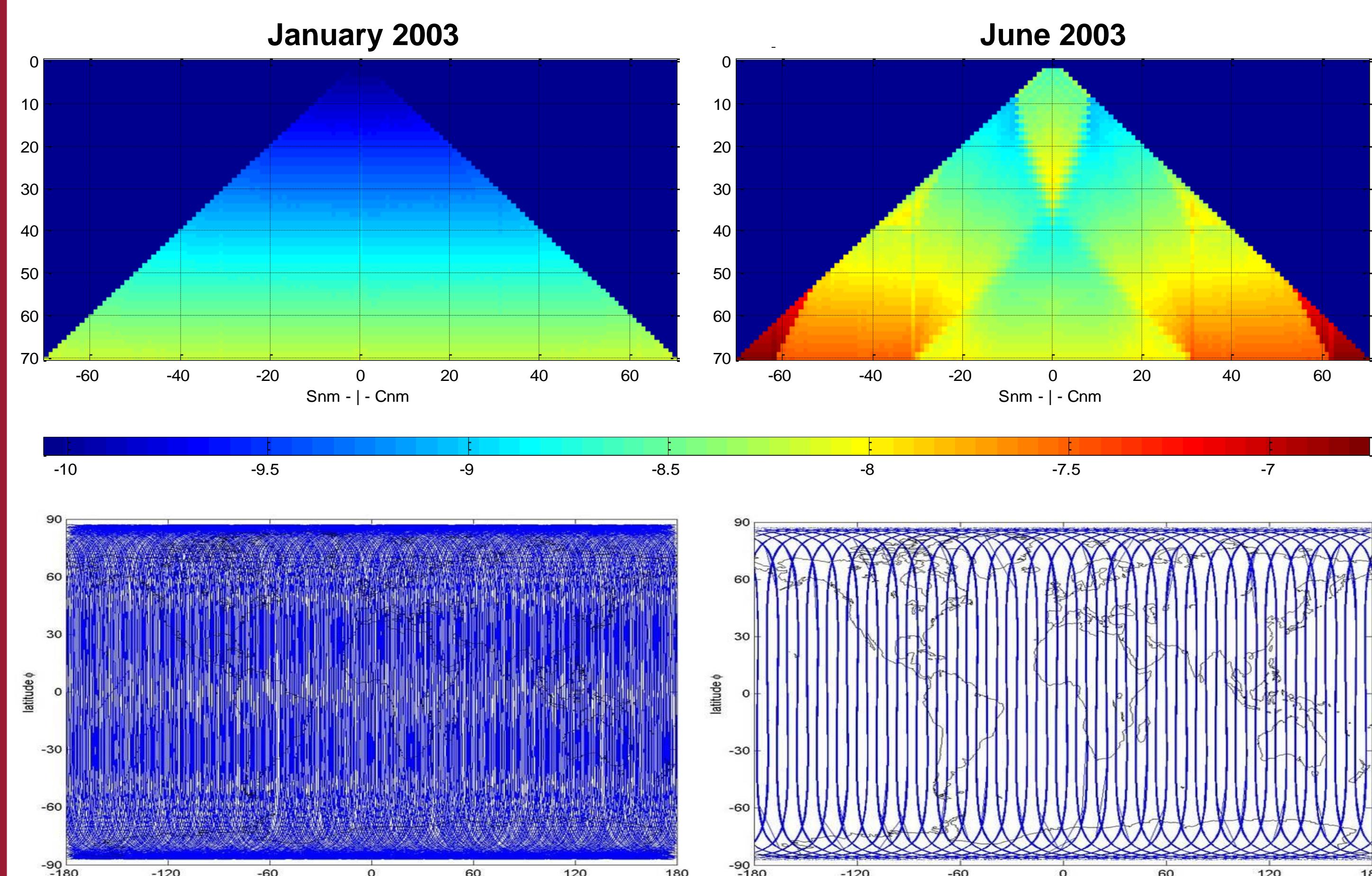
T = disturbing potential
 c = integration constant
 E_{kin} = kinetic energy
 U = normal gravitational potential
 Z = centrifugal potential
 $\int f dx$ = dissipative energy
 $\int \sum_k g_k dx$ = time variable changes

- Spherical harmonic analysis yields spherical harmonic coefficients on a monthly basis

CHAMP-only solutions:

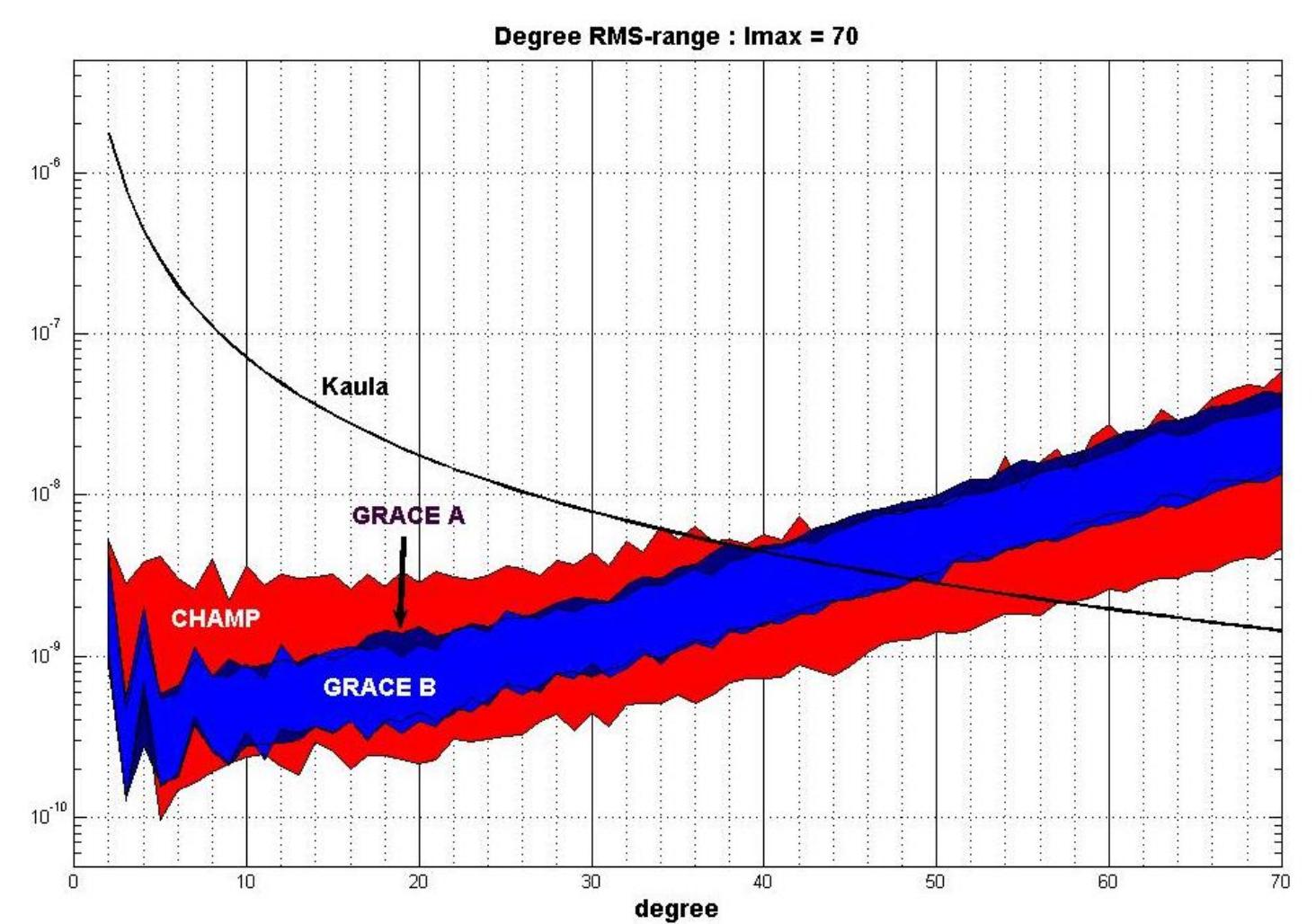
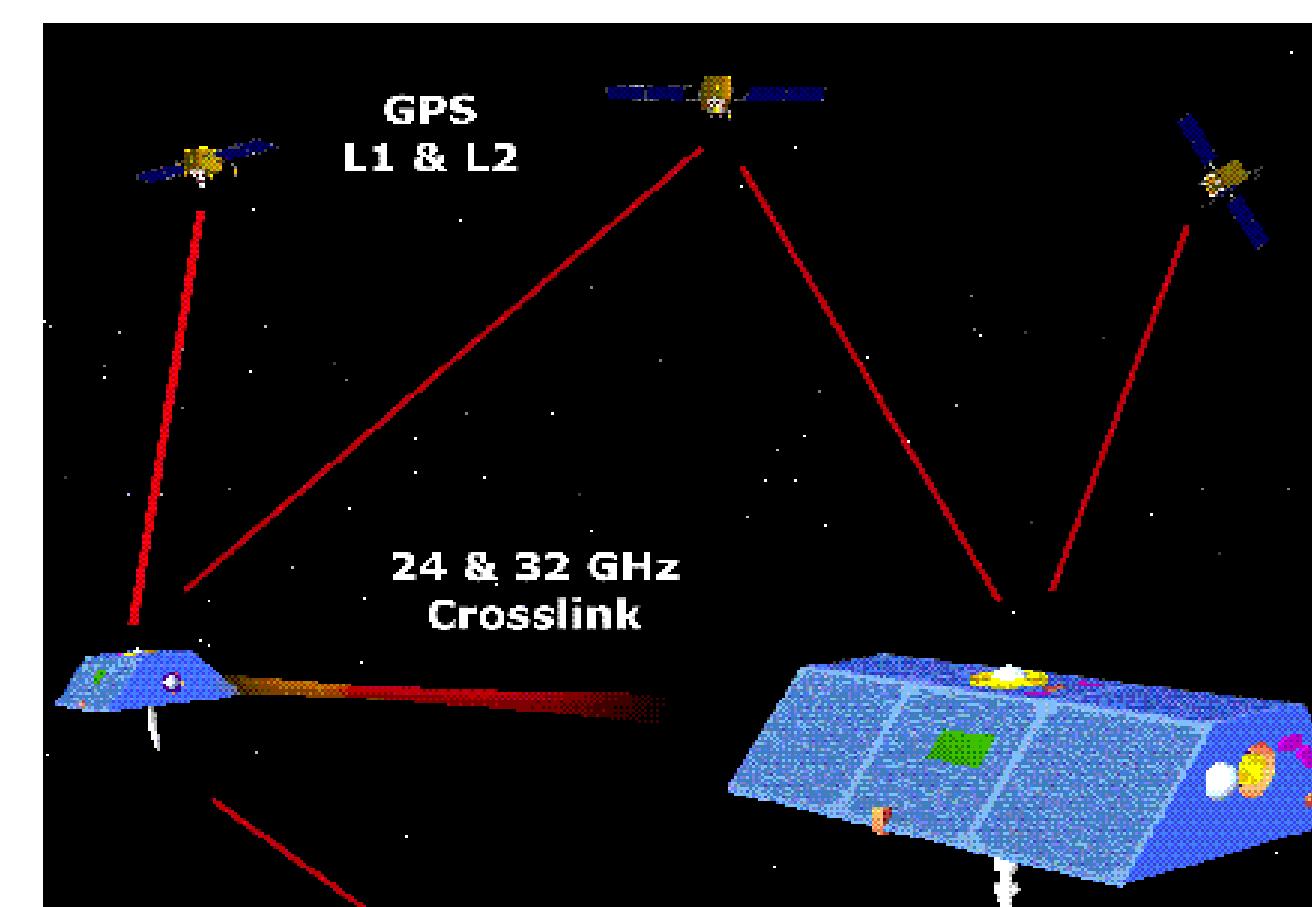


- Recovery of time variable signal from a time variable groundtrack pattern
- Poor groundtrack coverage yields degradation of monthly solutions



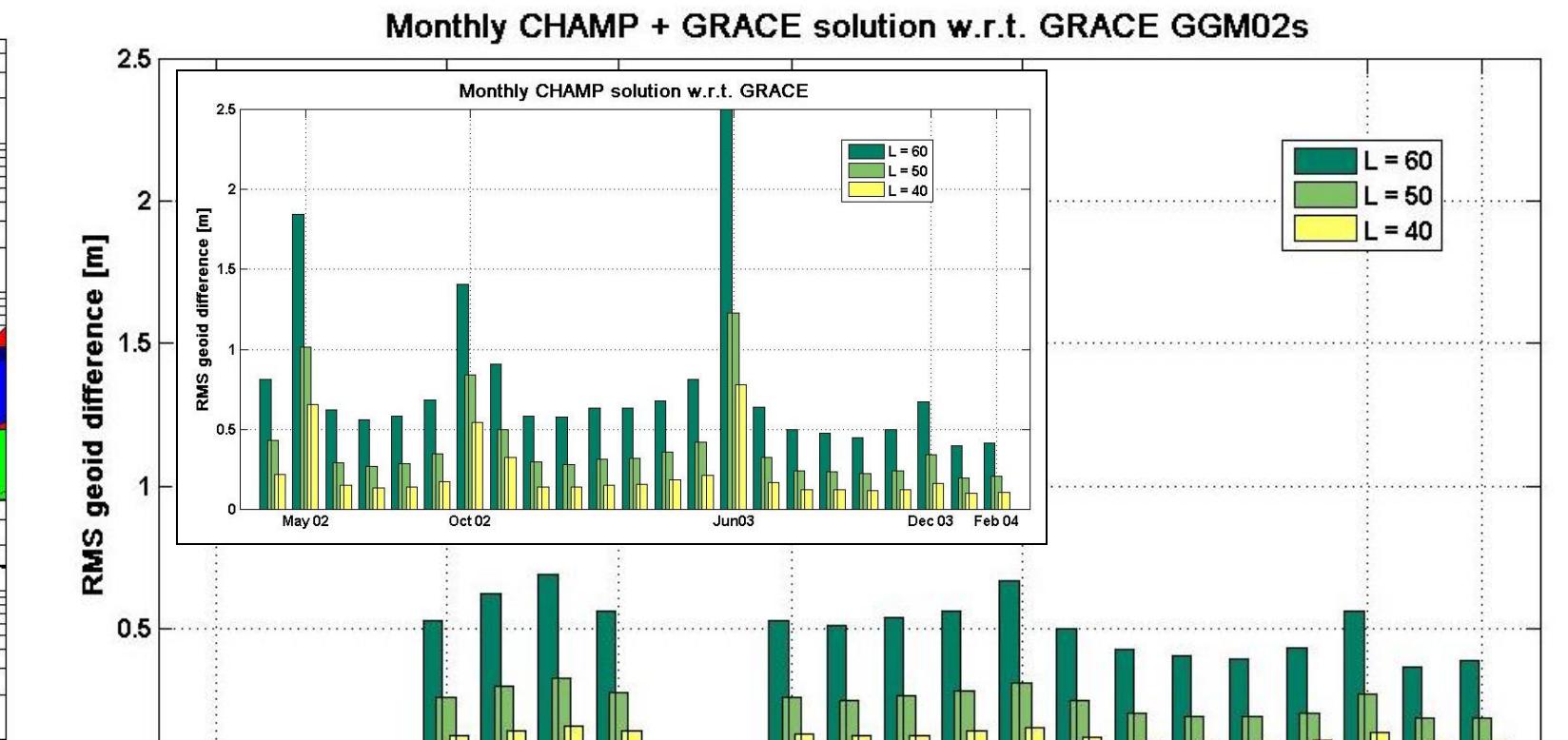
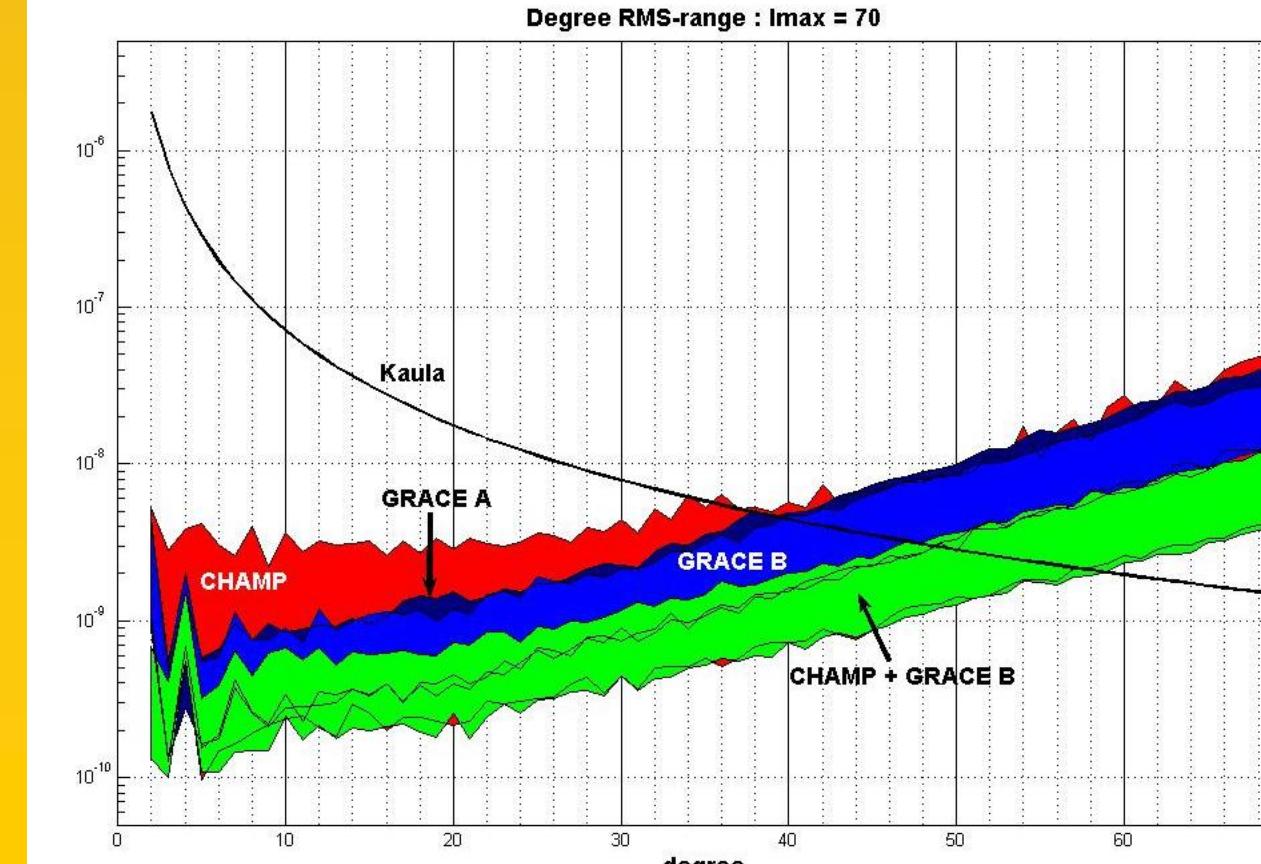
Combination with GRACE satellite data

- GRACE system viewed as two singles satellite systems

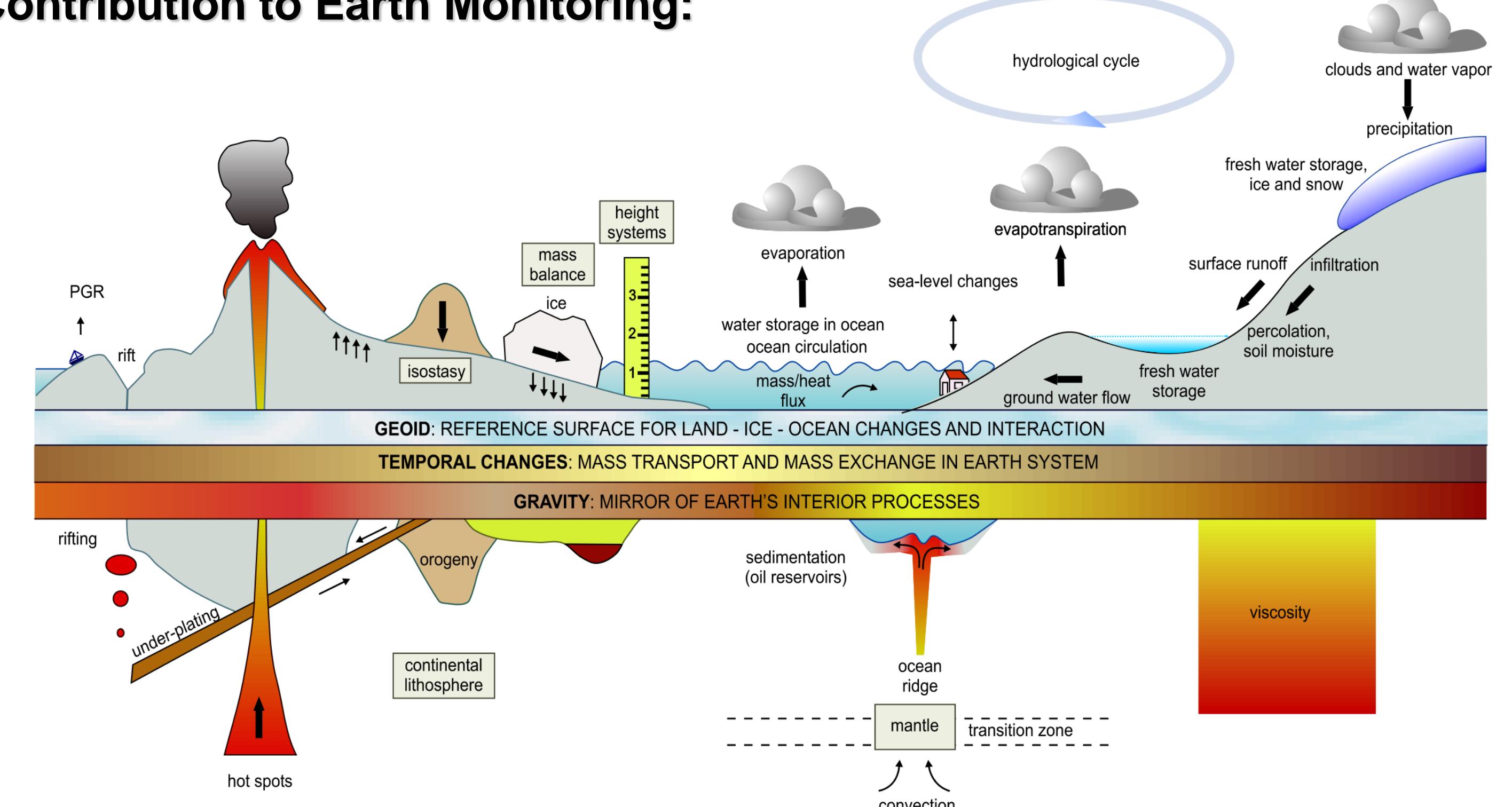


Improvement in monthly solution:

- More measurements and better groundtrack coverage yield more homogeneous and consistent monthly solutions
- Combination needs sophisticated tools, e.g. variance-component estimation



Contribution to Earth Monitoring:



Partner:



National Resources Canada
 Geodetic Survey Division, Canada
 Institute for Astronomical and Physical Geodesy,
 Technical University Munich
 Institute of Geodesy, University Stuttgart
 GeoForschungsZentrum Potsdam
 Institut für Erdmessung, University Hannover

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