

# CHAMP and GRACE Resonances, and the Gravity Field of the Earth

R. H. Gooding (1), C. A. Wagner (2), **J. Klokocnik** (3), J. Kostelecky (4)

(1) University of Surrey, Guilford, England (e-mail: family.gooding@virgin.net), (2) NOAA, Lab. Sat. Altimetry, Silver Spring, MD 20910-3226, USA (carl.wagner@noaa.gov), (3) CEDR - Astr. Inst. Czech Acad. Sci., CZ-25165 Ondrejov (jklokocn@asu.cas.cz), (4) CEDR - Res. Inst. of Geodesy, CZ-25066 Zdiby (kost@fsv.cvut.cz)

With the far more precise orbits of CHAMP and GRACE today than was the standard 2-3 decades ago, there was and is an unprecedented opportunity for determining precise and valuable values of certain lumped geopotential harmonic coefficients of selected orders, independently of comprehensive gravity field models, via the recently revived technique that capitalizes on the resonant variation of appropriate orbital elements, the inclination in particular. Here we first identify important resonances during the lifetime of CHAMP and GRACE in terms of the decaying semimajor axis, these being  $46/3$ ,  $77/5$ ,  $31/2$ ,  $78/5$  and  $47/3$  for CHAMP, and  $61/4$  for GRACE. Then we analyze state vectors for CHAMP and TLE for GRACE A from GFZ, and determined the relevant lumped coefficients. To increase its lifetime, the CHAMP satellite orbit was raised twice, in June and December 2002, so CHAMP passed through  $31/2$  resonance three times. More accurate values for these coefficients are obtained than originally, and the precision for the  $62:4$  'overtone resonance' (implicit in  $31:2$ ) is striking (comparable to that for  $31:2$ ). Most recently CHAMP passed throughout the  $47/3$  resonance yielding the opportunity to determine new lumped coefficients. For GRACE, we have no state vectors and have to work with the TLE only; nevertheless we have lumped coefficients of 61st order from its strong  $61/4$  resonance. In each case the resonant lumped values are compared with those derivable from various global gravity models. We thereby confirm the continuing power of the resonance technique.