

Session 3 summary
Science through missions

Chairs: G. Appleby, G. Bianco

Session 3

- **G. Neumann**, Interplanetary Spacecraft Laser Ranging: The Quest for 1 AU.
 - 2-way link achieved between the Mercury Laser Altimeter (MLA) and the GGAO; 1-way link to MOLA; LOLA, LCCD
- **P. Exertier**, Time Transfer by Laser Link (T2L2) : A way to synchronize laser ranging observatories at the ns level
 - T2L2 allows realizing some links between distant clocks with time stability of a few ps over 1000 s and accuracy of the order of 100 ps.
 - estimation of the frequency variations of the DORIS/Jason-2 oscillator, allowed to synchronize clocks used in the Satellite Laser Ranging observatories at the level of 1-2 ns.

Session 3 (cont'd)

- **G. Beutler**, GNSS for Positioning, Navigation, Timing, and Science.
 - GNSS global science applications considering in particular the commonalities of and the complementarity between GNSS and SLR geodesy.
- **R. Beard**, The NAVSTAR 35 and 36 Laser Retro-reflector Experiments
 - The objective of the NAVSTAR 35 and 36 arrays was the separation of the orbital errors from the onboard clock errors. The activities and development of these experiments will be described and the subsequent utility they provided to the GPS and geophysical communities.

Session 3 (cont'd)

- **B. Tapley, Space Geodesy Contributions to Gravity Model Development**
 - Measurements of the gravity signal associated with continental aquifer mass change, polar ice mass change, mass contribution to sea level change, ocean bottom currents and basin scale total water storage have gravity signals that can be measured to support studies of the climate change processes.
- **Zuheir Altamimi, Status of ITRF2013 preparation:**
 - Weekly solutions for the period 1983-2013.9 recently received from the ILRS Primary Combination Centre
 - ITRF2013 likely available Spring 2015

Session 3 (cont'd)

- **J.P. Berthias**, SLR And altimetry: a success story and a lasting partnership
 - SLR has remained a key contributor to the precise orbit determination of the next generation of European and American altimetry satellites, ERS2, GFO, Jason-1, ENVISAT and Jason-2, as well as for the newer French- Indian SARAL and the Chinese HY-2.
 - Global coverage of the oceans revealed large-scale dynamics and smaller-scale eddy transport
 - POD an absolute necessity to realise accuracy of the altimeters via geo-location of the orbits
- **B.E. Schutz**, The NASA Ice, Cloud and land Elevation Satellite (ICESat) Series: Science, data products and Operations
 - ICESat-1 was launched in January 2003 carrying a laser altimeter GLAS; orbit at 600km with inclination 94°
 - SLR will be required to validate the GPS-derived precise orbits

Session 3 (cont'd)

- **T. Murphy, Lunar Laser Ranging: Science and Status**
 - LLR currently provides many of the best tests of gravity that are available: strong equivalence principle, $G\dot{m}/G$, gravitomagnetism, geodetic precession, inverse square law, preferred frame effects and others.
 - The availability of the once-lost Lunokhod 1 reflector, found recently by LRO, has meant that up to 5 sites on the Moon are often ranged in a session, especially helping libration studies