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TOPEX/Poseidon Precision Orbit Determination: "Quit.k-l.ook" operations With GPS and Laser Tracking Data

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This paper presents a summary of the TOPEX/Poseidon "quick-look" orbit determination using Global Positioning System (GPS) and satellite laser (S1 .R) tracking data. The primary feature of this endeavor is that orbits are produced with small radial position errors (< 5 cm RMS), on a short production schedule (≤ 4 days), with minimal resources.

The TOPHX/Poseidon spacecraft, launched on 10 August 1992, has gathered precise sea-level measurements for over two years. To take advantage of the quality of these measurements, the radial orbit component must be known to better than a decimeter. "Quick-look" orbits using two-way laser tracking data have been created for production of Interim Geophysical Data Records (IGDRs) since launch. This effort has been updated with new geodetic models and expanded to include GPS data. These changes resulted in more accurate orbits and added redundancy to the quick-look processing.

The orbit production with both SLR and GPS data has provided an opportunity to update station location, gravity field, and tide models. The impact of these updates upon orbit quality is reported. With the two data types, there are actually five data combination scenarios which occur during operations: (i) GPS (w/ Anti-Spoofing) & SLR, (ii) GPS (w/o Anti-Spoofing) & SLR, (iii) GPS (w/ Anti-Spoofing), (iv) GPS (w/o Anti-Spoofing, and (v) SLR only. Based on mission experience to date, the first scenario is most frequently encountered, and the last is the former processing mode. The filtering strategy is matched to the data combination available. Comparisons of orbits created under all five scenarios are made to existing precision orbit ephemerides to demonstrate their relative accuracy as an orbit product.

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