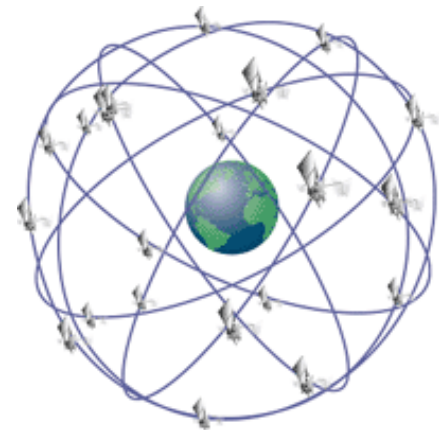


GPS Microwave Orbits versus SLR Observations

Tim Springer

Overview

- Detailed investigations by Claudia Urschl (AIUB, Bern, Switzerland)
 - SLR residuals from the GPS satellites show a strong dependence on orbital latitude ($u-u_0$) and elevation of the Sun above the orbital plane (beta-angle)
 - SLR residuals from the Glonass satellites do not show such behaviour
 - “Signal” observed within the SLR residuals of the GPS satellites may be due to the ROCK models
 - » With “CODE” model much less “signal” visible
 - Non-zero mean bias between all GNSS orbits (GPS and GLONASS) and the SLR observations. Glonass mean bias approximately 10mm
- Orbit modelling innovations by Marek Ziebart (UCL, London, England).
 - Earth Albedo and IR-radiation change the scale of the GNSS orbits
 - “Power thrust” effect also changes the scale
 - Total effect approximately ~20mm.
 - This does explain the mean bias, but does it also explain the observed “signal”?
 - JPL uses the Albedo/IR model and gets 0.5ppb orbit difference compare to IGS (0.5ppb = 13mm)
- Preliminary Giove-A analysis at ESOC
 - 7466 observations, -25mm Mean, 113mm RMS (two way range residuals)
 - » Bias approximately -13mm.
 - » No $u-u_0$ /Beta-angle dependency visible (RMS rather high).



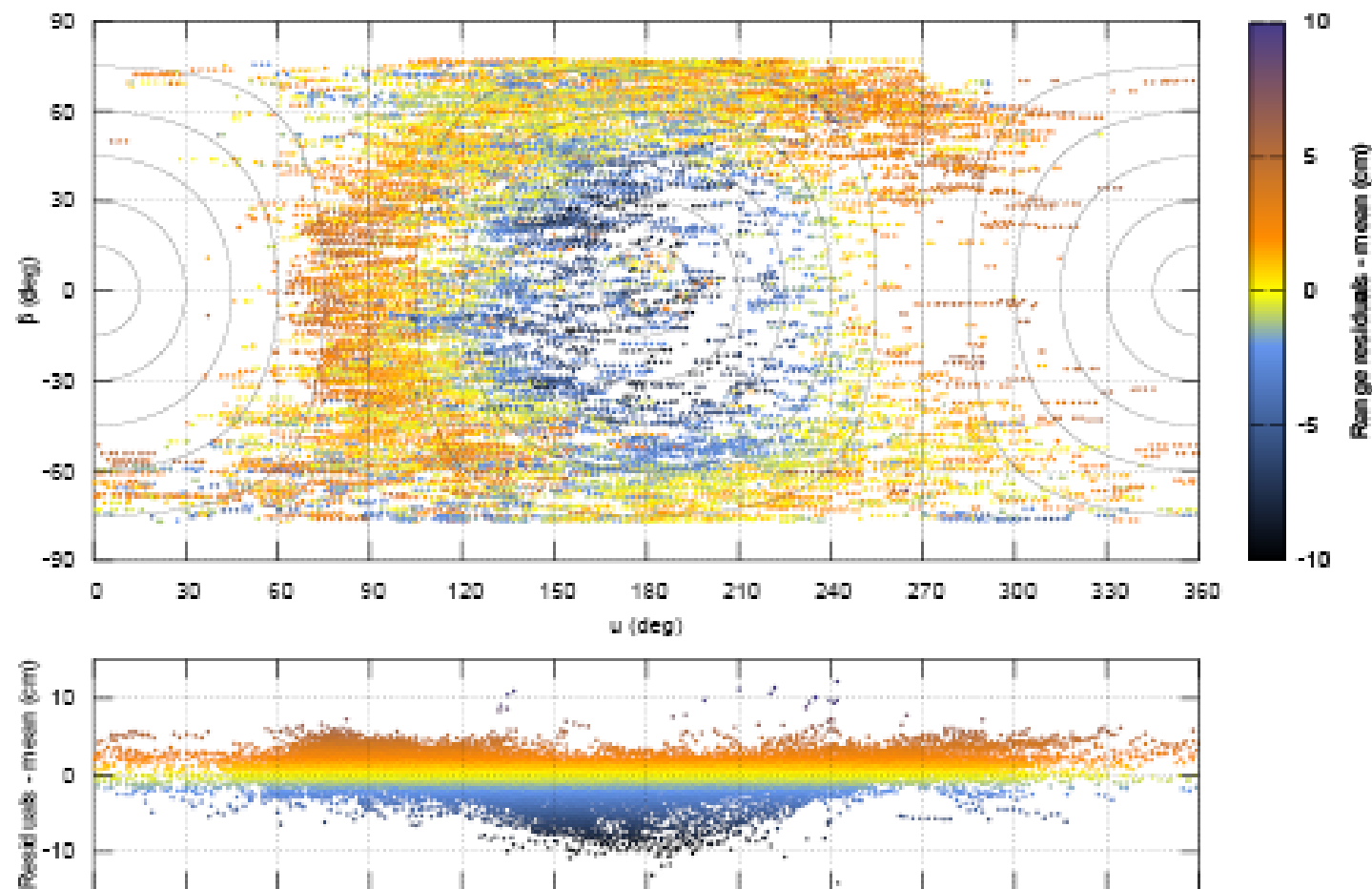
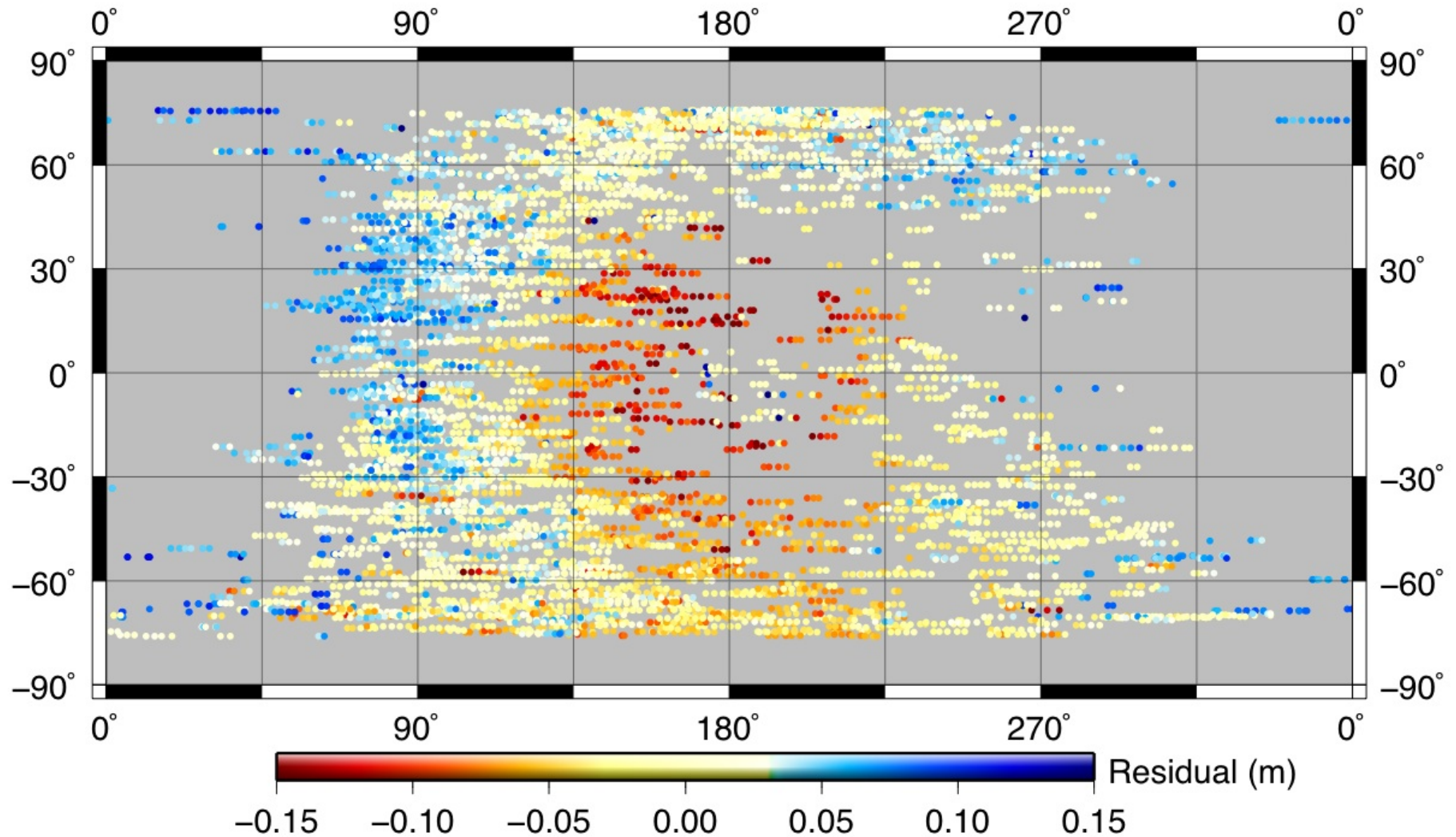


Fig. 4. Color-coded SLR range residuals (cm) minus mean value derived from CODE final orbits for the GPS satellites PRN G05 and G06 in the (u, β) -coordinate system; bottom: projection onto u -axis; circles represent elongation angle E , 15° spacing, 0° at center, 180° at edges.

GPS-SLR Residuals 2006

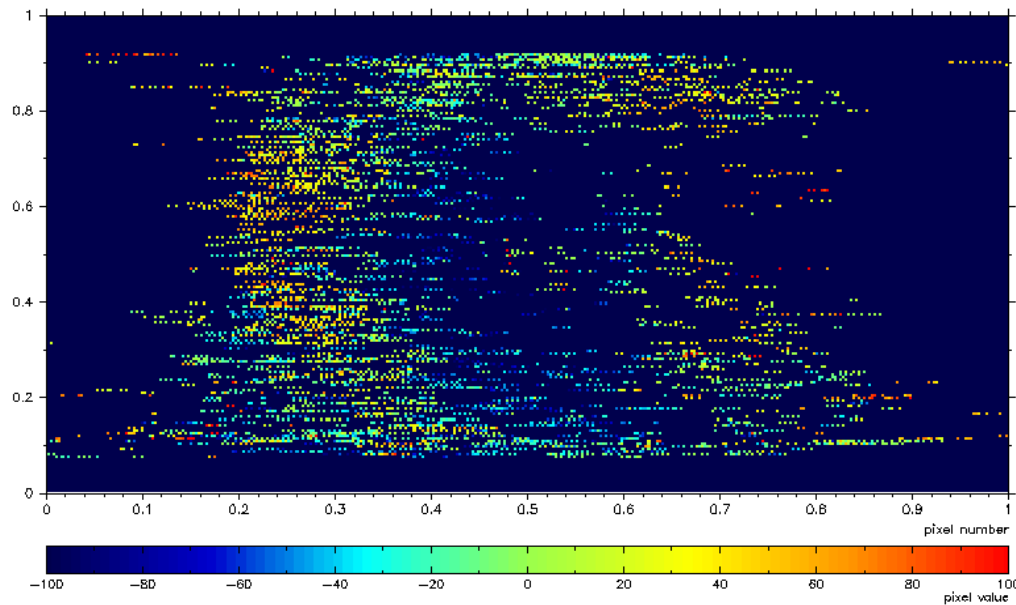


Based on IGS final orbits.

Note: These are 2-way SLR residuals, AIUB uses 1-way residuals SLR

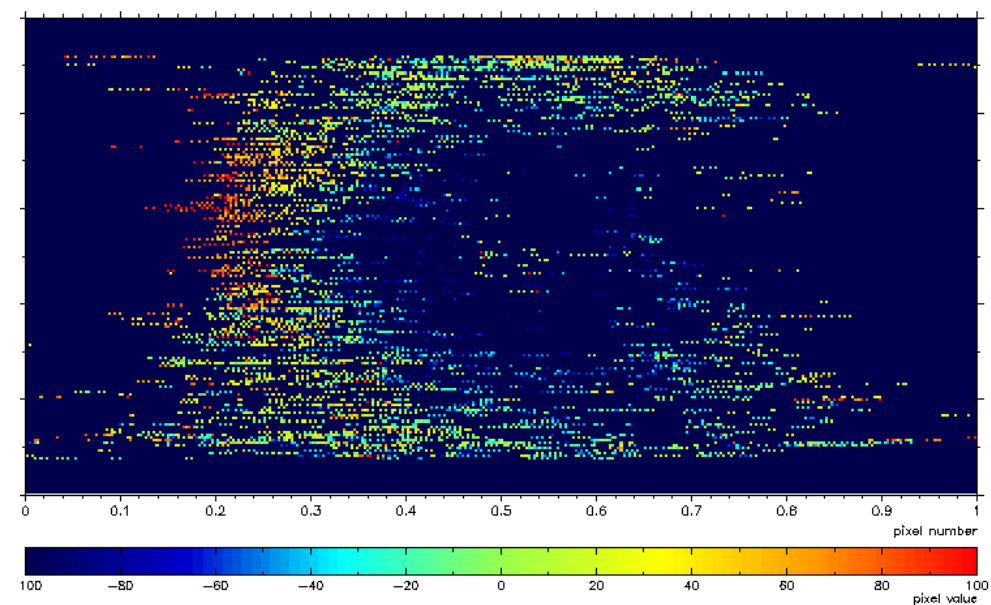
CODE

GPS-35



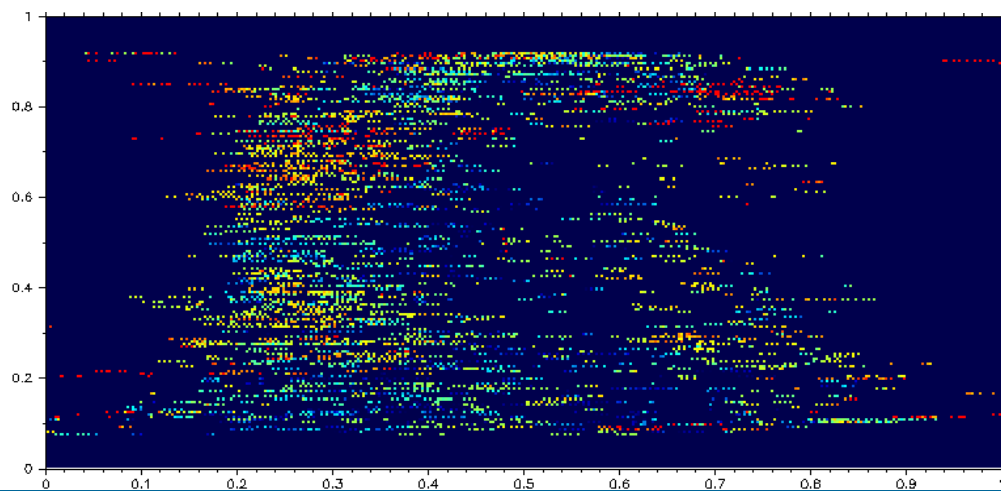
JPL

GPS-35

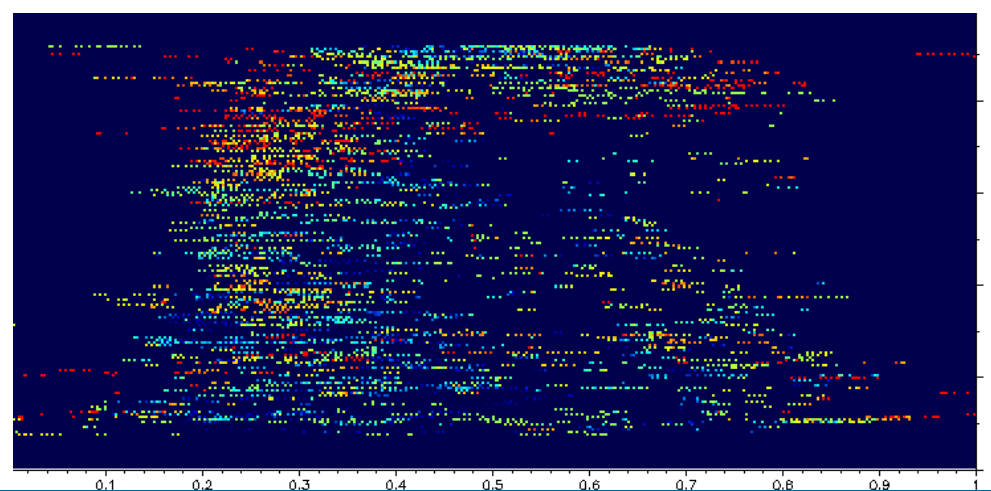


GPS-SLR Residuals 2006

MIT



SIO



CODE and JPL: Rock (or Rock-like) models as a-priori
MIT & SIO no Rock model as a-priori

Discussion

- Do we trust the ROCK model?
 - Is it the source for the observed “signal” in the GPS-SLR residuals
- Earth Albedo and Earth IR-radiation seem to give a scale effect
 - “old” and new (Ziebart) model both give a significant scale
 - Also tested at ESOC and observed 0.5ppb scale change
 - » Radial ~12mm bias and ~4.8mm periodic signal (16ps clock)
 - » 3D ~15mm bias and ~5.1mm periodic signal
- IGS will need to adopt an Albedo and IR model
 - Which one?
- How about the “power thrust” effect
 - Few mm radial effect

