



ERTH 455 / GEOP 555
**Geodetic Methods for Understanding Earth's
Surface Deformation**

– Lecture 01: Logistics, Introduction–

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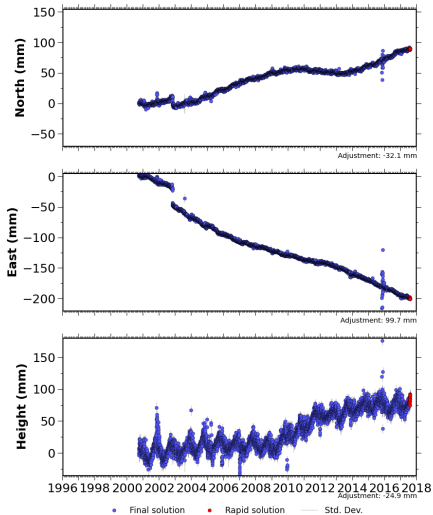
August 21, 2017

- Syllabus
- Course Website (in progress):
<http://grapenthin.org/teaching/geop555>
- Field trip? When is best time?: SMB site.
- Term Projects
- Labs
- This class is for YOU ...

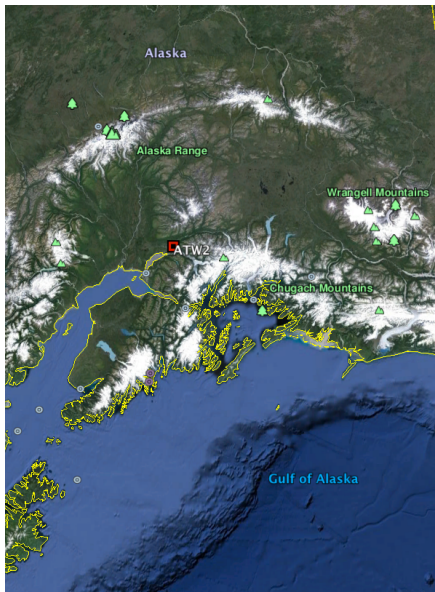
Guess The ≈ 8 Processes

ATW2 (ATW2_AKDA_AK2000) NAM08

Processed Daily Position Time Series - Cleaned (Outliers Removed)



Source file: ATW2.pbo.nam08.pos Last epoch plotted: 2017-08-18 12:00:00



A previous term project

different slides ...

Navigation improved them all . . .

- Geodesy: study of size and shape of the Earth; mapping of its surface (positioning, earth rotation/orientation, gravity)
- Timekeeping: Art and science of measuring time
- Astronomy: provided reference system

Old Geodesy, Astronomy

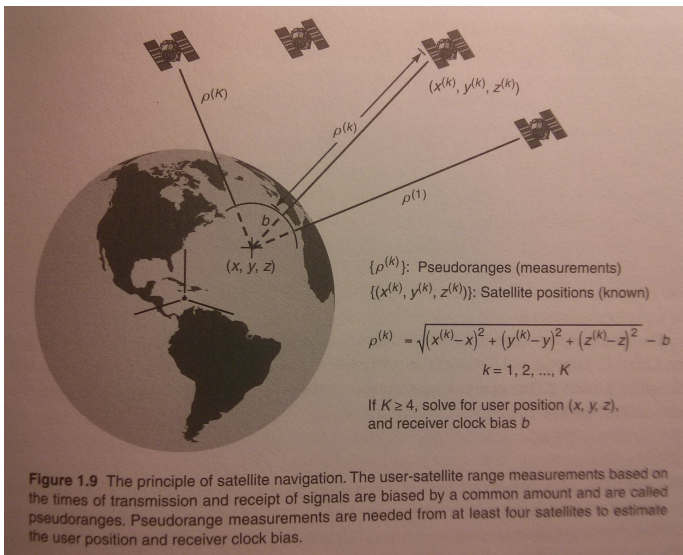
Measurement of angles:

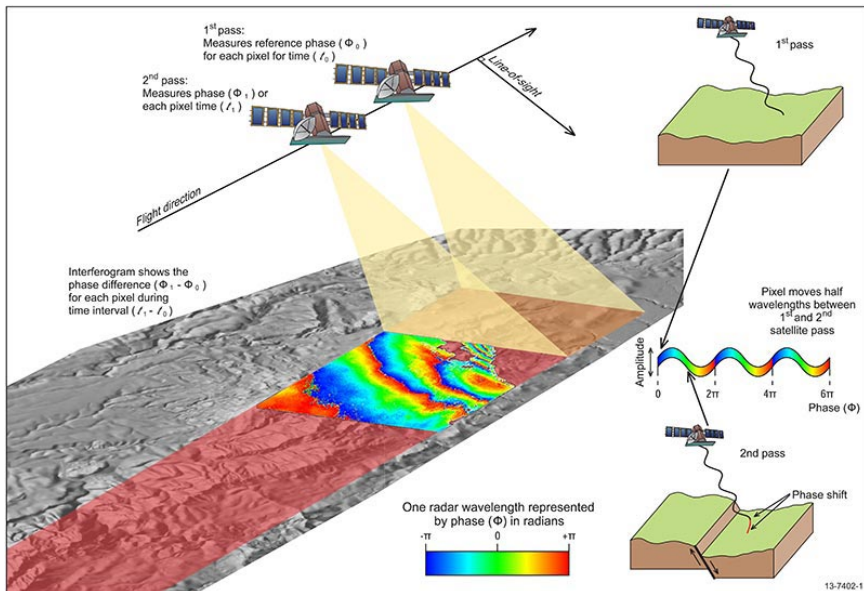


Peter Apian's *Geographia* 1533

Space Age Revolution (and atomic clocks!)

- Change from measuring angles to measuring **distances**
- Precise distance measurement requires precise timing: atomic clocks in 1950s
- Different satellite systems predecessors of GPS
- GPS: provide position, time, velocity
- Fundamental ideas in GPS:
 - passive system broadcasts signal, user listens
 - positioning through trilateration (70s: great clocks!)
 - spread spectrum signaling: all satellites transmit simultaneously on one radio frequency
 - constellation: each user needs 4+ satellites . . . economic choice: Medium earth orbit at 20,000 km





GRACE Mission

Science Goals
High resolution, mean & time variable gravity field mapping for Earth System Science applications.

Mission Systems

Instruments

- KBR (JPL/SSL)
- ACC (ONERA)
- SCA (DTU)
- GPS (JPL)

Satellite (JPL/DSS)
Launcher (DLR/Eurokot)
Operations (DLR/GSOC)
Science (CSR/JPL/GFZ)

Orbit

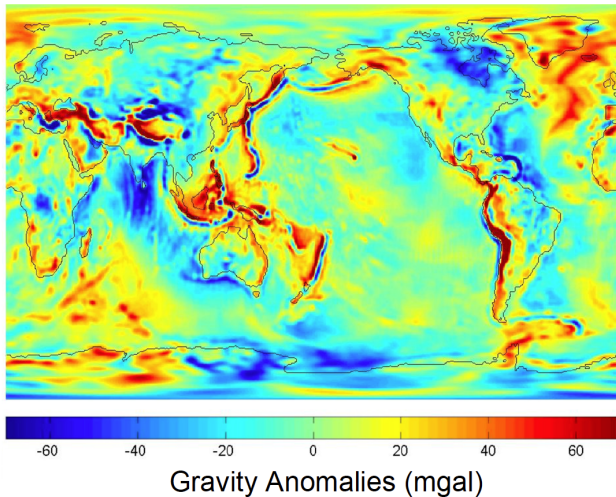
Launch: June 2001
Altitude: 485 km
Inclination: 87 deg
Eccentricity: ~0.001
Lifetime: 5 years
Non-Repeat Ground Track
Earth Pointed, 3-Axis Stable

The diagram illustrates the GRACE mission components. Two GRACE satellites are shown in orbit, connected by a red line labeled '24 & 32 GHz Crosslink'. They are also connected to GPS satellites labeled 'GPS L1 & L2'. Ground stations on Earth are shown with red lines connecting to the satellites: 'Poker Flat' (SDS, CSR/JPL/GFZ), 'Spitzbergen' (RDC, DLR-DFD), 'Neustrelitz' (Downlink: 1 MHz/1.5 GHz, Up: 4 Kbit/s), and 'Weilheim' (Downlink: 1 MHz/1.5 GHz). Other ground stations include 'NASA Stations LEOP & Contingency (Also McMurdo)' and 'Mission Control (DLR-GSOC)'. The satellite is also connected to 'S-Band TT&C'.

courtesy: Geoscience Australia, <http://www.ga.gov.au/scientific-topics/positioning-navigation/geodesy/geodetic-techniques/interferometric-synthetic-aperture-radar>

Gravity Field(from GRACE)

GGM03S (47 months)



Tapley et al. 2007, AGU