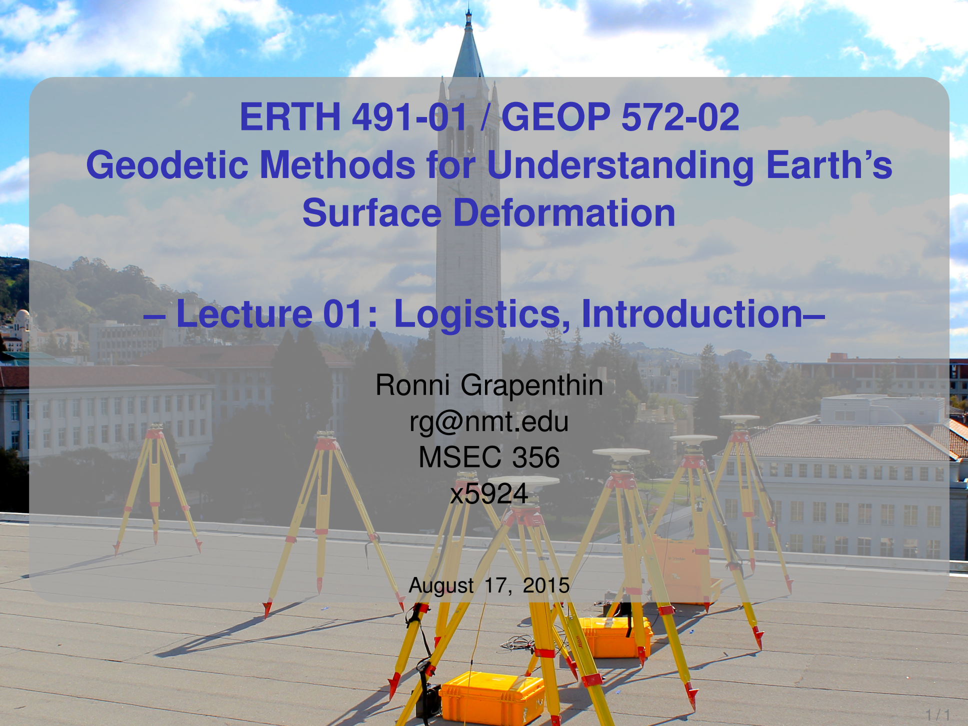

ERTH 491-01 / GEOP 572-02
Geodetic Methods for Understanding Earth's Surface Deformation

– Lecture 01: Logistics, Introduction–

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Logistics

- Syllabus
- Course Website (in progress):
  `http://grapenthin.org/teaching/geop572_2015`
- Field trip? When is best time?: Valles, local?
- Term Projects
- Labs
- This class is for YOU ...

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

Longitude and Time

- difference in longitude between 2 places == difference in local time
- Earth rotates 360° / 24 hrs = 15° / hr
- Challenge (for centuries!): Knowing local times in 2 places instantaneously
- Mechanical clocks: in 16th century good clock had error of 10 min/day ($\propto 1^c irc$, integrate over voyage!)
- Astronomy: observe celestial event and determine longitude . . . for navigation requires prediction of these events (decipher patterns of heavenly bodies)

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

GPS

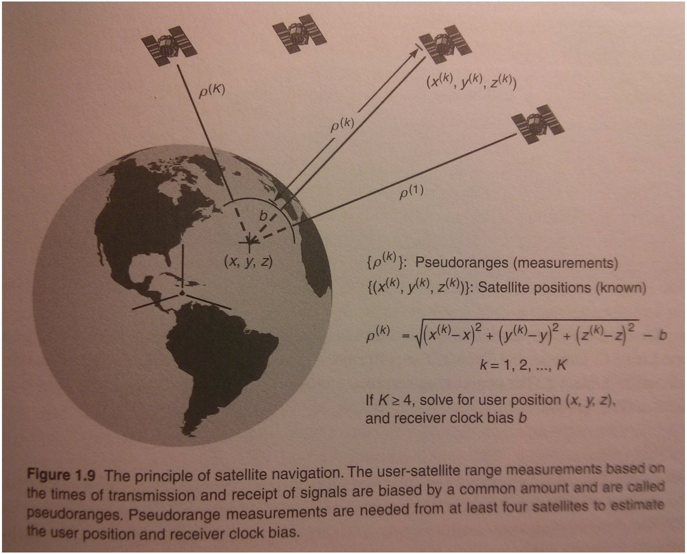
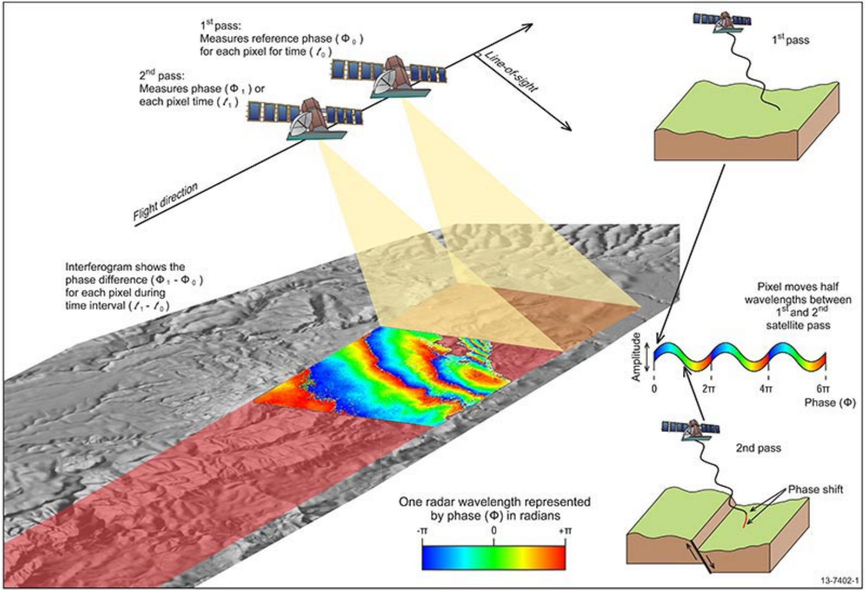


Figure 1.9 The principle of satellite navigation. The user-satellite range measurements based on the times of transmission and receipt of signals are biased by a common amount and are called pseudoranges. Pseudorange measurements are needed from at least four satellites to estimate the user position and receiver clock bias.

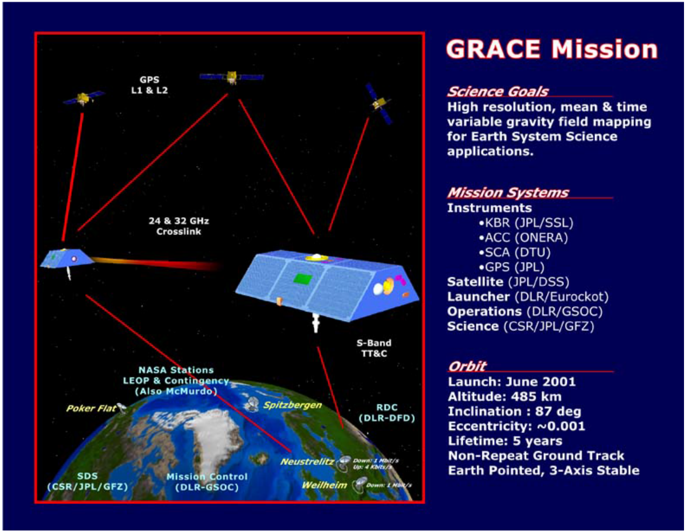
Misra and Enge, 2011, GPS–Signals, Measurements, and Performance

InSAR



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

Gravity



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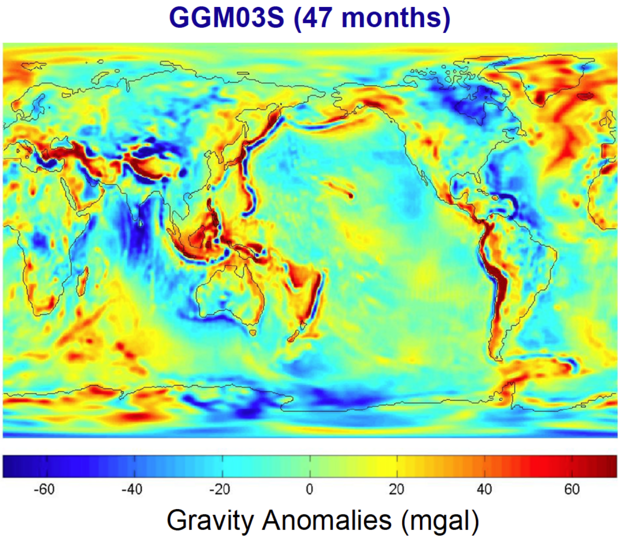
Gravity Field(from GRACE)



Tapley et al. 2007, AGU