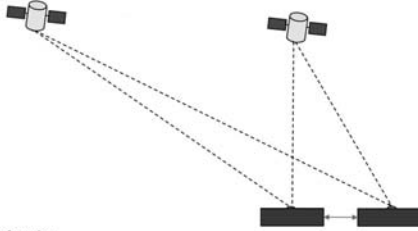


How GRACE Works

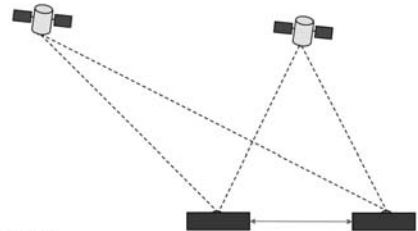
GPS SATELLITES



1 Ranging system measures distance change between the twin satellites

MASS ANOMALY
(fixed or moving "lump")

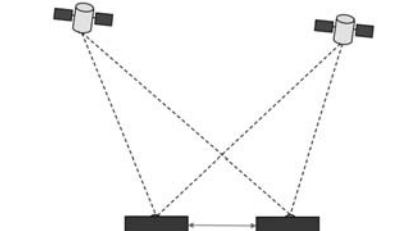
GPS SATELLITES



2 The leading satellite - being closer to the anomaly - feels a greater gravitational attraction, thus moves away from the trailing satellite

MASS ANOMALY
(fixed or moving "lump")

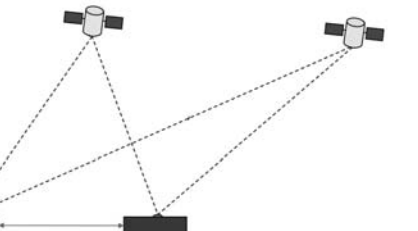
GPS SATELLITES



3 Now the trailing satellite, getting closer, is also accelerated by mass anomaly, thus catches up to the leading satellite

MASS ANOMALY
(fixed or moving "lump")

GPS SATELLITES



4 The leading satellite is far from the anomaly, and is not affected by it; while the trailing satellite - having just passed the anomaly - is being tugged backwards, increasing separation

MASS ANOMALY
(fixed or moving "lump")

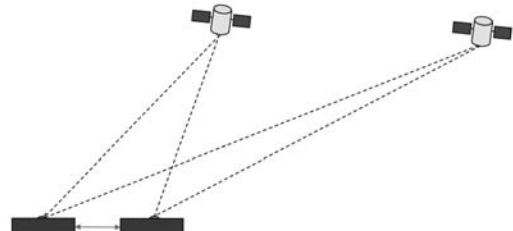
GRACE is different from most Earth Observing satellites. Rather than imaging the Earth, it detects gravity changes by measuring the distance between the satellites themselves. But how does this distance measurement relate to gravity?

The gravity field of a body depends on its mass and shape. For a perfectly spherical and uniform body, the gravity field is simple and symmetric in any direction. The mass distribution of our planet, however, is irregular and 'lumpy'. Molten rock flows in the Earth's mantle to drive tectonic plate motion, enormous quantities of water are exchanged between the ocean and land, and atmospheric masses are also in continuous movement.

As the satellites move through this uneven gravity field, the orbits of each satellite are slightly disturbed, which affects the distance between the two spacecraft. GRACE's uniquely precise microwave ranging system measures changes in the approximately 220 km distance between the satellites with an accuracy of some microns – about one-tenth the width of a human hair!

In addition to measuring the distance between each other, the satellites use the GPS system to determine precisely where and when the measurements were taken. The ultra-precise measurements taken by GRACE, combined with tracking data from the GPS satellites, allows scientists to map the Earth's gravity field with unprecedented accuracy.

GPS SATELLITES



5 The trailing satellite catches back up with leading satellite but the 'signature' of mass 'lump' has been captured as a sequence of changing disturbances

MASS ANOMALY
(fixed or moving "lump")