1. Calculate the change in gravitational acceleration at the point (in mGal) between the lunar noon and lunar midnight. Assume a spherical Earth of radius RE = 6.378 × 106 m, the distance from the center of the Earth to the Moon is RM = 3.8 × 108 m and the lunar mass is 7.3 × 1022 kg.

The acceleration ranges from 3.488 mGal at lunar moon to 3.262 mGal at lunar midnight giving a change of 0.226 mGal.

1. What is the increase in gravity at the equator from 600 Ma to the present due to this change in rotation, assuming no change in the Earth’s shape? By extrapolation, the period of the Earth’s rotation around 4 billion years ago was 6 hr. What is the difference in gravity at the equator due to this change in rotation? Express your answer in mGal.

The present acceleration due to rotation is 1073.66 mGal. At 600 Ma, this acceleration would have been around 1440.02 mGal, which means that gravity has increased by 366.36 mgal. At 4 billion years, the 6hr hour rotation gives an acceleration of 17178.56 mGal, which gives an increase of gravity around 16104.9 mGal since Earth’s early formation.

1. Plot a graph showing three curves: of the change in gravity as a function of latitude due to change in angular velocity, the change in gravity due to the flattening of the Earth, and the sum of these two graphs. Discuss the plot, which factor has the largest affect on gravity?



By the formulas, it would appear that the flattening of the earth is the main contributor to the variation in gravity. However, the increased mass towards the equator due to flattening helps reduce this effect, and leads to the centrifugal variation having a higher effect in reality.