EARTH TIPS THE SCALES:

Do you watch your weight? Do you ever step on the scale and groan or curse that extra pound or two? Well, thanks to GRACE (Gravity Recovery and Climate Experiment), we can all now blame just a tiny bit of that weight gain on Earth tugging at us from below. Earth, it turns out, has its own battle of the bulge, gaining and losing weight each year, changing -- ever so slightly -- our weight as well.

The GRACE program consists of two basic components. First is a dedicated satellite that orbits our planet, continuously taking measurements of Earth's gravity field with a highly sensitive instrument called a gravimeter. Second is a bunch of very smart geophysicists and computer programmers who analyze all this data and make sense of it. It's a wonderful example of international scientific cooperation among the United States (specifically, the National Aeronautics and Space Administration), Germany (the Deutsches Zentrum fur Luft und Raumfahrt) and Russia, where the group launched its satellite in March 2002.

As with measurements of our weight in the doctor's office or gym, the GRACE gravimeter is part of a program to monitor Earth's changing weight for the purposes of planetary health. Earth is gaining weight because of incoming cosmic dust, showers of shooting stars and the occasional large meteorite.

Although planetary weight changes may be slight, local gains are more noticeable. Many processes shift weight from one place to another -- for example, monsoon rains, rising sea level, melting glaciers, mined-out mountains, over-pumped aquifers and oil wells sucked dry. In response to these local gains and losses, Earth's crust flexes up and down ever so slightly. Though geophysicists have known about these things for years, the recent results from GRACE (published in the July 2004 issue of the journal Science) are absolutely astonishing. Its satellite can look down on Earth from outer space and watch the watershed of the Amazon River bulge up and down approximately a centimeter (the thickness of your finger). This occurs in response to weight gained and lost during wet and dry seasons, which are October through November and May through June, respectively.

Nature has given us the perfect excuse for blaming our weight gain on something else. But to convince our friends, we need to understand the basics of gravity as worked out by Isaac Newton, the Englishman with a funny wig. He was inspired when an apple fell on his head (so goes the story from middle school science class). He figured out that your weight on any scale results from three separate things. First is the accuracy of the scale, which we will assume to be correct. Second is the distance between your body and the center of Earth; you weigh slightly less while cruising in an airplane (or in Denver), slightly more while cruising in a submarine. The third and most important variable, however, is the combined mass of your body and that of Earth. You would weigh less on the moon, not because you have less mass, but because the moon does, meaning that it can't pull you downward with as much force as the more massive Earth.

Basically, the results from GRACE prove that Earth takes on water here and there, bulging and sagging in one place or another, though not quite enough to justify blanketing a continent with spandex or Lycra. As a consequence, Earth gains and loses mass beneath the scales we step on in our homes, the spa or locker room. Hence, clever folks like us can greatly exaggerate the gravitational influence of this extra mass to claim that Earth -- not that extra helping of mashed potatoes -- makes us weigh more on some days than on others. It's true, at least in theory.

Alas, the honest truth is that virtually all of the weight you gain and lose on the scale will be because of changes in the mass of your own body, not that of Earth. However, there will always be that teeny bit of weight change caused by the shift in the planet beneath us. I find that fact a comforting thought.
in the age of super-size meals and super-size rationalizations, one that might allow me to have my cake and eat it too.