Re: erosion, ice sheets, glaciers, glaciation and u−shaped valleys

Source: http://sci.tech−archive.net/Archive/sci.geo.geology/2005−09/msg00011.html

- *From*: "Daryl Krupa" <icycalmca@xxxxxxxxx>

- *Date*: 1 Sep 2005 18:45:28 −0700

don findlay wrote:
<snip>
> I would think compressibility is a very real property
> to take into account when it comes to crustal loads,
> but I don't think it figures in questions of
> isostatic equilibrium, ...does it?

It does not, usually.

> Isostacy just deals with 'floatation' does it not?

That depends on what definition you are implying by
" 'flotation ' ".

> and the lateral balance when you move loads
> about on the surface. Shifting weights.

The key word there is "lateral":
Depression of the surface results from lateral movement of
plastic mantle material away from the load.
After removal of the load,
Uplift of the surface results from lateral movement of
mantle material toward the formerly loaded area.

> Which leads to the question:−
> does a ship float *on* the water, or *in* the water (crust on/in
> mantle), and the equivalent one, is the ice floating *on* the crust or
> *in* the crust (and the attendant questions of 'forebulge' that you
> mention) (but no, I wasn't talking about that.)

This is more than one question.
The crust does not float on the mantle, or in it.
The crust rests on the mantle.
Ice on land is not floating.
I am having trouble determining your meaning of "floating".

> > Therefore, I do not know follow your meaning.

<snip>
> > Please elucidate your references to 'heave' and 'swell'
> > in relation to the effect of an accumulation of ice on
> > the movement of the Earth's surface.
>
> (Heave/ swell − depress/ raise) ...

Heave is an upward movement, not a depressing movement.
Thus my confusion.

> So, correct me if I'm wrong, but
> I don't think notions of crustal strength and compressibility are much
> taken into account when considering 'isostacy', except loosely to
> estimate slow rates of 'rebound',

Rates of rebound can be rather closely measured by
dating marine material on raised beaches and measuring
their elevation.
No discussion of crustal properties is required.
One need only observe the effects of the isostatic
movement, whatever its cause or complicating geophysical
factors.
I have not seen
notions of crustal strength and compressibility
mentioned in discussions of estimates or measurements of
isostatic rebound.
I have seen
notions of crustal strength
mentioned in discussions of tectonic movement and faulting,
but isostatic movement is not usually a part of those discussions,
IMO.
I do not recall seeing
notions of crustal compressibility
mentioned in discussions of vertical movements of
the Earth's crust; rather, the matters of mantle viscosity
and load are mentioned.

> and yet it would seem to be very important in itself,
> as a factor in whether isostacy works *at all* or not.

Isostatic happens. There is no question of that.
It is easily observed in areas that have been deglaciated
since the Last Glacial Maximum (LGM). E.g., by me.

> My facetious remark was a crude way of introducing the question,
> in view of the implication that follows from isostatic rebound, that
> the 'lifting of the land' to the extent of (say) creating the himalayas
> should be a measure of something like melting ice.

I see no question, above.
I do not know what you refer to with the term

"something like melting ice".
I can only guess at your meaning.
Please write for comprehension.

The Himalaya is an erosional remnant of
a previously uplifted area.
Isostacy did not create the uplifted area.
Isostacy is said to maintain it as an uplifted area,
as erosion reduces the load on the mantle.
Melting of Himalayan ice would result in uplift, just as
erosion of Himalayan rocky material would result in uplift.

> Why haven't the Deccan Traps, and the Ethiopian Highlands 'sunk',

I imagine that addition of lava to the Deccan surface
might create a depressing load, but the matter is
complicated by the uplifting and depressing effects of
volcanic movement of lava and magma beneath the surface;
this is not a useful example or analogy in this discussion.
The Ethiopian Highlands have presumably risen as a result of
erosive removal of load there; I do not follow your meaning.

> if it's a question of buoyancy?
> They are more dense after all, than regular crust.

The average density of the earth's crustal material is
greater than that of the Deccan Traps or the Ethiopian
Highlands; I do not follow your meaning.
You must define your meaning of
"regular crust".

> Or where are the 'forebulges' for them?

Because the Ethiopian Highlands are not a site of
accumulation of sedimentary load, they have no forebulge;
I do not follow your meaning.
The Deccan Traps are many millions of years old;
presuambly, any forebulge that might have been detected
around them (not that that area is a site of accumulation
of sedimentary load, either) would have become part of
the general tectonic movement of the area long ago, and
would no longer be detectable.

> The question goes to the root of whether isostacy is
> a geological (or just a mathematical) concept.

Isostatic movement of the Earth's crust is
an observed and measurable phenomenon.
It is not just a concept.

> It begins with the geological observation that

> the land has risen in areas where ice has melted
> (glacial dump)

Again, it is not clear what you mean by "glacial dump";
it could be the land, those areas, the ice,
melting of ice, rising of land, or something else.
When you introduce new terms, you must define them.

> but maybe it's that the sea level has fallen in a big way,

No.

> and the small eustatic rise that we see at the present day could
> be due to a much smaller effect − like *THAT* being the melting of ice.
> In other words, if we're going to melt ice then the net result should
> be eustatic rise in sea level, not the 'lifting' of land, which would
> be much slower.****

This is correct, but I do not see why the modern
eustatic rise of sea level implies a previous
large eustatic fall in sea level.
Quite the opposite has occurred since the LGM;
I do not follow your meaning.

> But the land *has* lifted, ..to the extent of exhuming stratigraphic
> sequence world−wide. How come (in an 'isostatic readjustment' model)?
> ICE? I don't think so.

Exhumation results from erosion.
Erosive removal of material during exhumation
decreases load and results in movement of mantle material
toward the area of decreased load.
That lateral movement of mantle material lifts the surface,
or maintains its altitude, allowing continued erosion and
exhumation.
The areas that get eroded have been uplifted by
whatever forces
before exhumation begins.
Exhumation does not initiate uplift.
Exhumation is the result of erosion is the result of uplift.

I do not know why you dismiss "ICE" with regard to
matters of exhumation and uplift.
Ice can erode, and therefore ice can exhume.
Addition of ice depresses a surface, and removal of ice
raises a surface, just as does the addition or removal of
any other mass resting on a surface.

Again, I do not follow your meaning.

> The pulsing rise of land (plateau levels) and the rise of sea−level.

> Two entirely different−scale processes, but lumped by geophysics as
> 'due to ice melting'. Sounds very iffy to me.

I do not know where to read about
"pulsing rise of land" (another unfamiliar term)
in relation to "plateau levels" as being
the result of melting of ice.
Perhaps you mean the webpage re: plateau levels in
Antarctica that you had cited earlier, i.e.
http://users.indigo.net.au/don/to/antarctica1.html
I do not see a claim of their cause being the melting of ice.
I see only one plateau level in the picture there,
i.e. the "incised peneplain" of the caption.
The incision that has occurred is the result of
erosion, which would have been the result of uplift.

Please tell me where I can see
a a geophysical claim that
"pulsing rise of land (plateau levels)"
is
"due to ice melting".

> ***And anyhow, ..I'm not sure why, when we say that there is up to half
> a metre a day flux in the crust due to the gravitational pull of the
> Moon, that isostatic rebound should be slow. Any ideas on that one?

Lateral mantle movement controls isostatic rebound.
That is not a tidal phenomenon; I do not follow your meaning.

> There are a lot of contradictions around, when it comes to
> 'numberologists'.

I do not know what you mean by
" 'numberologists' ".

Please define this term, and the others that I have asked you about.
After that is done, we might be able to have an intelligent
discussion.

–
Daryl Krupa

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- ***Follow−Ups***:
  - ♦ ***Re: erosion, ice sheets, glaciers, glaciation and u−shaped valleys***
    - ◊ *From:* don findlay

- Prev by Date: ***Re: Kathrina: Some interesting facts***

- Next by Date: ***Re: The Battle for New Orleans!***
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