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Interactive comment on “Plate tectonic raster reconstruction in GPlates” by J. Cannon et al.

Anonymous Referee #1

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General Comments:

Visualizing plate motion over geologic history has long been a difficult part of identifying the geodynamic processes from which tectonomagmatic structures originate in the lithosphere. The article ‘Plate tectonic raster construction in GPlates’ by J. Cannon et al. discusses an improved technique to interactively render high resolution rasters in GPlates. Much of the work is an attempt at overcoming the limitations of computing resources in rendering images of a globe with high resolution reconstructed geophysical raster data mapped onto it. They employ clever ‘level of detail’ sampling methods to map pre-scaled rasters that have a resolution appropriate for the field of view and use a ‘cube’ mapping technique to simplify reconstruction.

The manuscript is generally well written, although some of the explanations and discussion are perhaps overly technical, and could perhaps be made more straightforward

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for readers less familiar with the problems at hand. In particular, during much of the discussions in Sections 3.4.1 through 4.5 I often found myself dizzy and unprepared to appreciate the importance of that discussed. It may be worth revisiting their opening sections (e.g. section 3.0 and 4.0) and try to clearly set a stage for the reader to appreciate the problems and solutions discussed in the upcoming sections.

It is asserted that ‘the vast majority of desktop graphics hardware manufactured in the last decade is more than capable of displaying raster data at interactive frame rates. . .’ I’m not sure how to interpret this given that the increase in GPU power over the last decade has been quite remarkable (perhaps 20-100x speedup).

Section 2.2-3 discusses the problem of data streaming. Solid-state disk technology is also significantly faster than HDD. Modern 64-bit computing has a maximum of 64 GB RAM for standard desktops. Also, I wonder if RAMDISK technology can be coupled with GPlates. RAMDISK storage (treating RAM as storage) may also be able to utilize >4 GB RAM in a 32-bit operating system environment. Are any of these resources significant game-changers here? Also, is the cache file generated (797:21) stored on the HDD or in memory?

The LOD algorithm utilized here is in principle quite conventional in the 3D gaming industry. I wonder if there is a promising, significantly different avenue of future development for a scientific environment such as GPlates. For example, much of the visibility culling work of the algorithm presented is complicated, ad hoc, and even still somewhat lossy or overcomputed (even if much improved on previous efforts). For instance, in 798:2, the authors indicate that for a 1650x1050 display a raster of dimensions 2700x1350 can be used. This means that two times as many pixels are rendered than can be displayed. An alternative approach might be to find the global coordinates corresponding to each pixel in the field of view, evaluate its properties, and display its color. “Euclidean Geoverse” uses an algorithm of this kind. In this case, no LOD analysis is necessary.

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Nevertheless, the approach of the authors follows a long tradition and has intuitive virtues, despite some of its complexities. This is a welcome contribution to the task of making the interactive visualization of plate tectonic histories a more powerful tool. I recommend publication after minor revision.

Less-general comments:

Rotation model: Those unfamiliar with plate tectonic rotation modeling may be confused by the continued reference to plate tectonic motion as dictated by a 'rotation model'. It may be worth briefly mentioning that rotation models refer to biaxial rotations in 3D space of a rigid surface across a spherical shell.

Reconstruction: The continued reference to 'reconstruction' in the work was initially confusing to me. It may be worth a slightly more forward explanation in the introduction (about 794:25), indicating that mapping present-day geospatial data onto the globe is essentially a construction, and that modifying the rasterized data and tectonic configurations amounts to a 'reconstruction' of the tectonic state over geologic history.

796:8 rending should be rendering?

Interactive comment on Solid Earth Discuss., 6, 793, 2014.

SED

6, C351–C353, 2014

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