TPV205 and TPV210

October 27, 2009

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Part 1: Introduction

With TPV205 and TPV210 we are beginning to study the topic of convergence testing.

We are revisiting two of our previous benchmarks, TPV5 and TPV10, except now we are going to run them at multiple resolutions. Previously, we asked you to run TPV5 and TPV10 with an element size or node spacing of 100 m. Now, for TPV205 and TPV210, we are asking you to run the same problems with several different values for element size or node spacing, so that we can study how the results change as the element size or node spacing is varied.

We will be doing both 3D and 2D forms of TPV205 and TPV210. In the 2D benchmarks, it should be possible to get down to a very small element size or node spacing.

The 2D benchmarks are called TPV205-2D and TPV210-2D. The 3D benchmarks are called simply TPV205 and TPV210.

The web site is being modified to let you upload several sets of results for each benchmark.

Requested Resolutions

For these benchmarks, we request that you select the element size or node spacing from the following set of values:

200 m,   100 m,   50 m,   25 m,   12.5 m ,   6.25 m,   3.125 m,   1.5625 m

Everyone should run each benchmark at 100 m. This is our "baseline" case.

Also, everyone should run each benchmark at the smallest element size, selected from the above set, that you are capable of running given the computing resources you have available.

Finally, you may optionally select one or two additional element sizes from the above set. Please limit yourself to a maximum of three or four resolutions for each benchmark. If you only want to run two resolutions, 100 m plus your smallest possible resolution, that's OK too.

If you cannot run at any element size smaller than 100 m, then you can run at 200 m so that you have two different element sizes.

Integer Time Step Ratios

As always, you may select whatever time step you wish.

If possible, the time steps for different element sizes should be related by an integer ratio. In other words,

(high-resolution time step) = (low-resolution time step) / (some integer)

This will happen automatically if you make the time step proportional to the element size, because all the element sizes are related by integer ratios (in fact, by powers of 2).

We are making this request because in the future, we may want to calculate the difference between two time series at different resolutions. If the time steps are related by an integer ratio, then the difference can be computed without interpolation.

Size Limit on Contour-Plot Files

The web site has a limit of about 10 MB on the size of a file that can be uploaded.

For the 3D benchmarks, we are requesting that you upload contour-plot files. For a resolution of 50 m, a contour-plot file would be about 7 MB in size, which is getting close to the limit but is still OK.

For a resolution of 25 m or smaller, the contour-plot file would be way too large if you include all the nodes on the fault surface. Therefore, if you run a 3D benchmark at a resolution of 25 m or less, you need to reduce the size of the contour-plot file in one of the following two ways:

- Include only a subset of the nodes on the fault surface, so that you only have one node for every 50 or 100 meters.

- Interpolate your rupture times onto a grid with a spacing of 50 or 100 meters, and construct a contour-plot file containing the interpolated rupture times at the grid points.

Reducing the Size of Time-Series Files

If you use an element size of 6.25 m or less, you may find that your time-series files are several megabytes in size because the time step becomes very short. Even if they are under the 10 MB limit on the size of a file that can be uploaded, there is really no need to submit multi-megabyte time-series files because the graphs don't show that much detail.

So for the smallest element sizes, you may choose to reduce the size of your time-series files. For example, you might submit files that contain only every fourth time step, or every eighth time step, and so on.

Part 2. Benchmark TPV205

Benchmark TPV205 is the same problem as benchmark TPV5. Documents describing TPV5 are available on the web site.

All the model parameters, material properties, initial stresses, station locations, file formats, etc., are exactly the same as for TPV5.

Please submit results at two or more resolutions, as discussed above.

Part 3. Benchmark TPV205-2D

Benchmark TPV205-2D is the 2D form of TPV5.

To construct the 2D benchmark, take a horizontal slice through TPV5, at a depth of 7.5 km. This plane runs through the hypocenter. Here is a summary of the 2D benchmark:

- All the model parameters, material properties, initial stresses, nucleation technique, and so forth are the same as the 3D benchmark.

- All motion is horizontal, that is, in-plane.

- The fault is a line, extending from -15.0 km to +15.0 km along-strike.

- The nucleation zone extends from -1.5 km to +1.5 km along-strike.

- The zone of low initial shear stress extends from +6.0 km to +9.0 km along-strike, on the *right* side of the fault.

- The zone of high initial shear stress extends from -9.0 km to -6.0 km along-strike, on the *left* side of the fault.

- The time-series file format is exactly the same as for the 3D benchmark. Fields that refer to vertical motion should contain a value of zero (or a very small value).

- For the 2D benchmark, we only use stations at a depth of 7.5 km. That means there are seven on-fault stations, and two off-fault stations. Here is a list of stations:

`faultst-120dp075`	On fault, -12.0 km along strike, 7.5 km depth.
`faultst-075dp075`	On fault, -7.5 km along strike, 7.5 km depth.
`faultst-045dp075`	On fault, -4.5 km along strike, 7.5 km depth.
`faultst000dp075`	On fault, 0 km along strike, 7.5 km depth.
`faultst045dp075`	On fault, 4.5 km along strike, 7.5 km depth.
`faultst075dp075`	On fault, 7.5 km along strike, 7.5 km depth.
`faultst120dp075`	On fault, 12.0 km along strike, 7.5 km depth.
`body030st-120dp075`	3.0 km off fault (far side), -12.0 km along strike, 7.5 km depth.
`body030st120dp075`	3.0 km off fault (far side),, -12.0 km along strike, 7.5 km depth.

- For the 2D benchmark, there is no contour-plot file.

Part 4. Benchmark TPV210

Benchmark TPV210 is the same problem as benchmark TPV10. Documents describing TPV10 are available on the web site.

All the model parameters, material properties, initial stresses, station locations, file formats, etc., are exactly the same as for TPV10.

Please submit results at two or more resolutions, as discussed above.

Part 5. Benchmark TPV210-2D

Benchmark TPV210-2D is the 2D form of TPV10.

To construct the 2D benchmark, take a vertical slice through TPV10, perpendicular to the fault trace, passing through the center line of the fault. This plane is located at 0 km along-strike. Here is a summary of the 2D benchmark:

- All the model parameters, material properties, initial stresses, nucleation technique, and so forth are the same as the 3D benchmark.

- All motion is within the plane. In other words, there is no motion in the along-strike direction.

- The fault is a 60-degree dipping line, extending from the surface to 15.0 km down-dip distance.

- The nucleation zone extends from 10.5 km to 13.5 km down-dip distance.

- The time-series file format is exactly the same as for the 3D benchmark. Fields that refer to horizontal motion (that is, motion in the along-strike direction) should contain a value of zero (or a very small value).

- For the 2D benchmark, we only use stations at a 0 km along-strike. That means there are six on-fault stations, and ten off-fault stations. Here is a list of stations:

`faultst000dp000`	On fault, 0 km along strike, 0 km down-dip.
`faultst000dp015`	On fault, 0 km along strike, 1.5 km down-dip.
`faultst000dp030`	On fault, 0 km along strike, 3.0 km down-dip.
`faultst000dp045`	On fault, 0 km along strike, 4.5 km down-dip.
`faultst000dp075`	On fault, 0 km along strike, 7.5 km down-dip.
`faultst000dp120`	On fault, 0 km along strike, 12.0 km down-dip.
`body-030st000dp000`	-3.0 km off fault (near side), 0 km along strike, 0 km depth.
`body-020st000dp000`	-2.0 km off fault (near side), 0 km along strike, 0 km depth.
`body-010st000dp000`	-1.0 km off fault (near side), 0 km along strike, 0 km depth.
`body010st000dp000`	1.0 km off fault (far side), 0 km along strike, 0 km depth.
`body020st000dp000`	2.0 km off fault (far side), 0 km along strike, 0 km depth.
`body030st000dp000`	3.0 km off fault (far side), 0 km along strike, 0 km depth.
`body-010st000dp003`	-1.0 km off fault (near side), 0 km along strike, 0.3 km depth.
`body-005st000dp003`	-0.5 km off fault (near side), 0 km along strike, 0.3 km depth.
`body005st000dp003`	0.5 km off fault (far side), 0 km along strike, 0.3 km depth.
`body010st000dp003`	1.0 km off fault (far side), 0 km along strike, 0.3 km depth.

- For the 2D benchmark, there is no contour-plot file.

Part 6. Uploading Multiple Versions to the Web Site

As always, results should be uploaded to the web site at:

```
http://scecdata.usc.edu/cvws/cgi-bin/cvws.cgi
```

For these benchmarks, we are modifying the web site so that you can upload multiple versions of each benchmark. Each resolution is considered to be a different version of the benchmark.

After you log in to the "Upload Files" section of the web site, you will see a new button called "Change Version." You use this button to create multiple versions, and to select the version for which you are uploading files.

When you press "Change Version" the web site displays a list of versions. The web site automatically creates one version for you, and supplies a description based on your user information. Please use this first version to upload your 100 m baseline case.

Start by changing the description of the first version, to show that you are using 100 m resolution. Press the "Modify" button, then change the description to something like this, which shows your name and the resolution:

```
Adam Modeler - 100 m
```

Press "Save" to save the new description.

Now you can create additional versions. Press "New Version" and then enter a description for the new version. For example, if you are using 50 m resolution you might supply a description like this:

```
Adam Modeler - 50 m
```

Press "Save" to create the new version.

You may create additional versions as needed. Try to limit yourself to a maximum of three or four versions. You don't need to create all your versions at once. You can start with one or two versions, upload their files, then create more versions later.

To begin uploading files, press "Select" next to one of the versions. You can then upload files for that version. The version is displayed at the top of the page, to remind you which version you are using. When you are done uploading files for that version, you can press "Change Version" to select another version.