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Geoscientific Model Development Discussions

Interactive comment on "Verification of an ADER-DG method for complex dynamic rupture problems" *by* C. Pelties et al.

Anonymous Referee #2

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This is a useful paper that presents thorough benchmarking of an arbitrary high-order derivative Discontinuous Galerkin (ADER-DG) method on unstructured meshes for advanced earthquake dynamic rupture problems. The authors validated the method in comparison to well-established numerical methods in a series of verification exercises and showed that the combination of meshing flexibility and high-order accuracy of the ADER-DG method makes it a competitive tool to study earthquake dynamics in complicated setups. I think that this paper is worth publishing in GMD. My minor points are the followings:

P5983: Ohnaka and Mogi (1982) is not an appropriate reference because this paper did not discuss a constitutive law. Examples of better references to cite here are Ohnaka and Kuwahara (1990) or Ohnaka and Shen (1999). Ohnaka, M., and Y. Kuwa-

hara, Characteristic features of local breakdown near a crack-tip in the transition zone from nucleation to unstable rupture during stick-slip shear failure, Tectonophysics 175, 197-220, 1990. Ohnaka, M., and L. Shen (1999), Scaling of the shear rupture process from nucleation to dynamic propagation: Implications of geometric irregularity of the rupturing surfaces, J. Geophys. Res., 104(B1), 817–844, doi:10.1029/1998JB900007.

P5988 lines 3-5. "The development of a supershear daughter pulse in TPV11, caused by stress concentration ahead of the sub-shear rupture front (Dunham, 2007), is equally well captured, as shown in Fig. 2." I cannot catch well the development of a supershear daughter pulse from Figure 2. More explanations will be necessary.

P5995, line 25; P5996, line 16; p5992, line 21 "rate-and-state dependent constitutive relationships" should be amended to "rate- and state-dependent constitutive relationships"

Equation (1): Definition of L should be added.

Equation (4): W and w should be defined. If spatial distribution of a is shown in Figure 15a, this equation seems to be unnecessary.

P 5997, line 20: Since a usual rate- and state-dependent friction law is introduced, slow velocity friction seems to be better.

P5986 line 11 " we compare our results to the well-established software FaultMod" -> "we compare our results to that from the well-established software FaultMod"

Equation (7) Is vˆ8/v_* correct ? In the paper by Dunham et al. (2011), this term is (v/v_*)ˆ8. Also mu_s seems to be mu_w.

P6004 lines 14. The unit of L should be added.

Table 1. tau_0 is used for nucleation shear stress along-dip and nucleation shear stress along-dip.

Table 6: this is not referred to in the main text.

Figure 8: Unit of X and Y should be added.

Figure 9: In the main fault (a), it would be better to show the location where fault branch occurs. Please add an explanation on a blue zone (concentrated blue lines).

Figure 15 a: It would be better to divide this figure into two figures; initial stress and friction parameter a.

In Figure 17, the unit of L should be added. Caption “the nucleation zone. for different” -> “the nucleation zone for different”

Interactive comment on Geosci. Model Dev. Discuss., 6, 5981, 2013.