From: Brittain Hill
To: "Nancy Adams" <nadams@cnwra.swri.edu>
Date: 10/13/2006 7:52:13 AM
Subject: Re: Volcano Module - TPA

Hola Nancy. Yeah, the nomenclature changes/conventions have always been a struggle between me and the PA bund. Seems like they always fancy creating names first, then are extremely reluctant to change them into something that makes more sense. Selah.

The geometric model actually is a revision to a pseudo-area model in the tpa4.1j code, which calculated the number of WP hit by a dike as {[dike area (i.e., length x width)] * [HLW load (i.e., MTU) per area] } / [MTU / WP]. Thus, the physical area of a dike was thought to represent the number of WP hit, which is absurd but was the way things were done since IPA2 (the TPA predecessor).

So rather than chunder around with fake mechanistic models, we developed a user-defined distribution approach for TPA 4. This allowed independent calculation of the # of WP hit by an intrusive event, which was 1-12 drifts based on a 1-km -long dike, and accounting for the fact that magma would actually flow into an intersected drift. Since each drift then had 150 WP, the distribution range was then 150-1800 because there was a single repository panel and the # of WP/drift was pretty uniform. Since 2004, though, DOE has gone to the 5 panel design where drifts are 500-800m long and separated by access tunnels, which makes for a much more complicated intrusion-flow scenario.

In TPA5.1, the PA guys developed a new "geometric" approach that is supposed to allow a dike to form randomly in the footprint, give it a derived length and angle, and explicitly calculate the number of drifts intersected. All WP in the intersected drifts are supposed to fail. Now, I'm not sure what all this "NormalizedMagmaInducedMechanicalFailuresRemainingInDrift" is about. Previously, I had supplied a user-defined distribution based on a simple stochastic model for dike length and drift location, to calculate # of WP hit during intrusion. This is documented in my old scientific notebook #88. This was before PA developed the new geometric model. As I recall, they may have done some sort of Normalization to a single panel, then added some scaling factor later to account for different # of WP in each of the 5 panels. Recall that the # of WP in the repository always is changing, depending on WP load, spacing, locations, etc, so some normalization to the current #of WP in repository always is needed.

At any rate, if the new "geometric" (i.e., explicit dike intersection approach) model is verified as working correctly, this probably is the better option to use for base-case intrusive runs. However, the user-defined distribution can also be changed to evaluate any alternative conceptual model you want, such as failures due to secondary effects; dikes consisting of dike swarms rather than a simple, single planar dike; multiple volcanoes for a single event, etc.

For the extrusive source, there also are 2 models for # of WP entrained:

The "geometric" model is the conduit (not cone; see first paragraph) diameter from 5-50m, which should translate to 1-10 WP entrained. Should verify this, as you never know how the mechanics of translating actual space to actual WP is handled in TPA. This model assumes the conduit diameter is unaffected by presence of drift and behaves like analog basaltic systems.

The "distribution" model for extrusion is a user-defined distribution, which accounts for the dog-leg hypothesis. Thus, a bocca is allowed to break out at a random location away from the point of original intersection, and all WP between the original point and the bocca point are entrained by magma flow to the bocca. This simple approach also is documented in my scientific notebook (#88), where I allowed the initial intersection and bocca breakout locations to vary randomly along a drift, and determined that the beta distribution best fit the results of that model.

Hope this helps - please give me a call if you'd like to talk this over further. There are 2 approaches for extrusive source term, and 2 for intrusive source term. Unfortunatly, they are not logically arranged in the tpa.inp file.

Magmatically-
Britt

>>> Nancy Adams <nadams@cnwra.swri.edu> 10/12/2006 6:37 PM >>>

Aloha- My most recent stepping-into-BHill's-shoes task has me rewriting the VOLCANO module of the TPA User's Guide. As it turns out…nobody here is terribly aware of the VOLCANO module or the bases for changes made to it since the 4.0 version. Ron Janetzke has been very helpful and provided me with a number of SCRs; Roland Benke also pointed out the usefulness of the SRD for the TPA Version 5.1 Code. I am not a programmer and have never worked in FORTRAN, so this has been challenging. I think I have made some headway, however, I have a question for you (what I suspect might be the first of a series). What is the background/reasoning behind the distribution model? What was the motivation behind its creation? I think I understood the geometric model was developed first, but the results weren't always satisfactory; why? The distribution model always seems to give larger doses compared to the geometric model (at least for small number realization runs). Is it a measure of conservatism? Also,It, i.e., the distribution model, seems to calculate intrusive failures… UsersuppliedpwisecdfNumberOfMagmaInducedMechanicalFailuresRemainingInDrift[](which in the current code I believe has become)wpfailedindriftfactor190
00.1 0.084200 0.094600 0.1171000
0.1411400 0.1751800 0.2132110 0.2572111

0.4752827	0.5623147	0.5883148	0.7125000
0.7816300	0.8137800	0.8439122	0.8819123
0.9679444	0.9699445	1.000	

Ron Janetzke said he didn't know how this series was derived. It is now in the code, and I traced it back to SCR-490, Change Requested by: B. Hill 8/20/2004 It seems then thatwpfailedindrift = nwpinsa * wpfailedindriftfactorso that the number of failed WPs = total # if WPs in a chosen subarea * a factor chosen from the above series. Thanks for your help,nan

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Subject: Re: Volcano Module - TPA
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From: Brittain Hill

Created By: BEH1@nrc.gov

Recipients
"Nancy Adams" <nadams@cnwra.swri.edu>

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Files	**Size**	**Date & Time**
MESSAGE	6294	10/13/2006 7:52:13 AM
TEXT.htm	20580	3/12/2008 9:58:23 AM

Options
Priority: Standard
Reply Requested: No
Return Notification: None
None

Concealed Subject: No
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Usersuppliedpwisecdf
NumberOfMagmaInducedMechanicalFailuresRemainingInDrift[]
(which in the current code I believe has become)
wpfailedindriftfactor
19

0	0
0.1	0.084
200	0.094
600	0.117
1000	0.141
1400	0.175
1800	0.213
2110	0.257
2111	0.475
2827	0.562
3147	0.588
3148	0.712
5000	0.781
6300	0.813
7800	0.843
9122	0.881

9123	0.967
9444	0.969
9445	1.000

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so that the number of failed WPs = total # if WPs in a chosen subarea * a factor chosen from the above series.

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