Skill of a debris flow model at different temporal resolutions in the Matilija Creek watershed

Sarah Lundell1, Elsa Culler1,2, Ryan Cassotto1, Toby Minear1, Ben Livneh1,2

1-Cooperative Institute for Research in Environmental Science at the University of Colorado Boulder (CIRES)  2-University of Colorado Boulder Department of Civil, Environmental, and Architectural Engineering (CVEN)

Debris flows are a common issue in Southern California. Studies have shown that there is an increase in debris flow after wildfires. High intensity rain after a fire often leads to excessive runoff and hillslope erosion, resulting in mass movements (Cannon & Gartner, 2005). When modeling debris flows in these areas, low temporal sampling of precipitation data used to calculate streamflow is often insufficient to forecast peak flows accurately. Here, we evaluate the effect of precipitation data resolution on discharge using 30-minute IMERG-early data averaged over different time intervals to model streamflow using data from the Matilija Creek Watershed. The Matilija Creek watershed had a fire in late 2017 to early 2018 followed by an extreme precipitation event which led to a debris flow (Culler, 2020).

Method Overview:

The dimensionless discharge model uses stream flow flux and produces a proportional value that can then be compared to a threshold (Tang et al., 2019). 30-minute IMERG-early data was averaged over varying time intervals to test how resolution effected debris flow prediction.

Dimensionless Discharge Equation:

\[ q^* = \frac{q}{\rho_s \cdot g \cdot D_{50}^3} \]  
[Tang et al., 2019]

Assumptions:

- \( D_{50} = 0.015 \text{ m} \)
- \( \rho_s = 1330 \text{ kg/m}^3 \)

Conclusion:

- Low resolution data is unable to capture all debris flow locations
- Averaging over 2 hours of data really seems to degrades the results

Work funded by:

NASA Interdisciplinary Research in Earth Science (IDEX) program (grant number 80NSSC17K0017)

Citations:


Background:

Debris flows are a common issue in Southern California. Studies have shown that there is an increase in debris flow after wildfires. High intensity rain after a fire often leads to excessive runoff and hillslope erosion, resulting in mass movements (Cannon & Gartner, 2005). When modeling debris flows in these areas, low temporal sampling of precipitation data used to calculate streamflow is often insufficient to forecast peak flows accurately. Here, we evaluate the effect of precipitation data resolution on discharge using 30-minute IMERG-early data averaged over different time intervals to model streamflow using data from the Matilija Creek Watershed. The Matilija Creek watershed had a fire in late 2017 to early 2018 followed by an extreme precipitation event which led to a debris flow (Culler, 2020).

Method Overview:

The dimensionless discharge model uses stream flow flux and produces a proportional value that can then be compared to a threshold (Tang et al., 2019). 30-minute IMERG-early data was averaged over varying time intervals to test how resolution effected debris flow prediction.

Dimensionless Discharge Equation:

\[ q^* = \frac{q}{\rho_s \cdot g \cdot D_{50}^3} \]  
[Tang et al., 2019]

Assumptions:

- \( D_{50} = 0.015 \text{ m} \)
- \( \rho_s = 1330 \text{ kg/m}^3 \)

Conclusion:

- Low resolution data is unable to capture all debris flow locations
- Averaging over 2 hours of data really seems to degrades the results

Work funded by:

NASA Interdisciplinary Research in Earth Science (IDEX) program (grant number 80NSSC17K0017)

Citations:

