

# IEEE 2022 SciVis Contest

## Vorticity-driven Lateral Spread Ensemble Data Set

October 2022, Oklahoma, USA



TECHNISCHE  
UNIVERSITÄT  
DARMSTADT



Milad Bagheri, Holger Marschall, Institute of Mathematical Modeling and Analysis, Department of Mathematics, TU Darmstadt, Germany

Submission ID: a-scivis-1017

### The Contest

To understand:

- Evolution of wildfires
- Vorticity-driven lateral spread (VLS) [1]

Scientific questions:

- How does the slope of the terrain impact its progression?
- How do topography, wind speed, fuel moisture and fuel type impact the fire?

### The Dataset

Computational Fluid Dynamics code:

- LANL's HIGRAD/FIRETEC [2, 3]

Topographical structure:

- Valley: A canyon in northern New Mexico
- **Mountain:** Idealized topographies

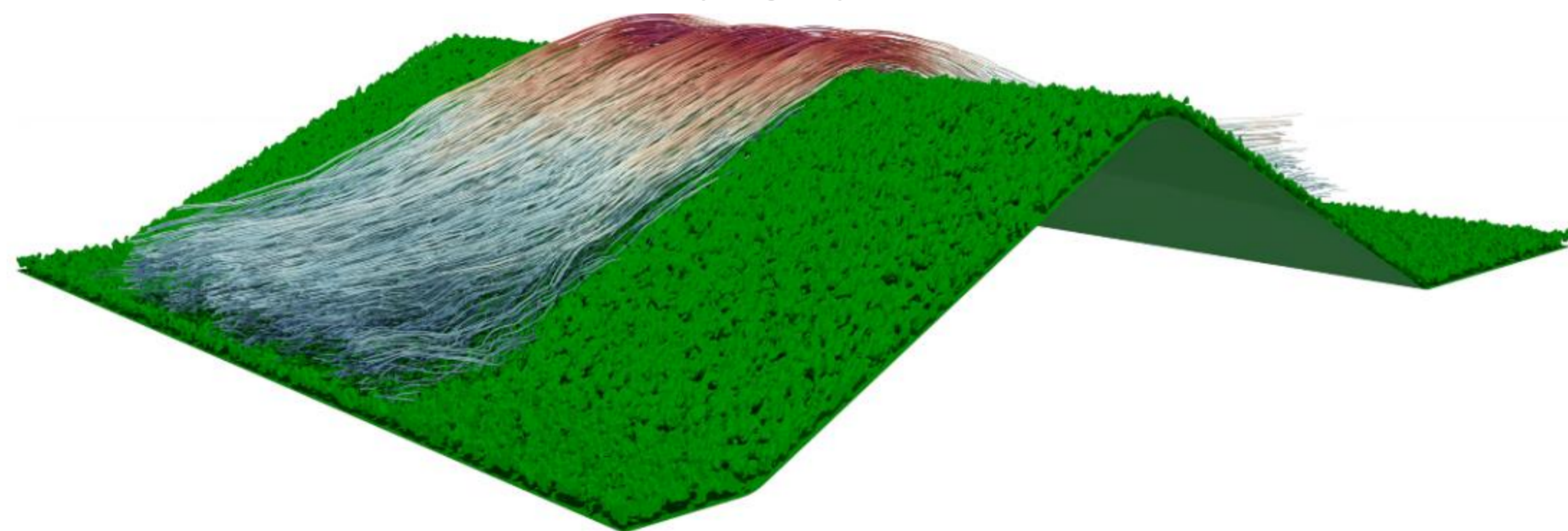


Fig. 1: Mountain topography.

Mountain topography:

- Three different radius of curvature
- Headfires: Fire spreads in the direction of ambient wind
- Backing fires: Fire spreads against the direction of ambient wind

R=40

R=80

R=320

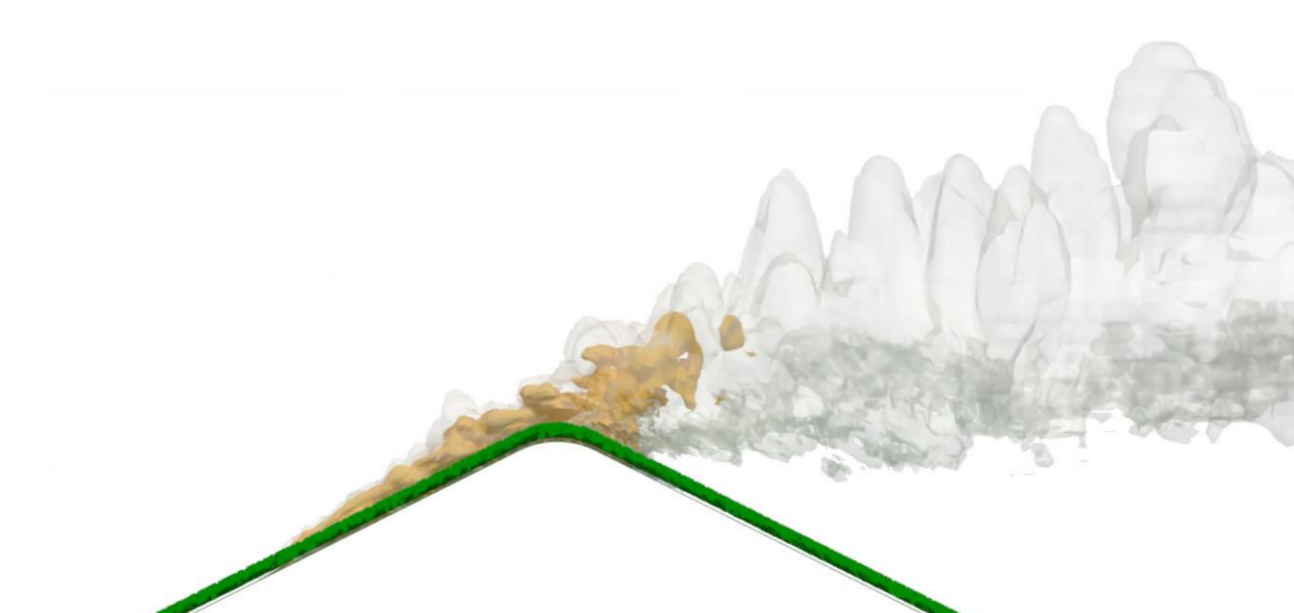


Fig. 3: Headfires.

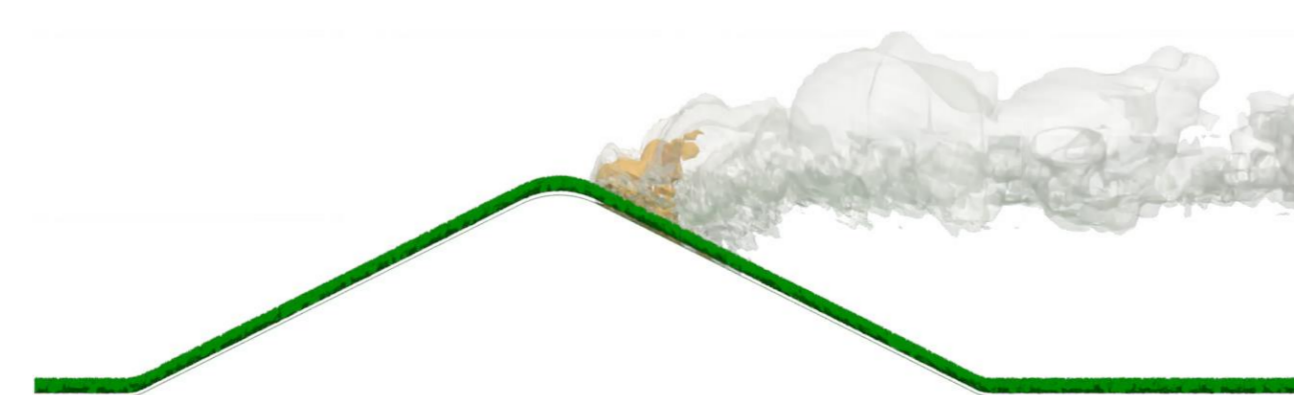


Fig. 4: Backing fires.

Fig. 2: Three different radius of curvature.

### Postprocessing Method

Scientific visualization software:

- ParaView-5.9.1



Visualization technique:

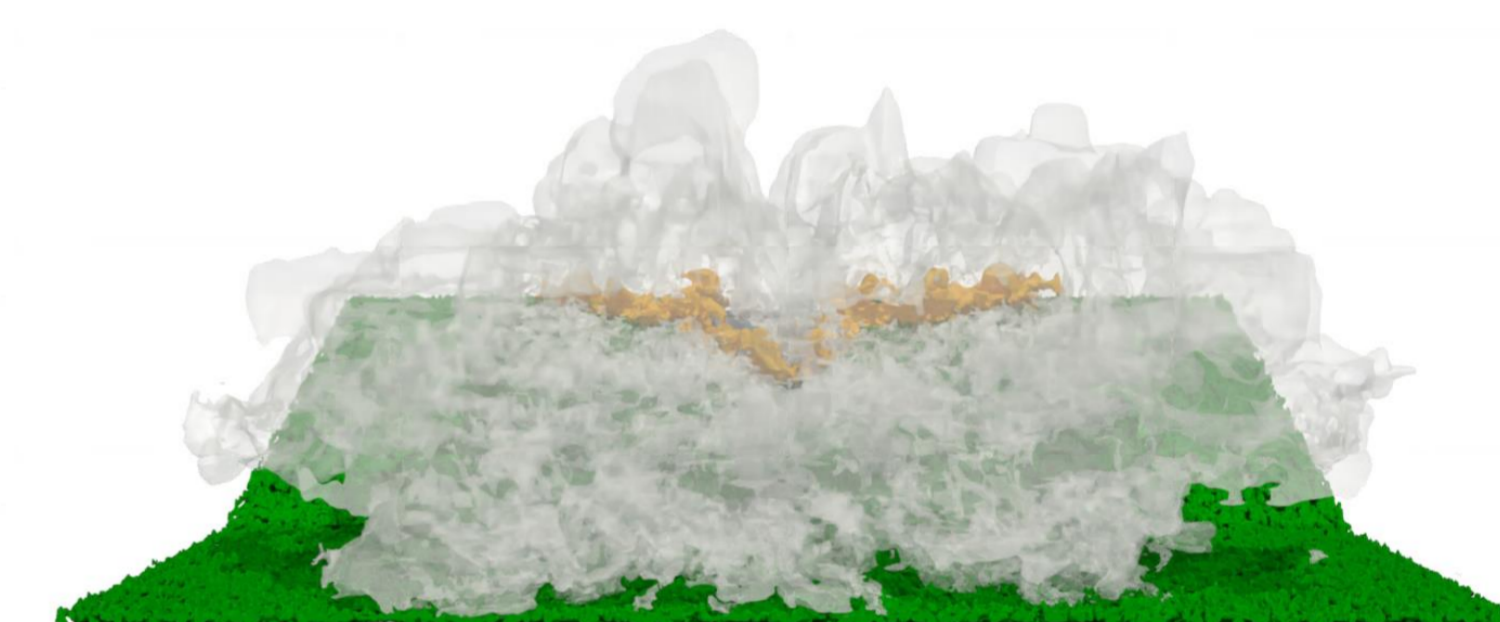
- OSPRay pathtracer

### Comparative Analysis

Performed postprocessing of all the combinations of mountain topography.

Side view

Back view



Top view

Front view

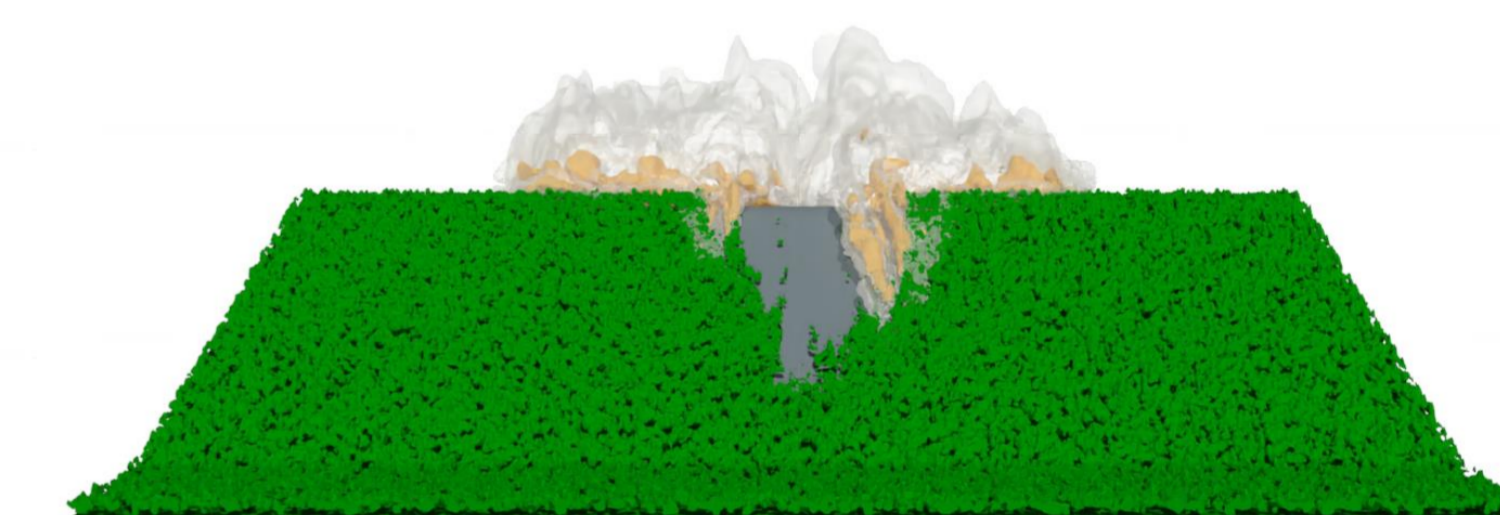
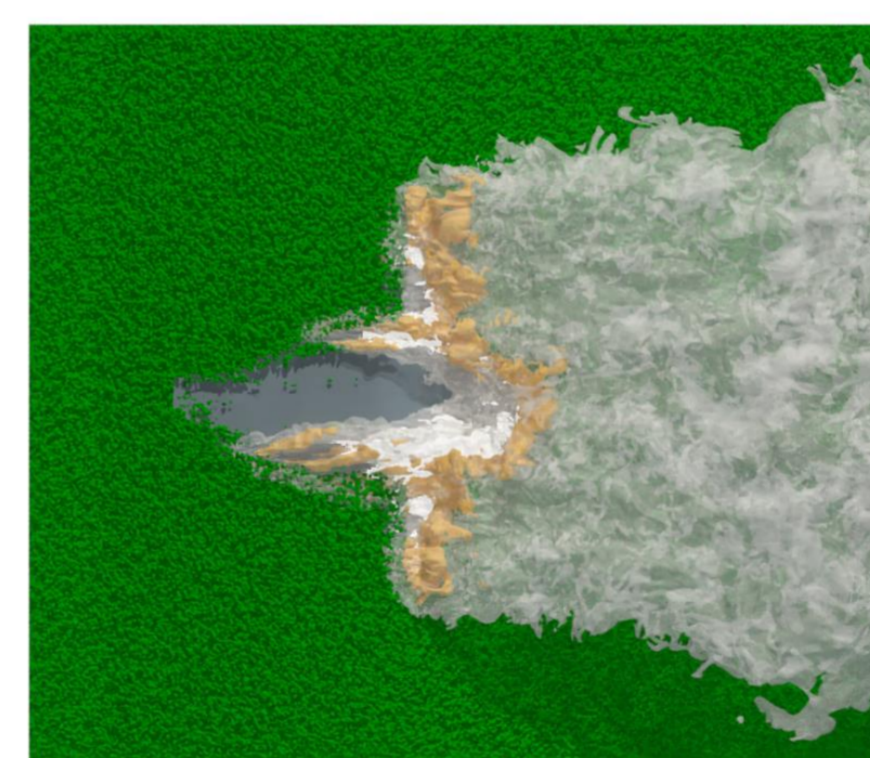


Fig. 5: Different viewing angles of the mountain topography headfires with the radius of curvature of 80. **Green:** Fuel (vegetation), **Orange:** Fire, **White:** Smoke.

### QR Access Codes

Access to the 1<sup>st</sup>  
YouTube Animation



Access to the Contest  
Description



Access to the 2<sup>nd</sup>  
YouTube Animation



### References

- [1] Sharples, J. J., et al. "Pyrogenic vorticity from windward and lee slope fires." *Int. Congr. Model. Simul., Gold Coast, Aust. 29 Nov.-4 Dec (2015)*: 291-97.
- [2] Linn, Rodman, et al. "Studying wildfire behavior using FIRETEC." *International journal of wildland fire* 11.4 (2002): 233-246.
- [3] Linn, Rodman Ray. *A transport model for prediction of wildfire behavior*. New Mexico State University, 1997.