


# Bolide Analysis Using Ground and JPL CNEOS Data

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## Introduction

Bolides (fireballs) are meteors that explode in the atmosphere upon impact, producing an extremely bright, high-energy event, and sometimes leave recoverable fragments 

The project aims to develop a new analysis pipeline using JPL CNEOS government sensor data.

## Methodology

The data is obtained from the JPL CNEOS fireball database [1], which uses government-based sensors to capture light-curves of events.

### Workflow:

- Classify light curves with the BLADE framework [3],
- Construct trajectory,
- Implement an orbital model with REBOUND,
- Develop a fragmentation model,
- and generate a strewn-field.

The results were compared with the bolide event in Palotai et al. [2]

## Results

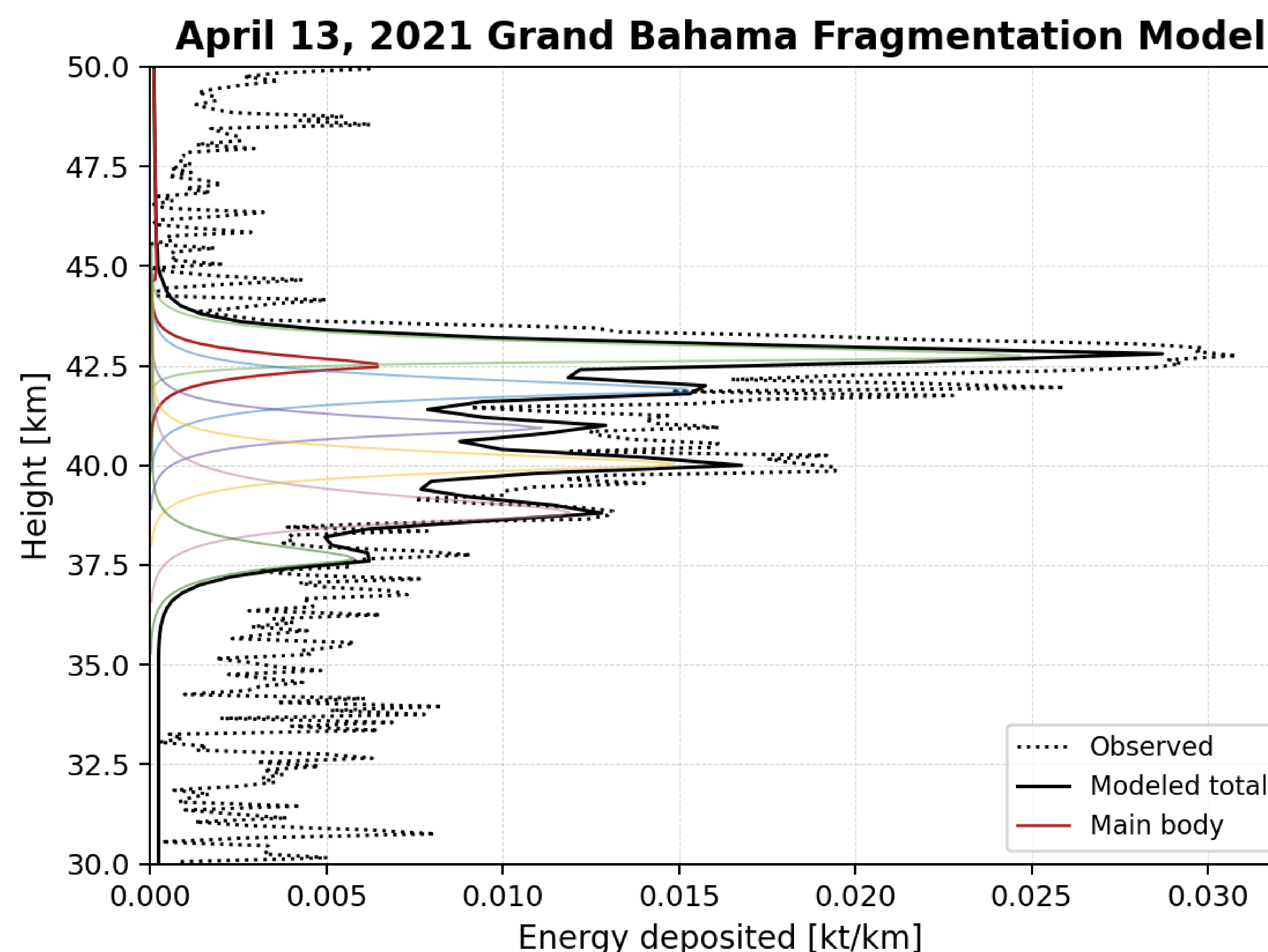


Figure 1: fragmentation model based on observed energy deposition data

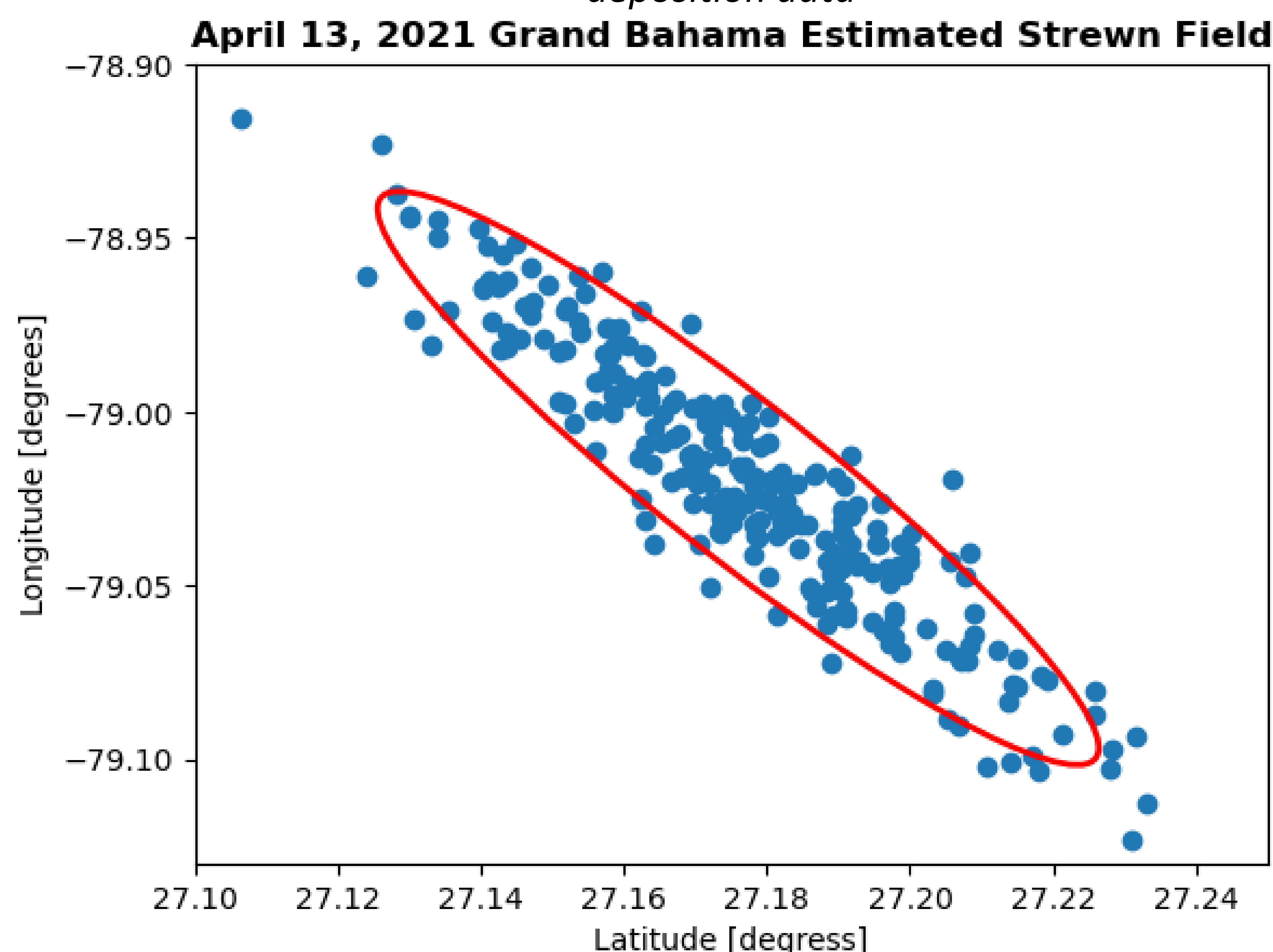


Figure 2: strewn field based on fragment trajectory

Latitude	26.8 N
Longitude	79.1 W
Altitude (km)	44.4
Velocity (km/s)	[-2.8, 12.6, 5.6]
Total Impact Energy (kt)	0.082

Table 1: JPL values relevant to analysis

Mass (kg)	3466
Density (kg/m <sup>3</sup> )	~2000
Type	Stony Meteorite

Table 2: Bolide characteristics from analysis

## Conclusions

An initial version of a framework was developed to analyze bolide events using JPL CNEOS space-based data.

### Future work:

- Conduct comparative analysis of additional bolide events
- Optimize numerical models
- Implement Monte Carlo simulations

## References

- [1] NASA JPL, CNEOS Fireball Database (online)  
 [2] Palotai et al. (2021), doi:10.1111/maps.13781  
 [3] Silber, E. A., & Sawal, V. (2025), *AJ*, doi:10.3847/1538-3881/adeb55