Sensitivity to Uncertainty in Asteroid Risk Assessment (Global Effects)

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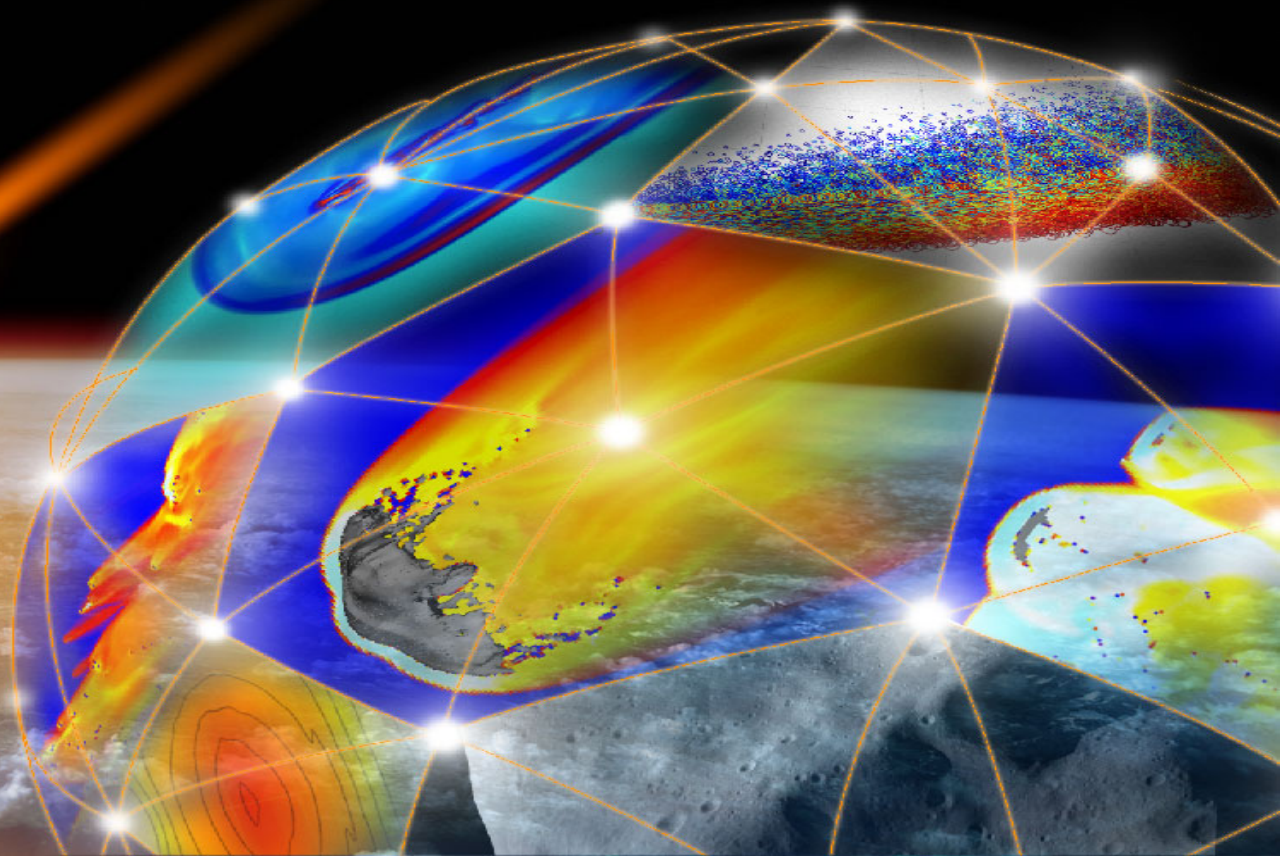

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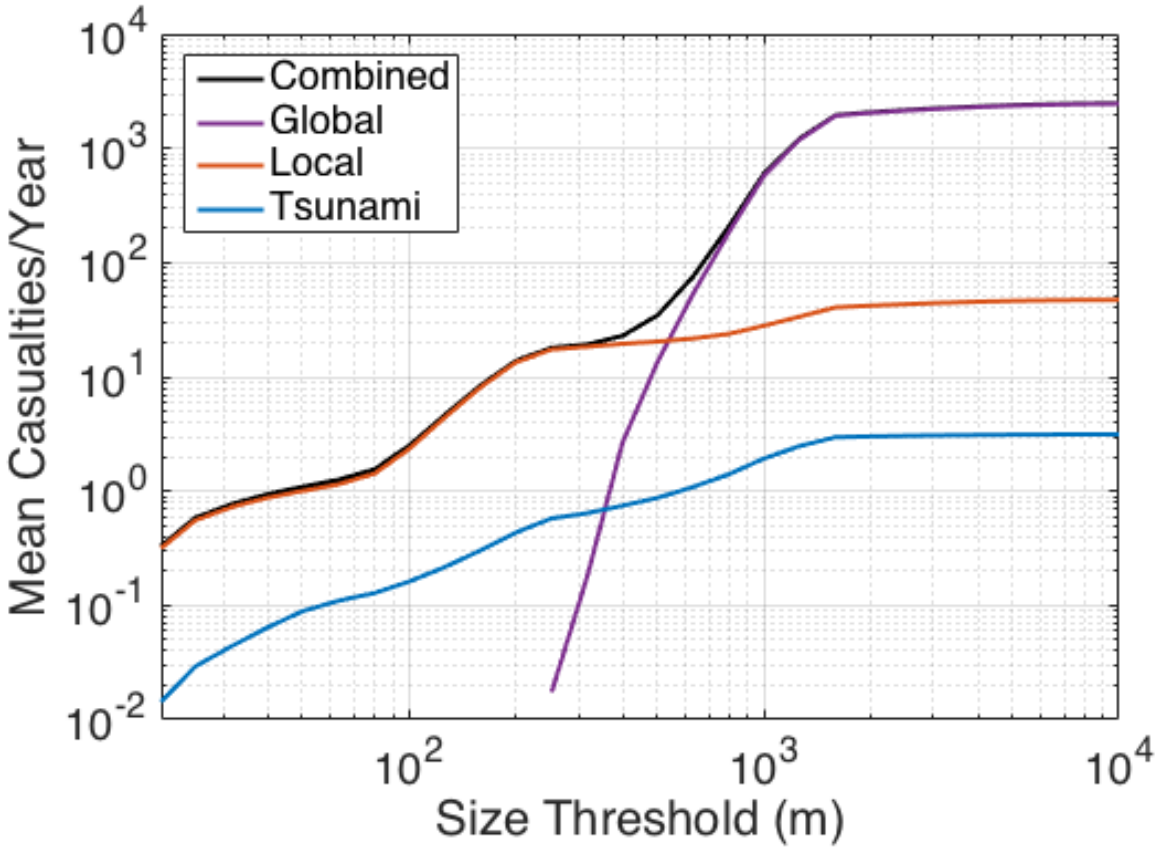
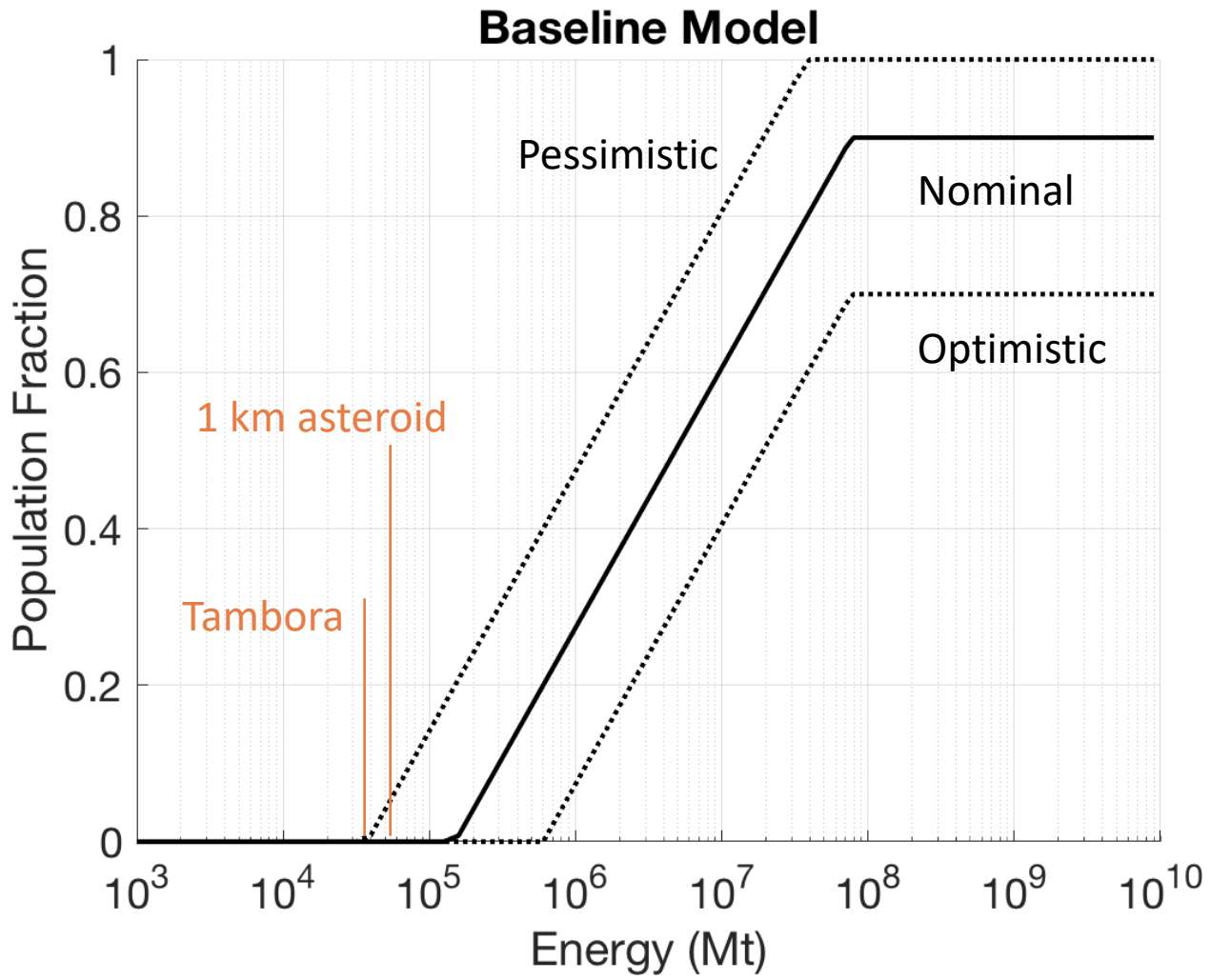
Ensemble Risk Assessment

- Have previously shown that uncertainty in (ensemble) impactor details swamp modeling fidelity related to local damage sources.
- Long-term risk is dominated by large impact events.
  - Asteroid generated tsunami risk, on average, low compared to other sources.
  - ”Global effects” largest hazard in ensemble assessments.
- Global effects models for ensemble risk assessment are ad hoc and lack basis in higher fidelity modeling.
- In this presentation, we will assess GE model assumptions
  - Identify key sensitivities
  - Guide next steps of modeling

The NEO SDT report (2017) showed that long-term expected casualties driven by large impact scenarios



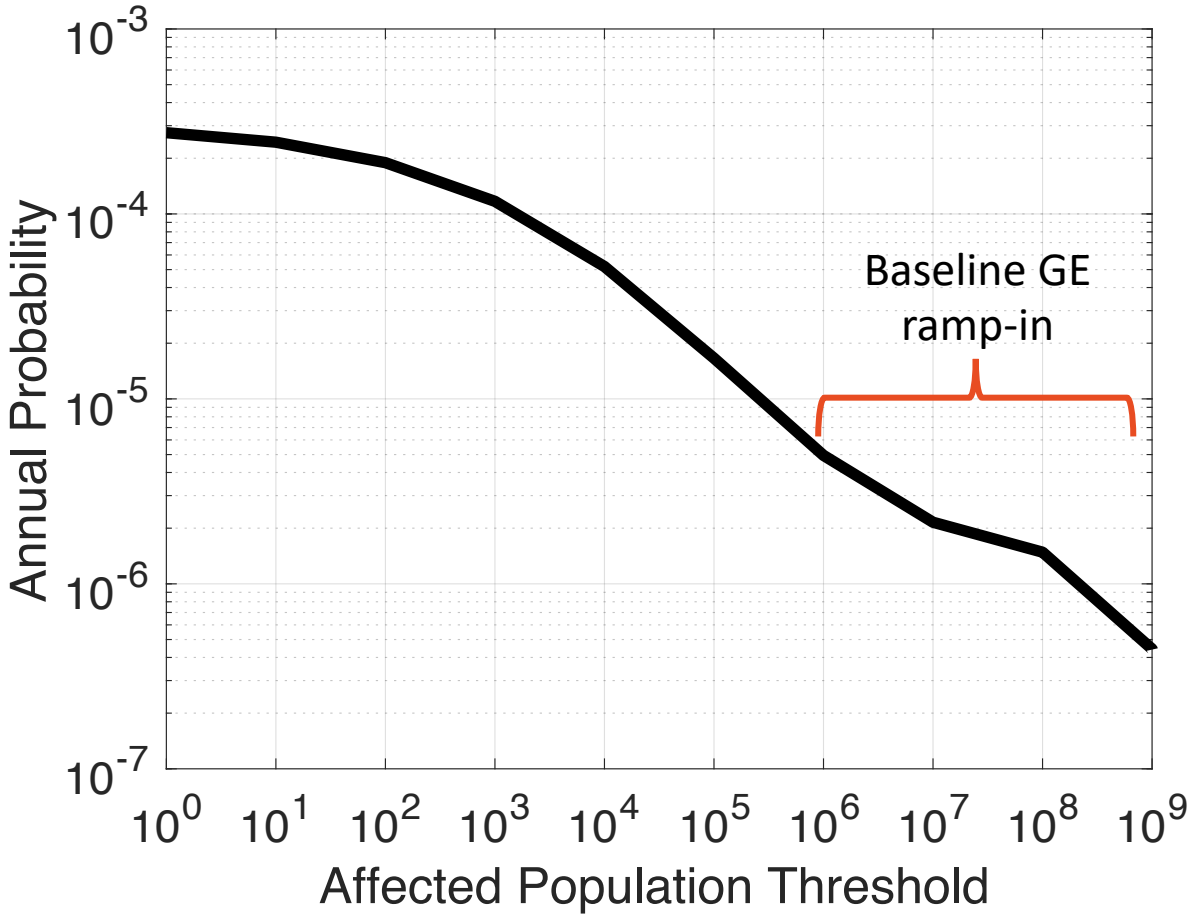
Baseline Global Effects Model

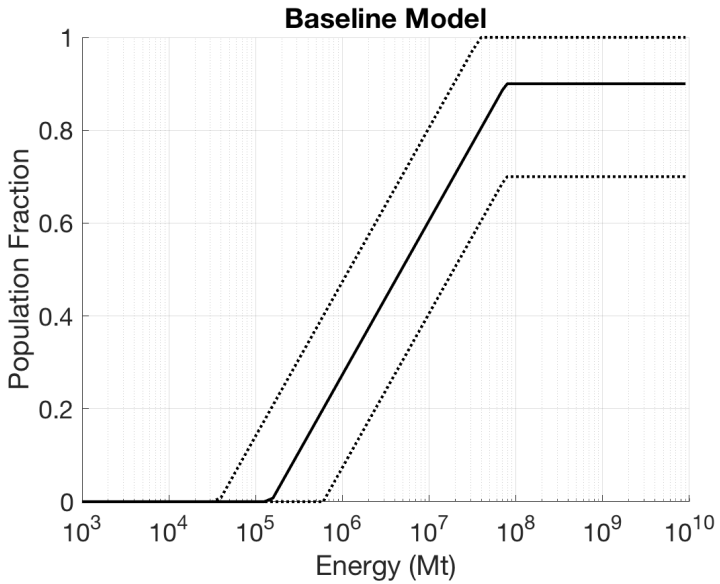


- Current model from NEO Science Definition Team (Stokes et al. 2003, 2017).
- Serves as proxy for large-scale impact effects.
- Represents a generic range of consequences from regional weather disruption through global extinction.
- Completely based on assumptions and not tied to specific physics.

Baseline Affected Population Risk

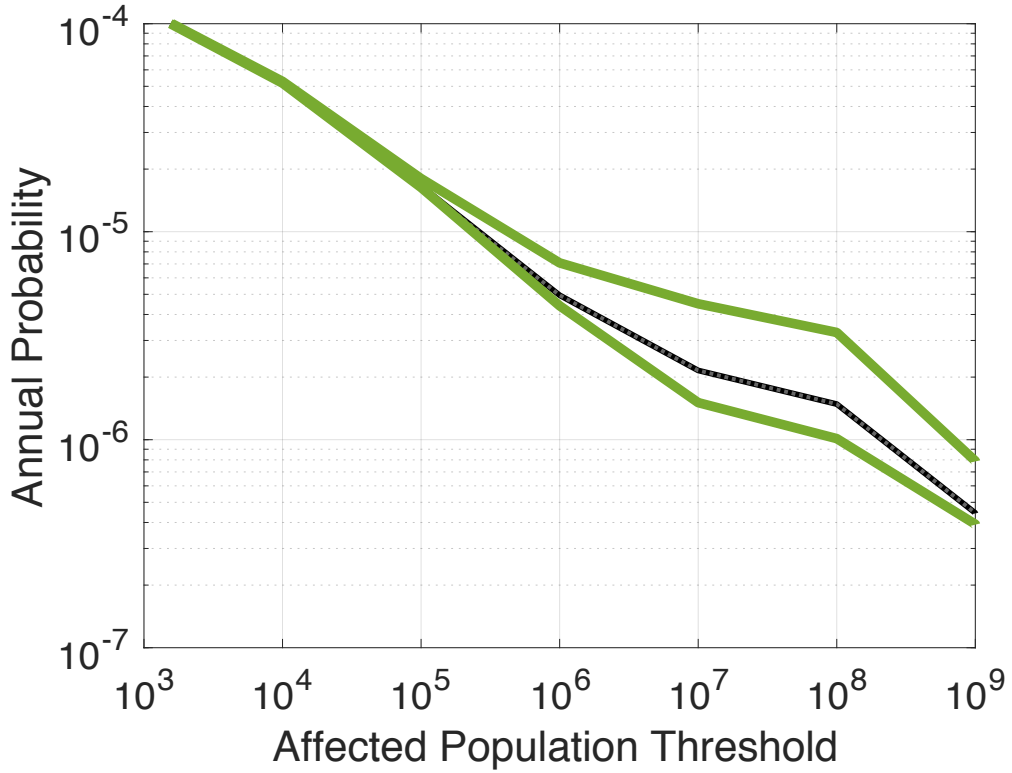
Population Risk CCDF: Annual probability of impact affecting at least a given population threshold or more

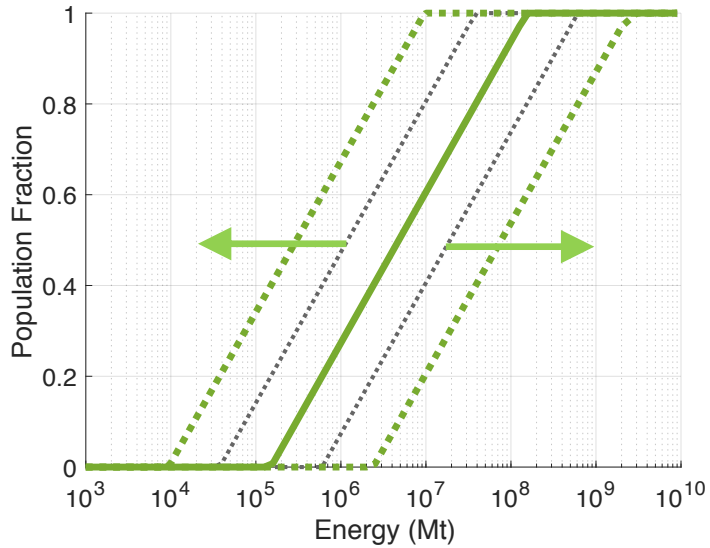


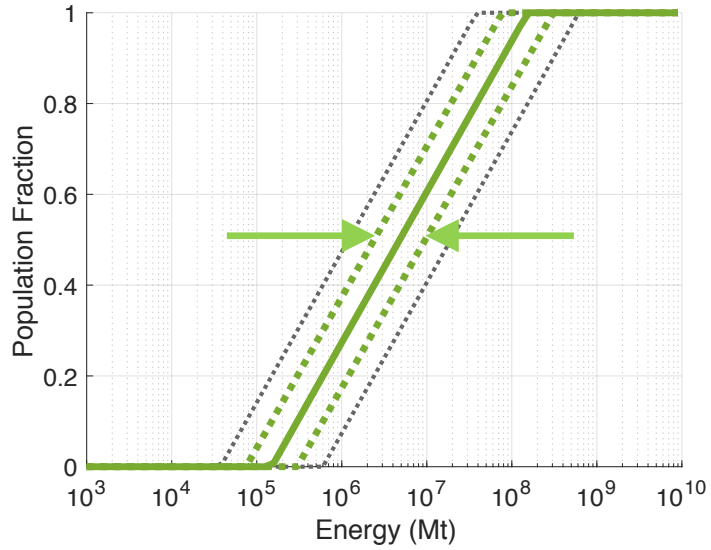


Uncertainty Range

Baseline
Range

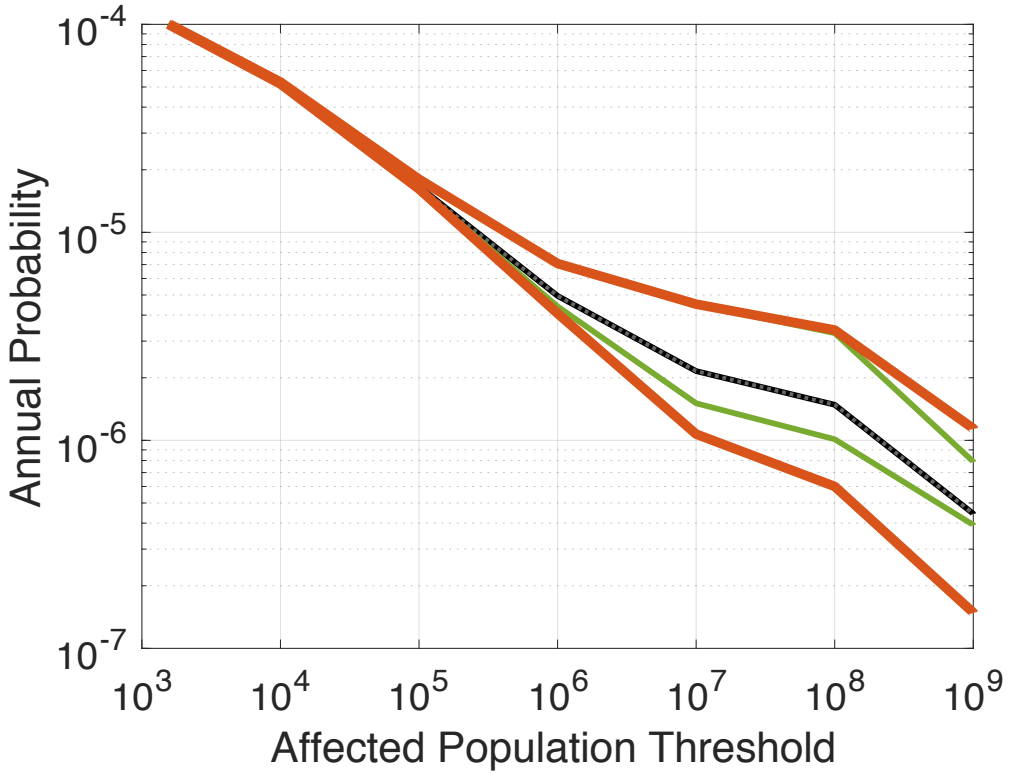


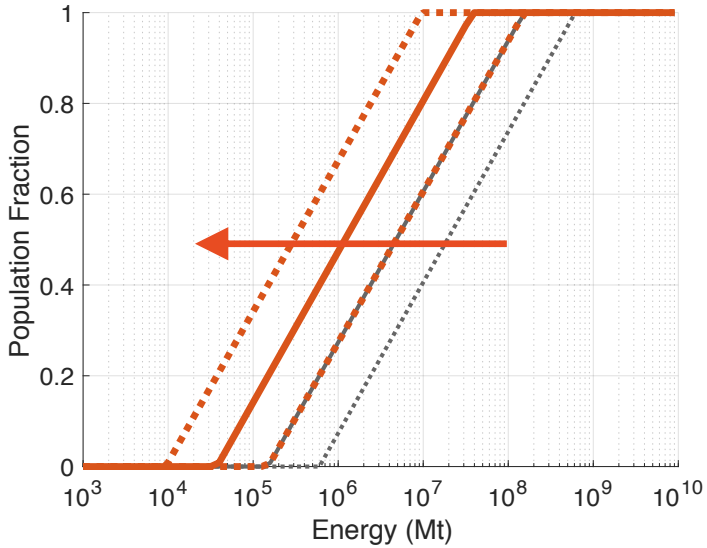


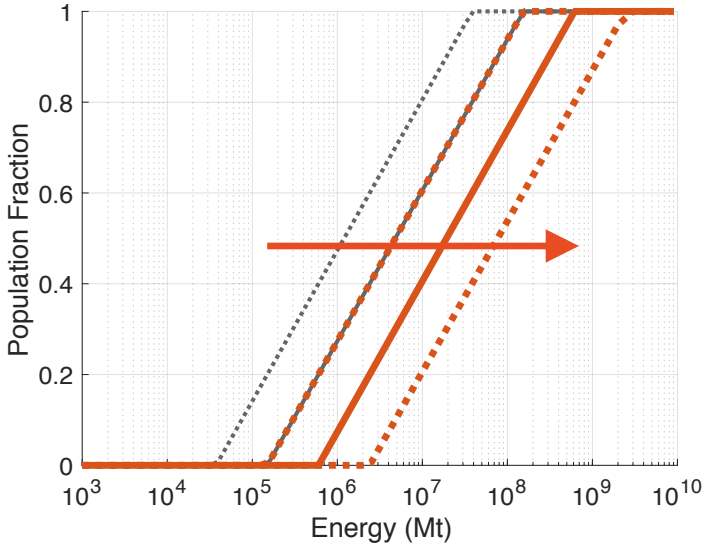


Onset Shift

Baseline
Range
Shift

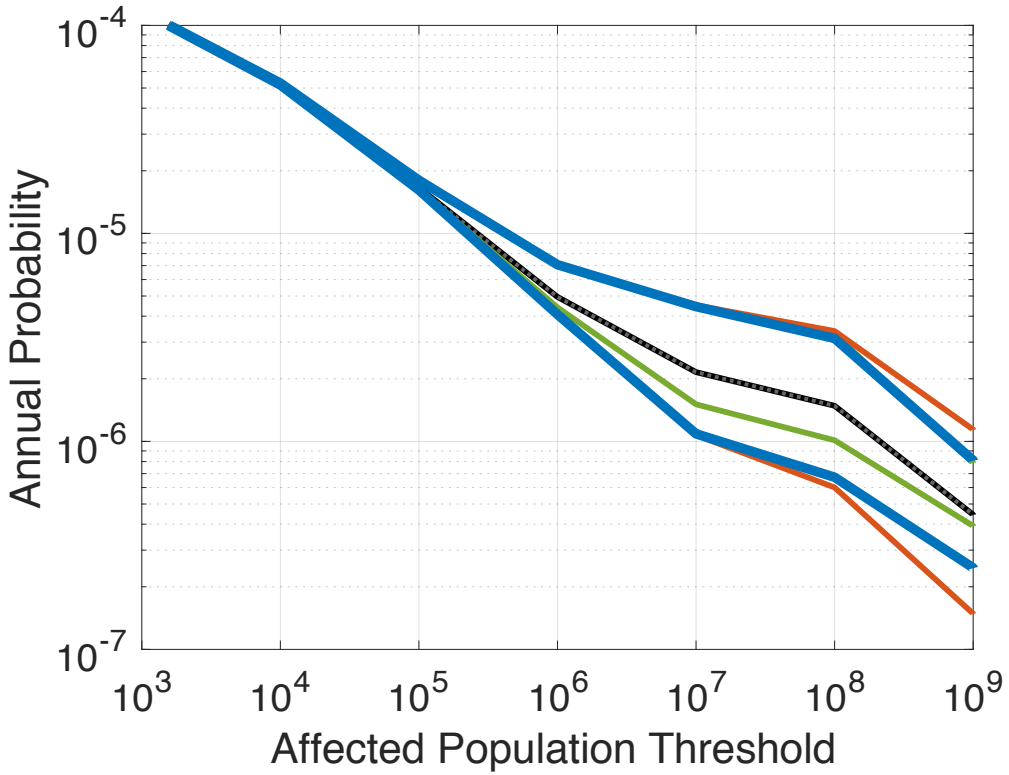


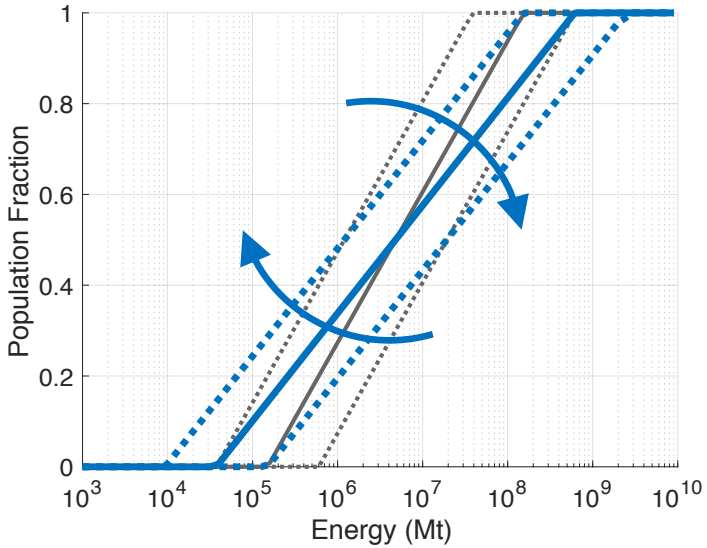


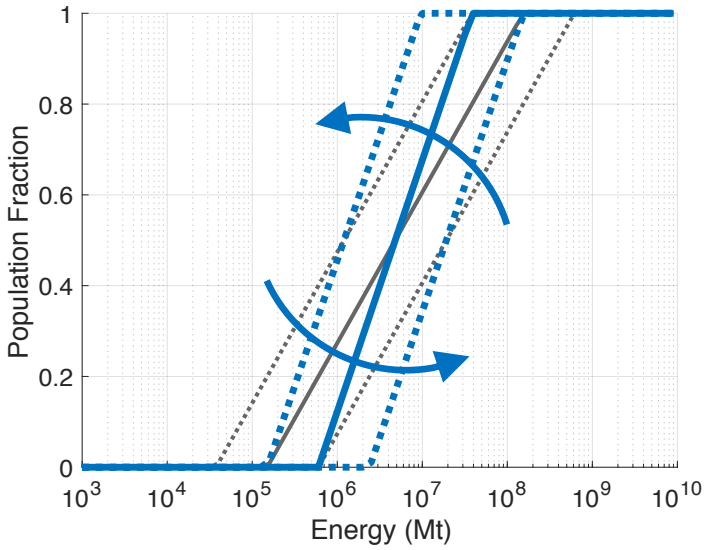


Slope Change (midpoint fixed)

Baseline
Range
Shift
Slope: midpoint fixed

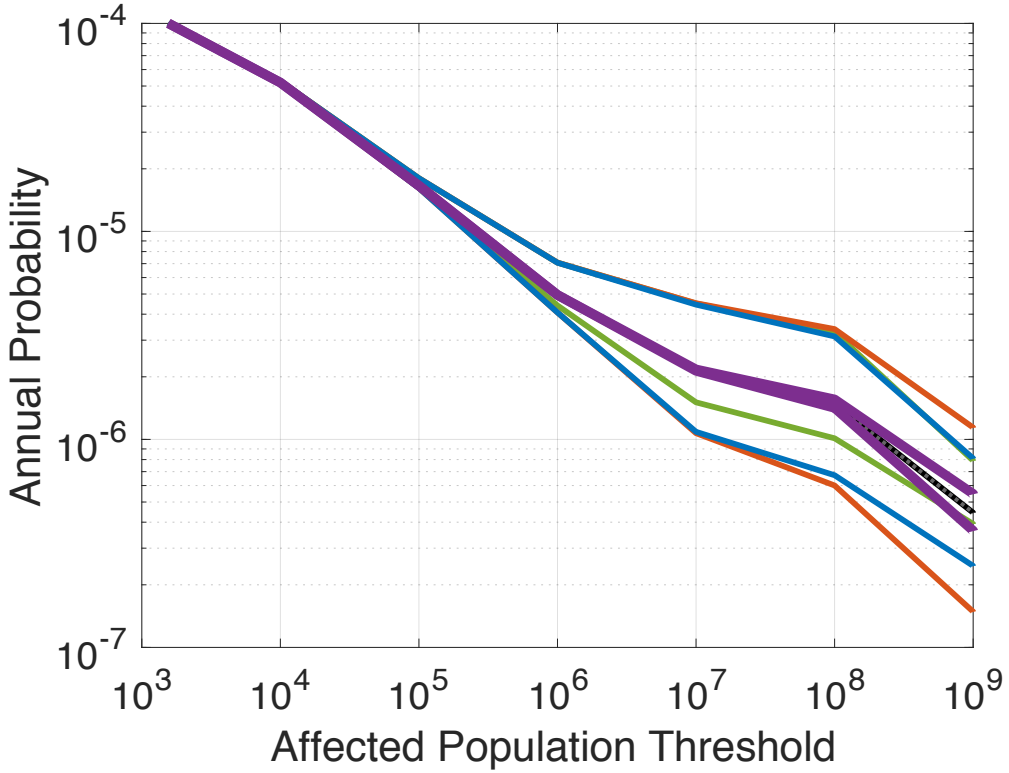


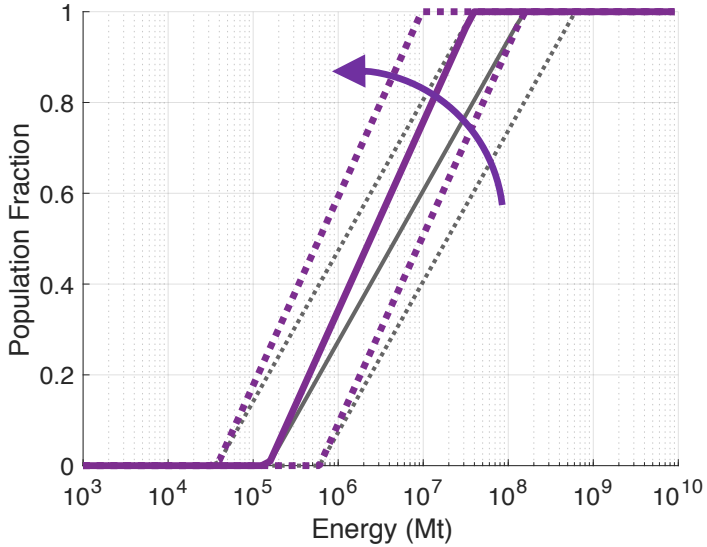


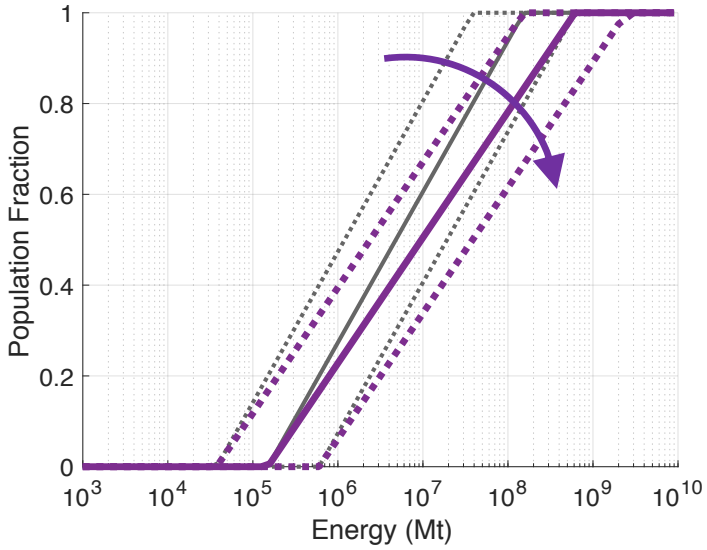


Slope Change (low end fixed)

- Baseline
- Range
- Shift
- Slope: midpoint fixed
- Slope: max shifted

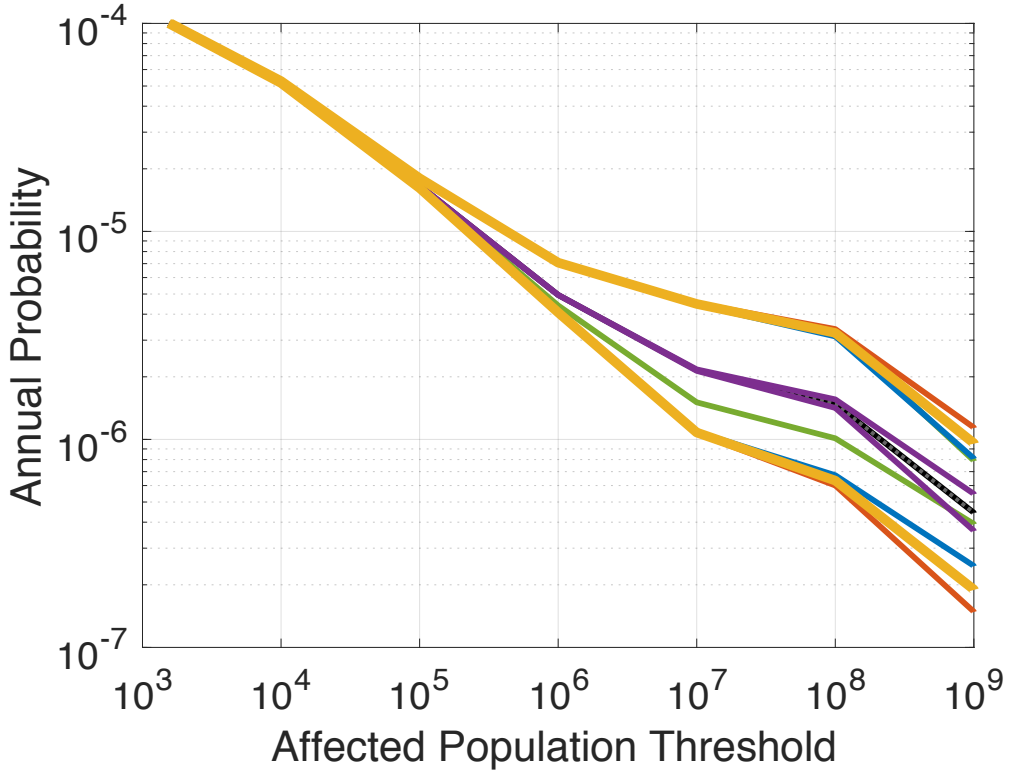


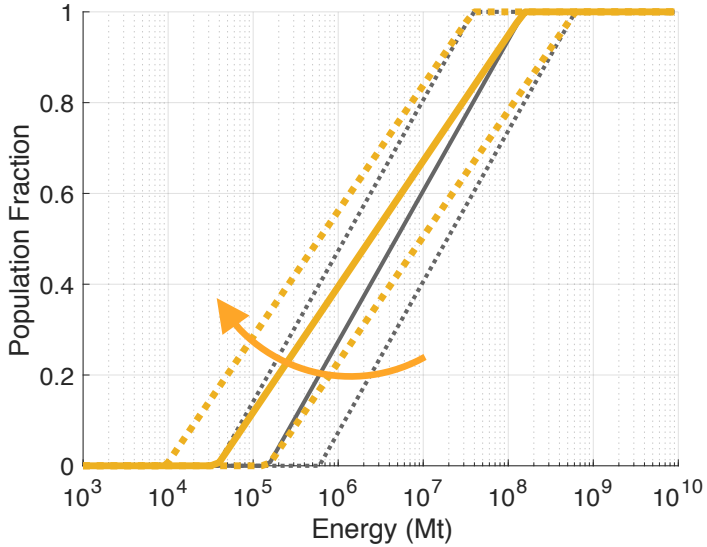


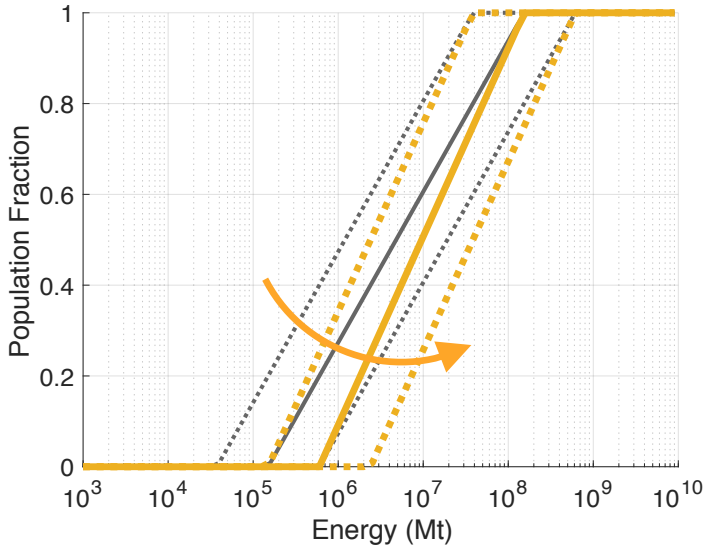


Slope Change (high end fixed)

- Baseline
- Range
- Shift
- Slope: midpoint fixed
- Slope: max shifted
- Slope: min shifted







Summary

- Global effects drive the long-term risk estimates associated with NEO impacts.
- Current GE model based on expert opinion and driven by assumptions.
- This study quantifies risk sensitivities due to changes in model assumptions.
- Point of onset in GE model is most important factor.
- Next steps are to link GE onset to impact physics.
- Such model updates have the potential to meaningfully
  - Shift the long-range risk estimates due to PHOs
  - Change mitigation and emergency preparedness strategies