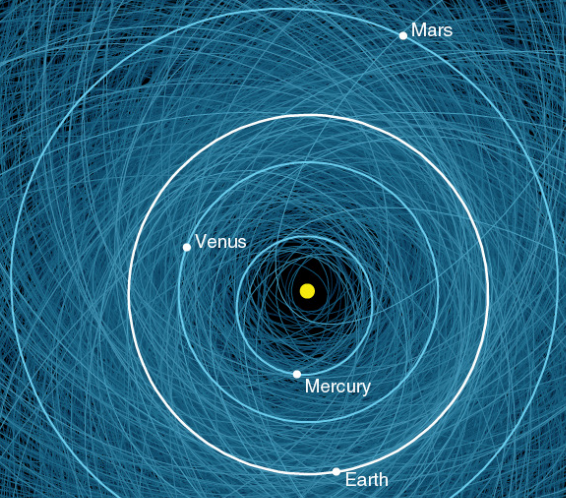
EXERCISE ONLY!!




# 2021 PDC Exercise Final Inject: October 14, 2021 (6 days to impact)

# Asteroid 2021 PDC Detected by Radar: Size Smaller Than Previously Thought, Impact Energy Likely About 40 Mt

**Paul Chodas** (CNEOS/JPL/CalTech) & **Lorien Wheeler** (NASA Ames Research Center)
on Behalf of IAWN

2021 Planetary Defense Conference, College Park, Maryland


EXERCISE ONLY!!

# 2021 PDC: 6 Days to Impact, Detected by Radar

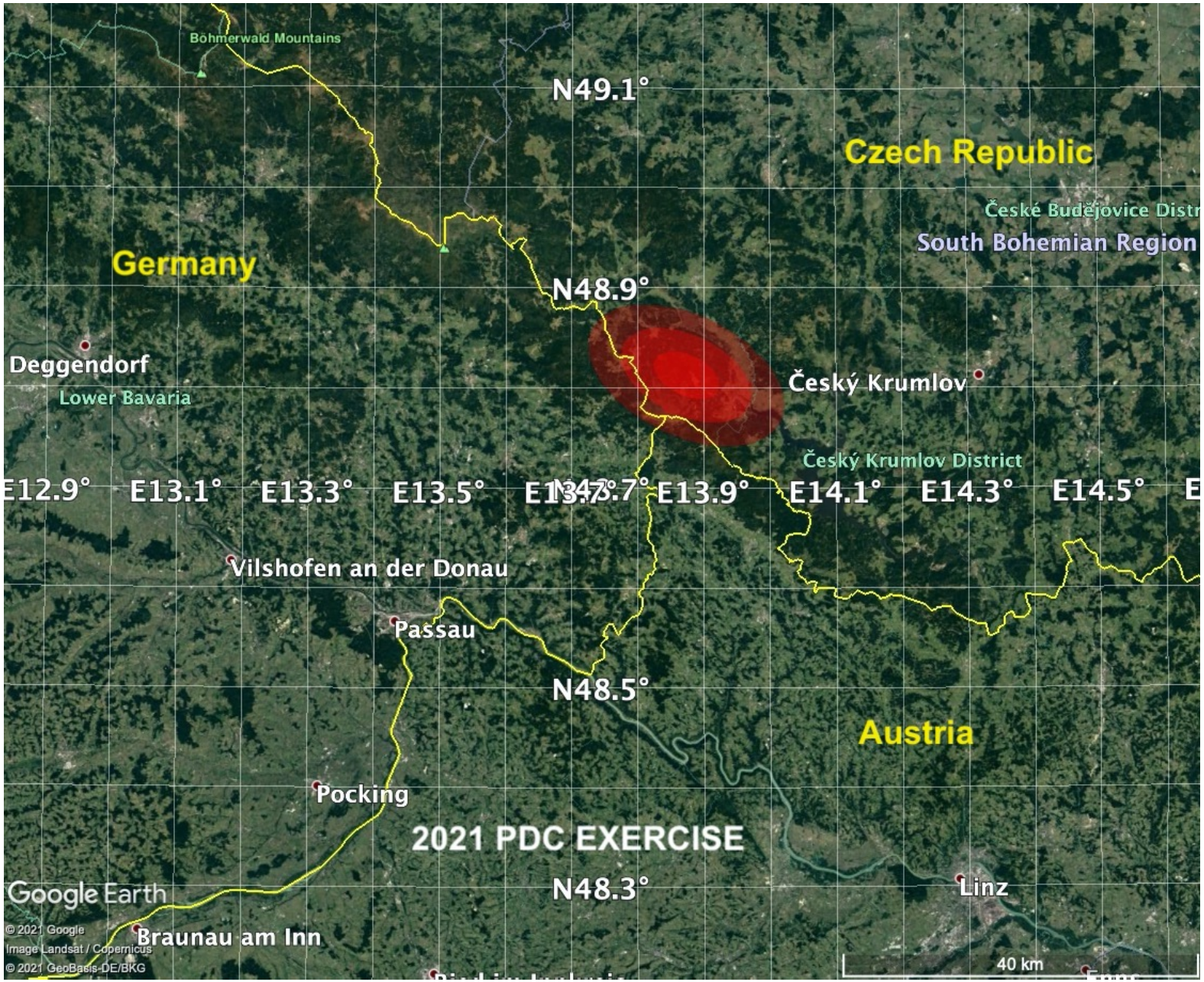
EXERCISE

- With only 6 days left until impact, 2021 PDC has finally approached within range of Goldstone radar (current distance is ~6.3 million km)
- The radar images show the size of 2021 PDC to be **105 m ± 10%**
- Optical tracking over the last 3 months has led to increasingly accurate orbit and impact-region estimates; the radar astrometry has now enabled the most accurate prediction yet of the impact region, which is centered near the border of 3 countries: Germany, Czech Republic and Austria (see next slide)
- The impact location can be predicted to within 23 km, and time to within 1s
- The entry velocity will be **15.2 km/s** (9.5 mi/s or 34,000 mph)
- Still uncertain: size, shape and bulk density, and therefore mass; this leads to a full range of possible impact energies of 9 – 156 Mt; average is ~**40 Mt**
- The worst-case damage region is ~300 km across; average case, ~**150 km**
- For more info: **https://cneos.jpl.nasa.gov/pd/cs/pdc21/final.html**

**EXERCISE ONLY!!**

# 2021 PDC: Predicted Impact Region Six Days Before Impact

EXERCISE




Impact point only: Does NOT include impact effects

Probability of impact inside the entire red shaded region: 99%

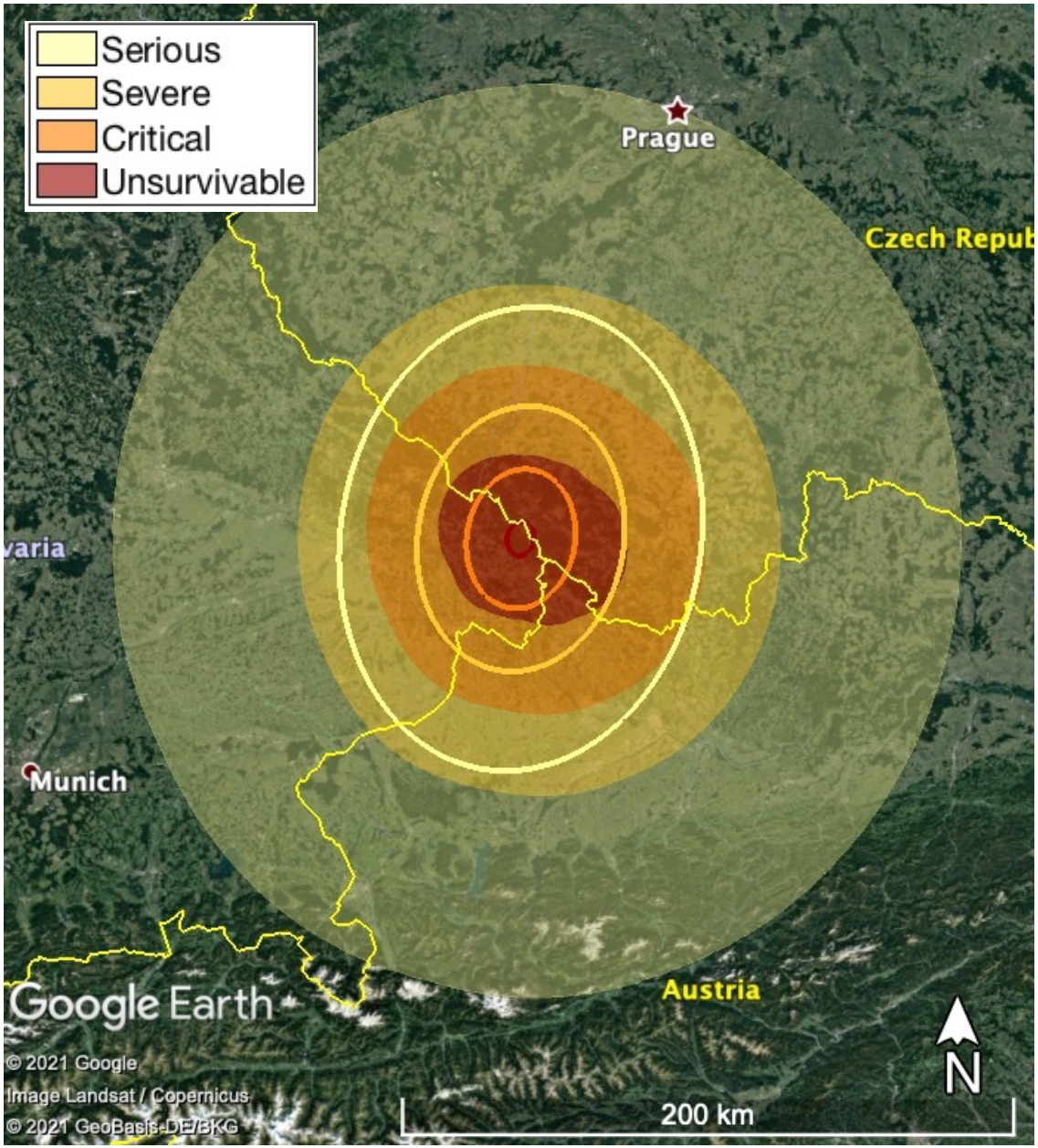
Inside the middle two regions: 87%

Inside the central red region: 40%

**EXERCISE ONLY!!**

# Final Damage Risk Swath

## (full extent of regions potentially at risk)




**Damage risk swath:**

- Shows full range of regions potentially at risk to local ground damage from all modeled cases
- Includes unlikely worst-case objects and all sampled impact locations

**Extent of swath region:**

- ~300 km across

**Damage Extent Estimates:**

- Average: ~120-150 km across
- Max: ~260 km across

EXERCISE

# 2021 PDC: A Few Take-Aways

- A short-warning scenario poses extreme challenges for in-space mitigation
- Had a more sensitive asteroid survey such as NEOSM or Rubin Observatory (LSST) been in place in 2014, it would almost certainly have detected the scenario object, and the 7-year warning of potential impact would have opened up a host of different possible outcomes. In particular, space missions would have been feasible for reconnaissance or simple kinetic-impactor deflection
- Precoveries could play a major role in assessing the impact probability of a threatening object, and in helping to constrain the impact location
- The large end of the estimated size range becomes the dominant factor in a scenario: capabilities that can put an upper bound on the size would be invaluable (space-based IR, planetary radar and recon missions)