Supplement of
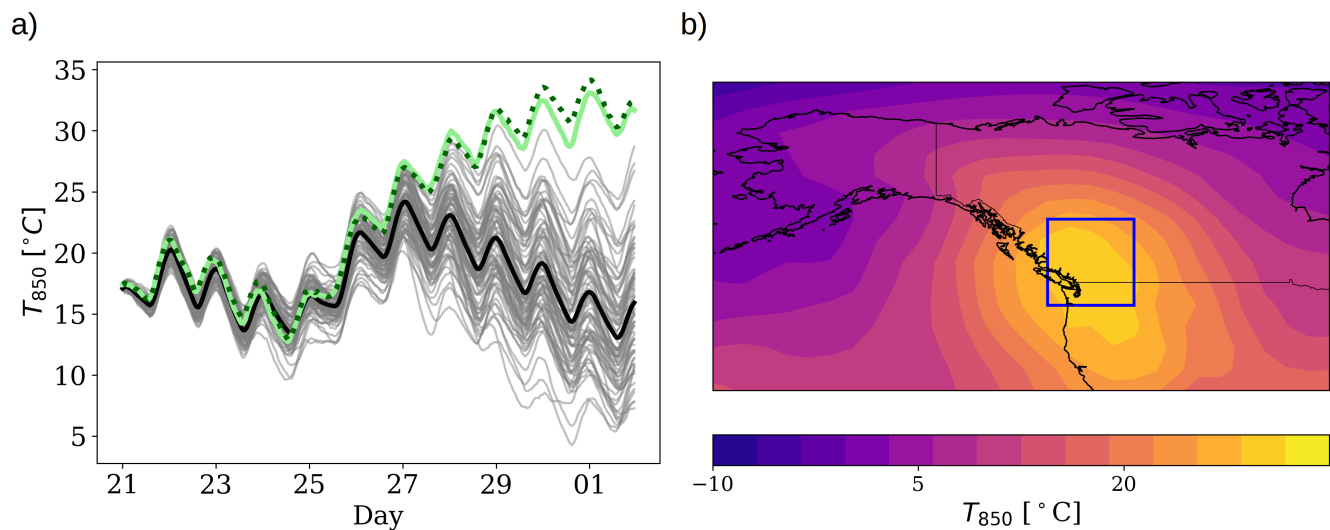
Constructing extreme heatwave storylines with differentiable climate models

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S1 Temperature at 850hPa

a)

b)

Figure S1. Over elevated terrain such as the Canadian Rockies, the 1000 hPa surface is often below ground level. To ensure physically meaningful temperatures across the domain, we also analyze T_{850}. Despite optimization targeting T_{1000}, anomalies at 850 hPa exceed ensemble values, though with smaller magnitude. (a) Time series of T_{850} for EXP50, EXP75, and the ensemble. (b) Spatial map of T_{850} anomalies from EXP75.
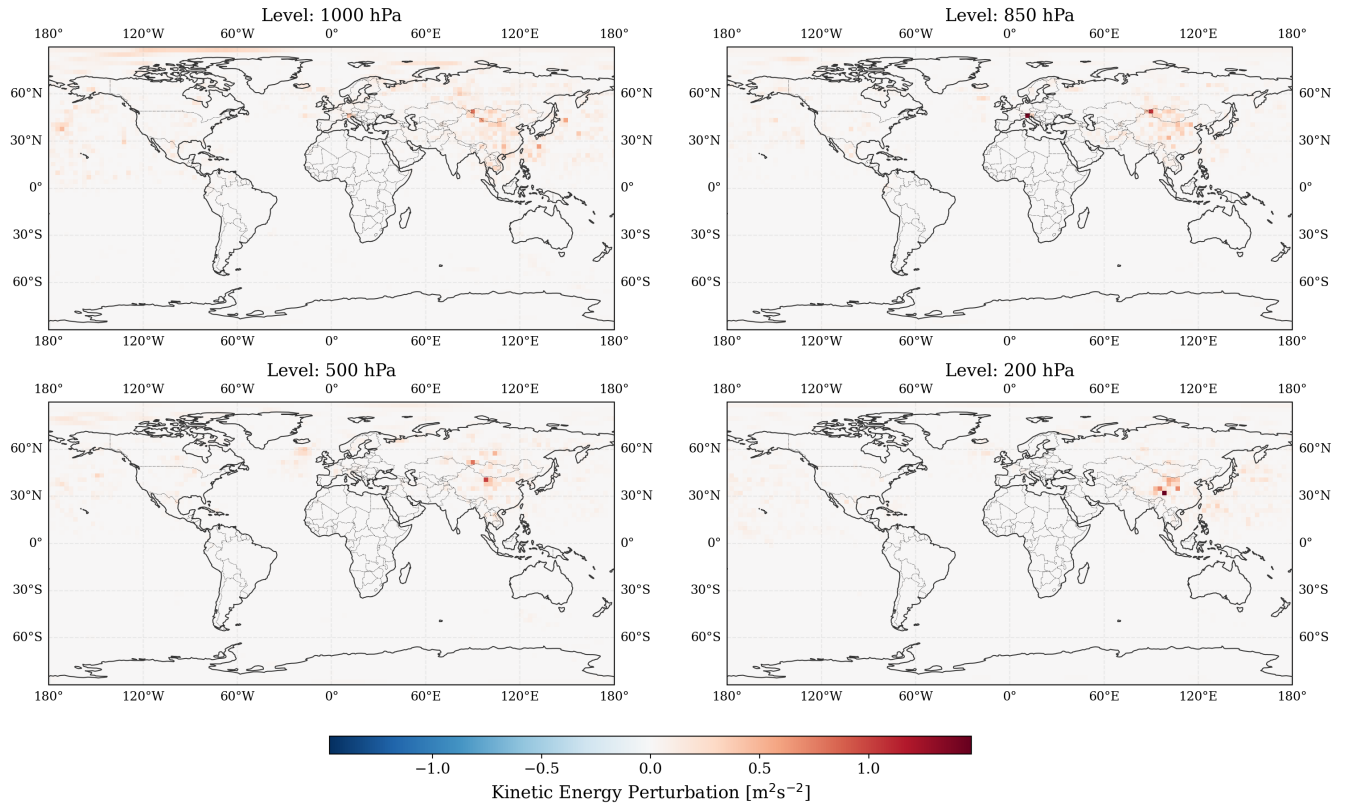
S2 Perturbation Maps
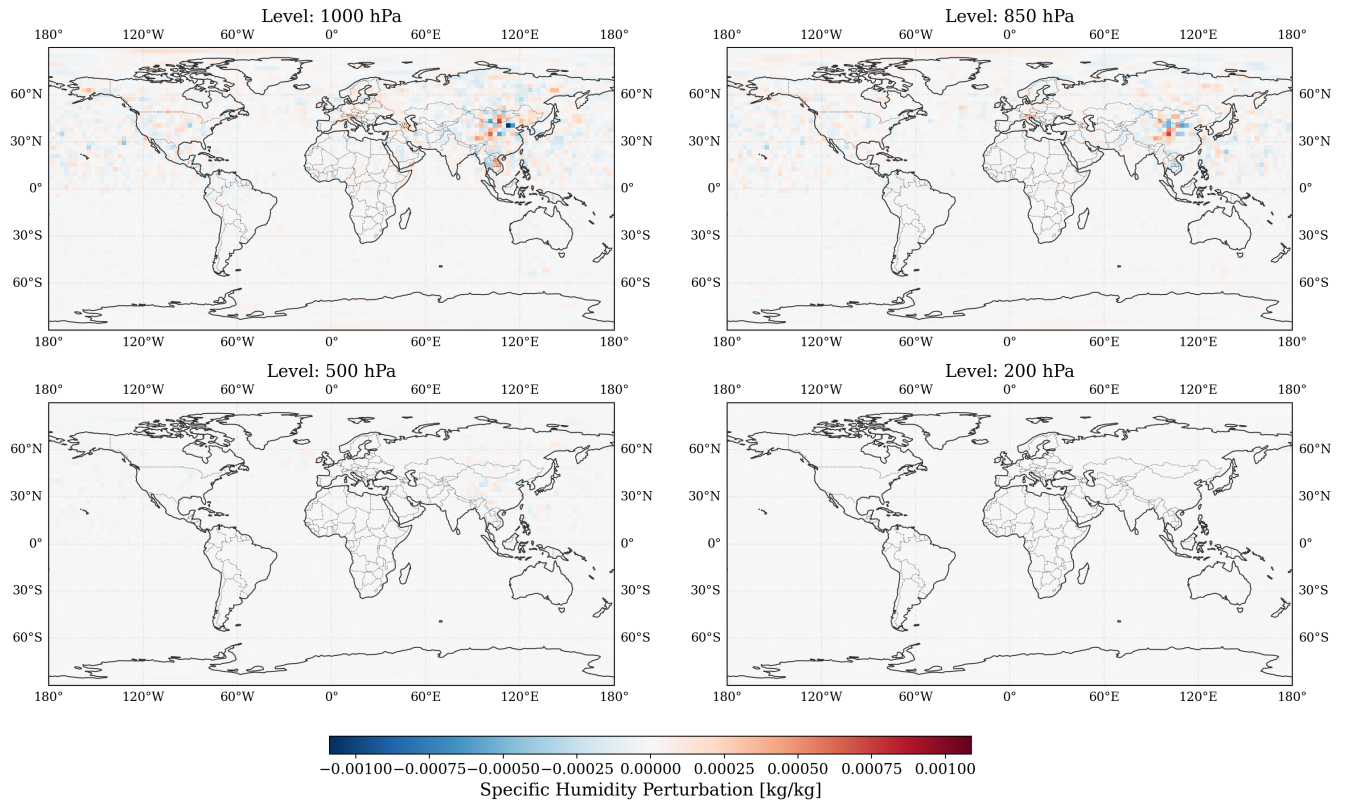
Spatial Distribution: Geopotential
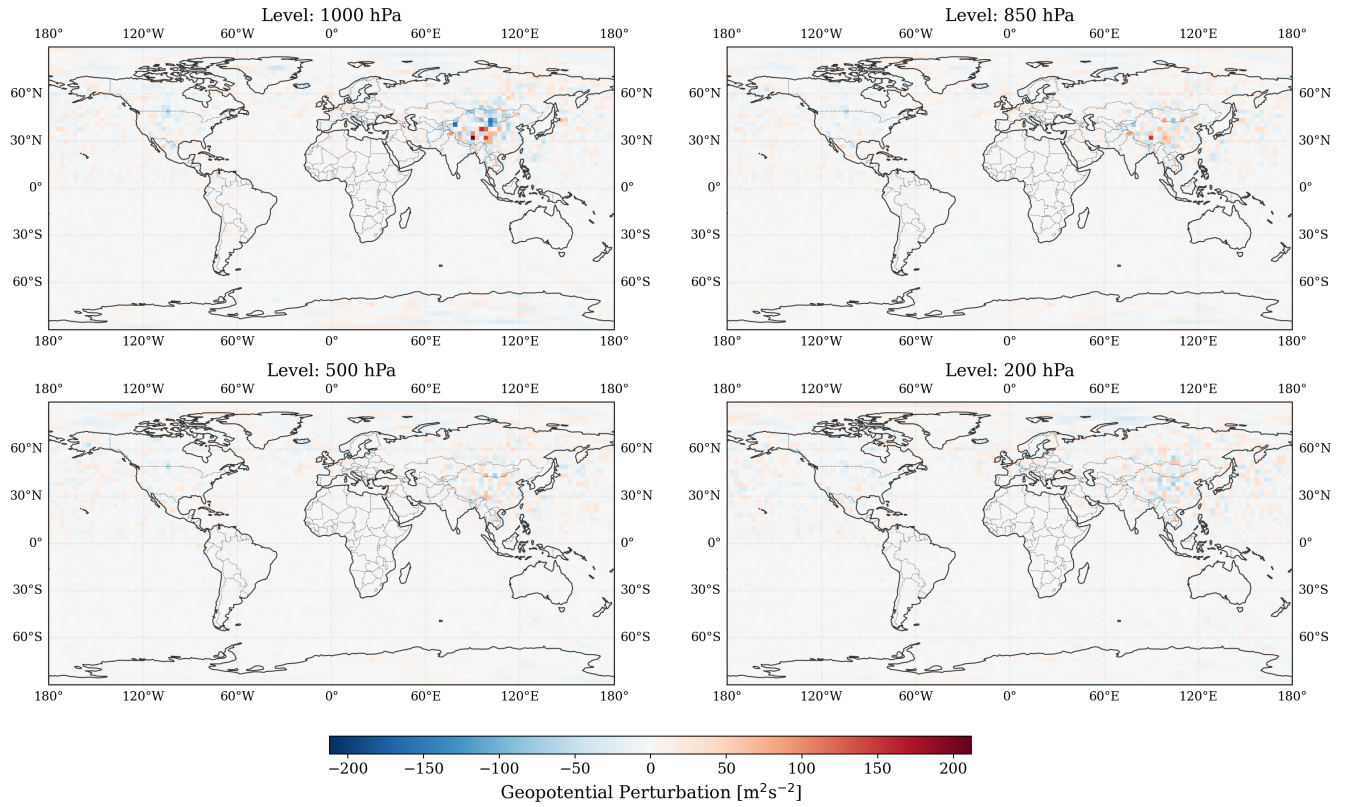
Figure S2. Spatial distribution of initial condition perturbations in geopotential height at four pressure levels (1000, 850, 500, and 200 hPa). The perturbations are primarily concentrated over Asia with lower levels having stronger perturbations
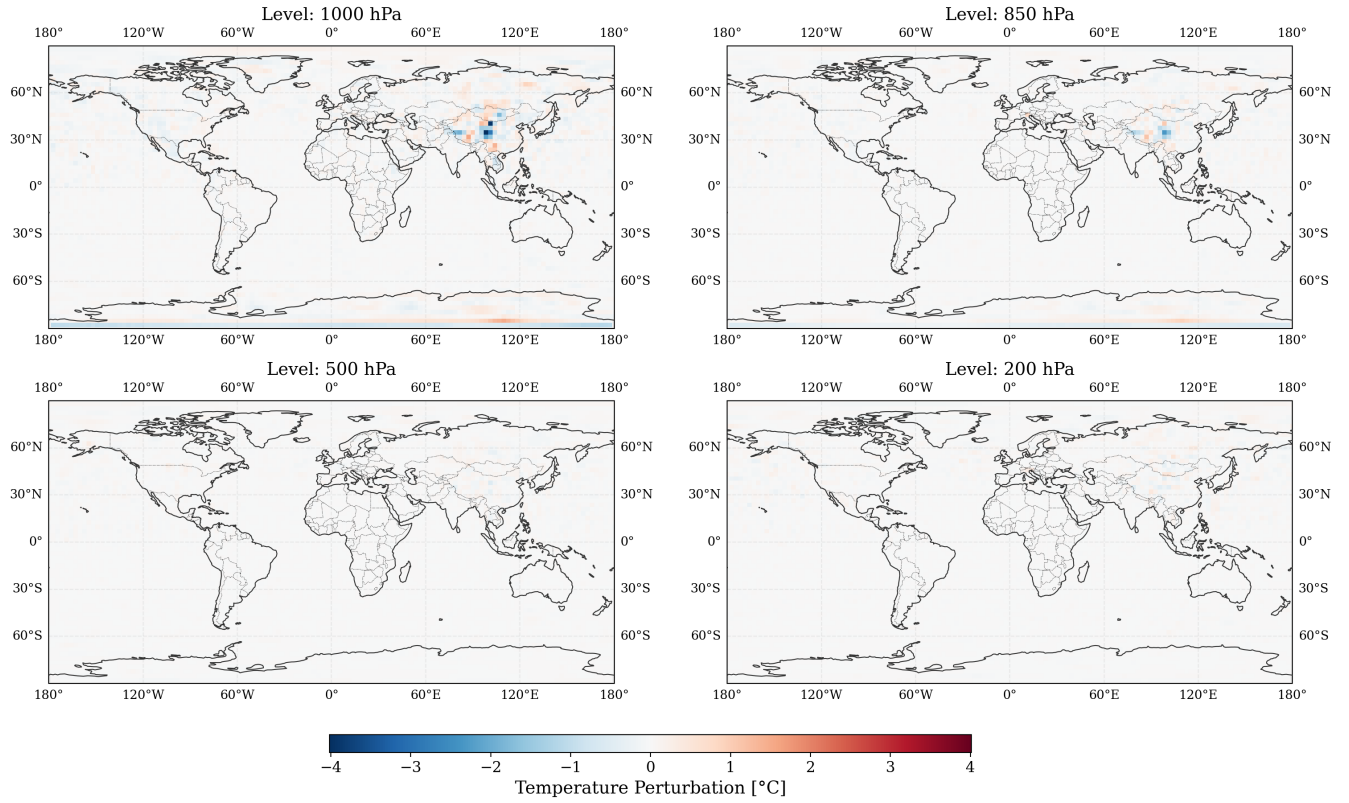
Spatial Distribution: Kinetic Energy

Figure S3. Spatial distribution of initial condition perturbations in kinetic energy at four pressure levels (1000, 850, 500, and 200 hPa). The perturbations are primarily concentrated over Asia with similar strengths of perturbations at all model levels.

Spatial Distribution: Specific Humidity

Figure S4. Spatial distribution of initial condition perturbations in specific humidity at four pressure levels (1000, 850, 500, and 200 hPa). The perturbations are primarily concentrated over Asia with lower levels having stronger perturbations

Spatial Distribution: Temperature

Figure S5. Spatial distribution of initial condition perturbations in temperature at four pressure levels (1000, 850, 500, and 200 hPa). The perturbations are primarily concentrated around Asia and stronger for the lower levels.