

Crowd-Sourced Annotation of Extreme Weather Events

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1 Introduction

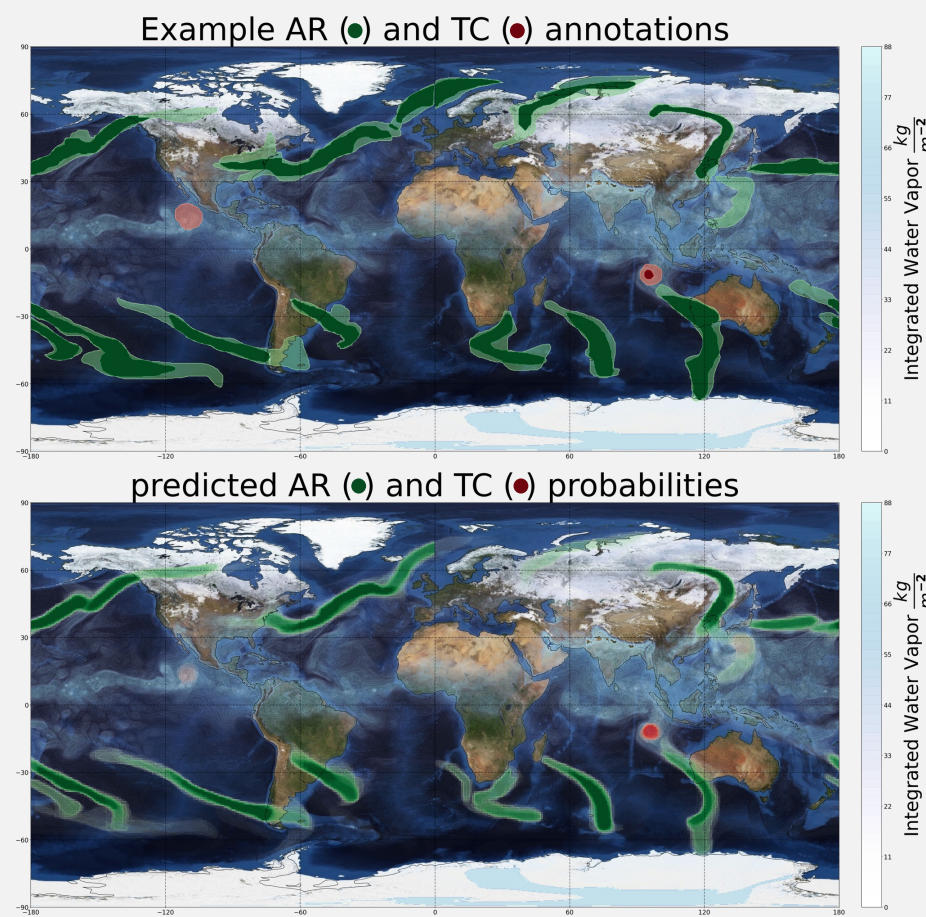
We present the world's **largest annotated dataset of extreme weather events**, including Tropical Cyclones, Atmospheric Rivers and Blocking Events, **compiled using crowd workers under expert guidance**.

2 Data Set

- Human annotators segmented **10,000 time-steps of ERA5 reanalysis data** into **pixel-level segmentation masks** for individual events
 - Annotated samples span a time range of 40 years and represent a diverse set of different atmospheric conditions
- Iterative feedback using detailed annotation guides ensures **high annotation quality**
- Each timestep is annotated by 2 annotators to provide **redundancy** and help with the estimation of **uncertainty**

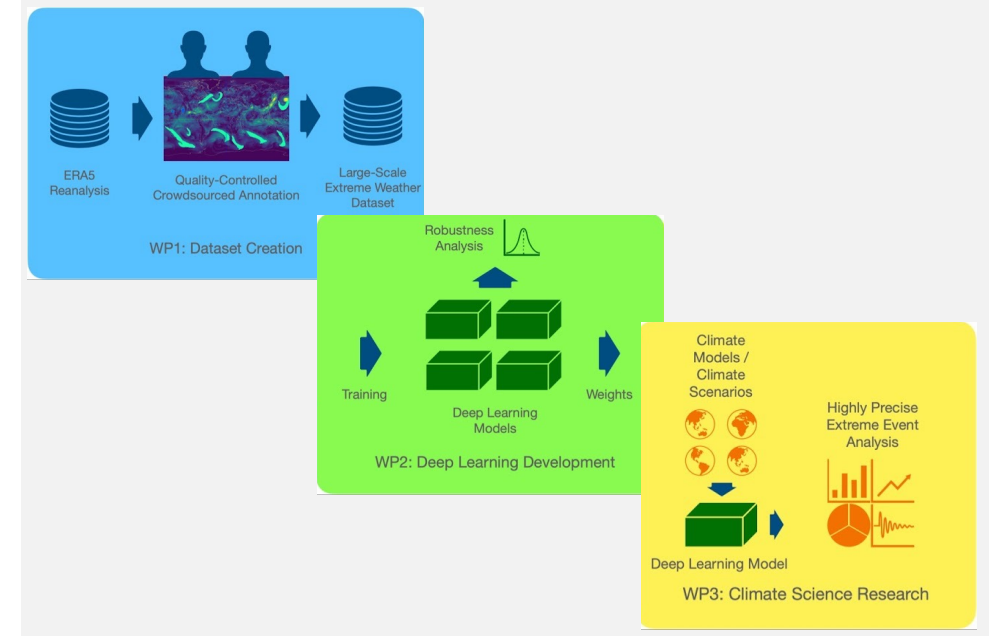
3 Probabilistic Segmentation of Extreme Weather

- How to provide probabilistic detection of extreme weather events without hand-crafted heuristics?
- We train conditional diffusion models [1] that predict segmentation masks from atmospheric states
 - Aggregating multiple samples enables uncertainty estimation



4 Next Steps

- Extend segmentation model to support blocking events
- Run extensive evaluation on different modalities (observational data and climate model output) to investigate the robustness and reliability of our methods as compared to previous work [2, 3]



References

- Wu, Junde, et al. "Medsegdiff: Medical image segmentation with diffusion probabilistic model." *arXiv preprint arXiv:2211.00611* (2022).
- Kashinath, Karthik, et al. "ClimateNet: An expert-labeled open dataset and deep learning architecture for enabling high-precision analyses of extreme weather." *Geoscientific Model Development* 14.1 (2021): 107-124.
- Kapp-Schwoerer, Lukas, et al. "Spatio-temporal segmentation and tracking of weather patterns with light-weight Neural Networks." (2020).