A DEEP LEARNING FRAMEWORK TO EFFICIENTLY ESTIMATE PRECIPITATION AT THE CONVECTION PERMITTING SCALE

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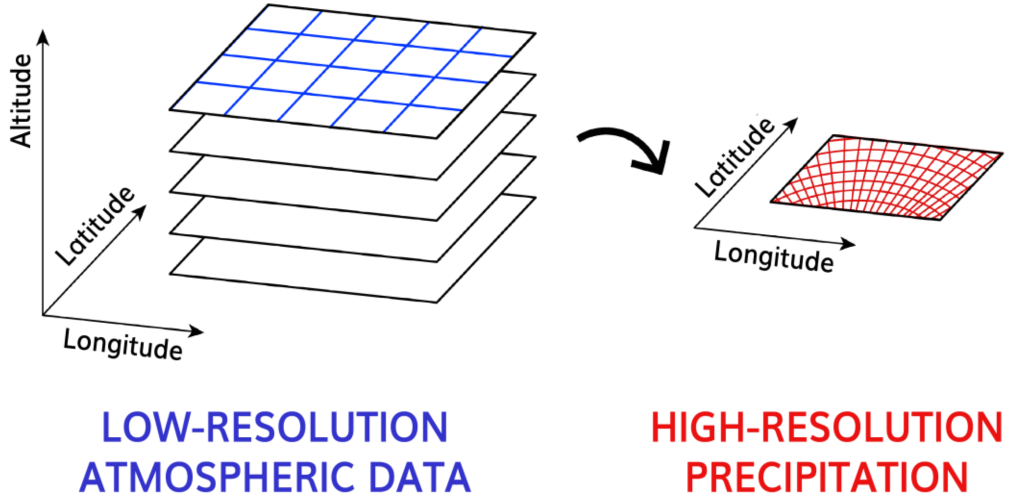
Climate Change AI

Tackling Climate Change with Machine Learning Workshop at ICLR 2024

1. MOTIVATION AND OBJECTIVE

- Severe precipitation is a challenging phenomenon and high-res estimates are needed to correctly quantify the associated hazard.
- Traditional methods either lack in accuracy or are computationally very expensive.
- This work presents a novel data driven framework based on deep learning to efficiently map large scale atmospheric data to local precipitation.
- The trained framework can be used to derive precipitation estimates that resemble the observations, at the convection-permitting scale.

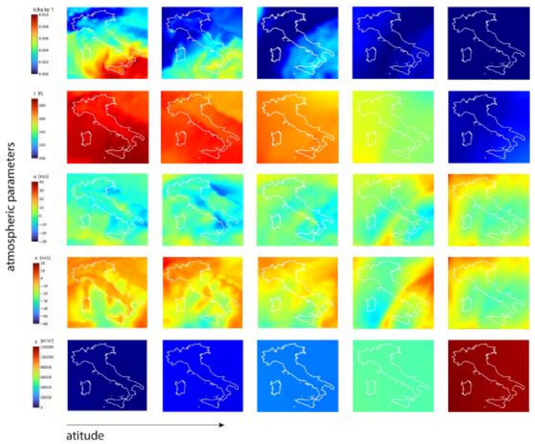


2. DATA

Input datasets

Target dataset

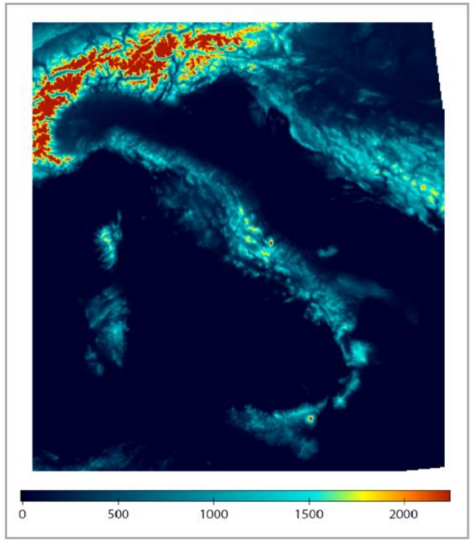
ERA5 REANALYSIS (~25 km)



HUMIDITY, TEMPERATURE, WIND, GEOPOTENTIAL

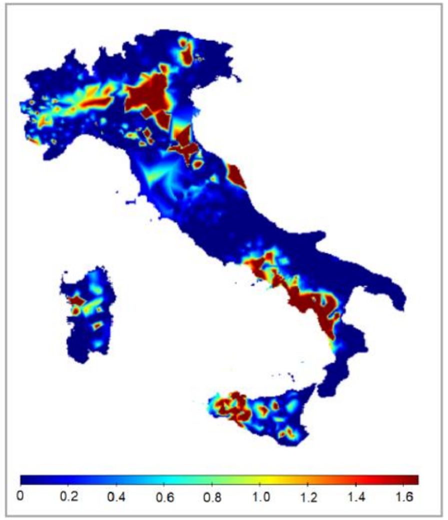
4D: lon, lat, altitude, time (hourly)

TOPOGRAPHIC ELEVATION (3 km)



2D: lon, lat

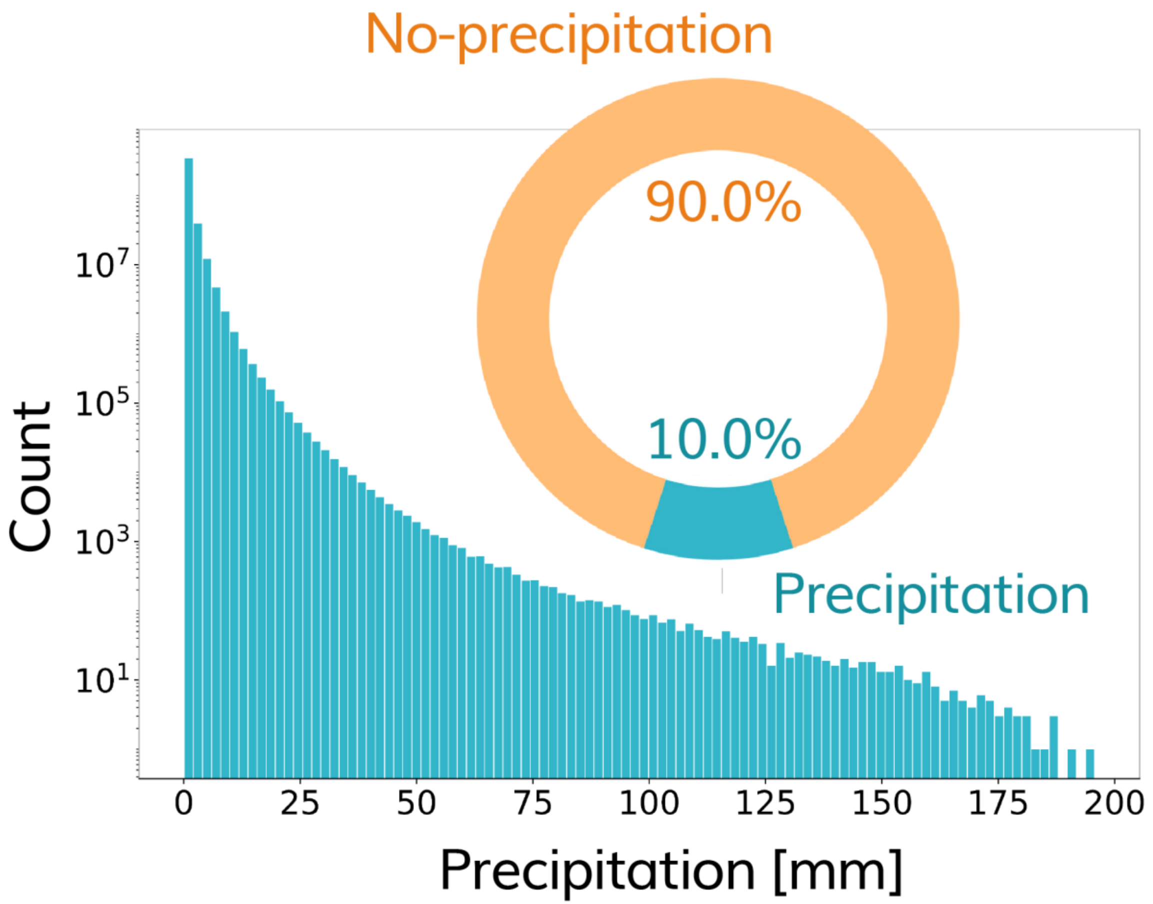
GRIPHO OBSERVATIONS (3 km)

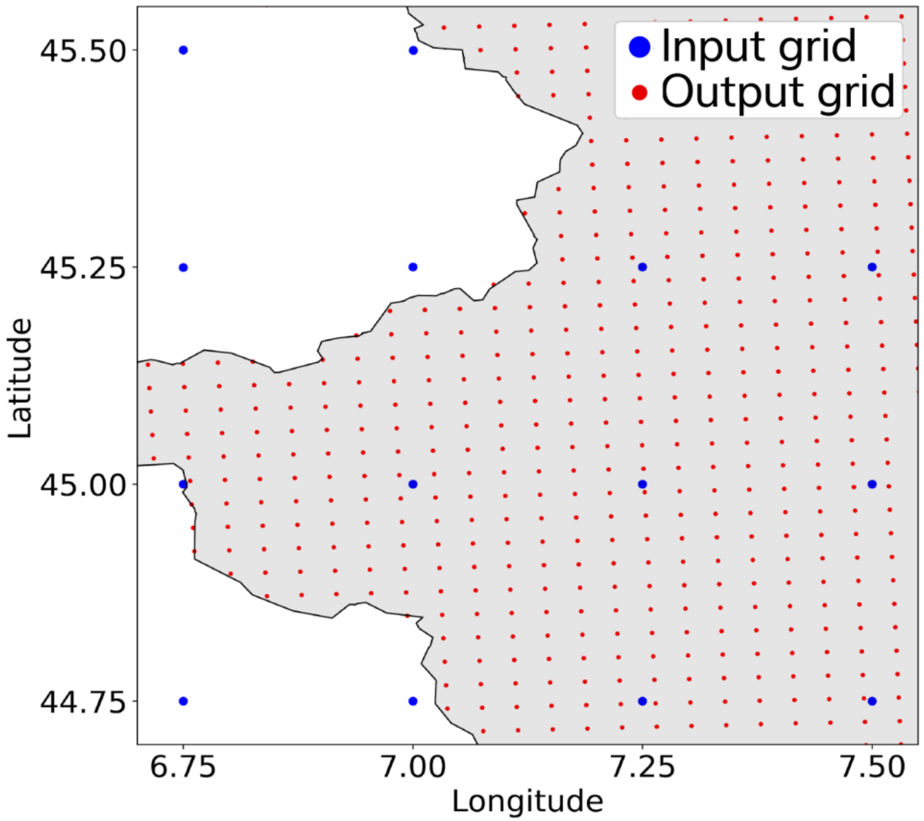


PRECIPITATION

3D: lon, lat, time (hourly)

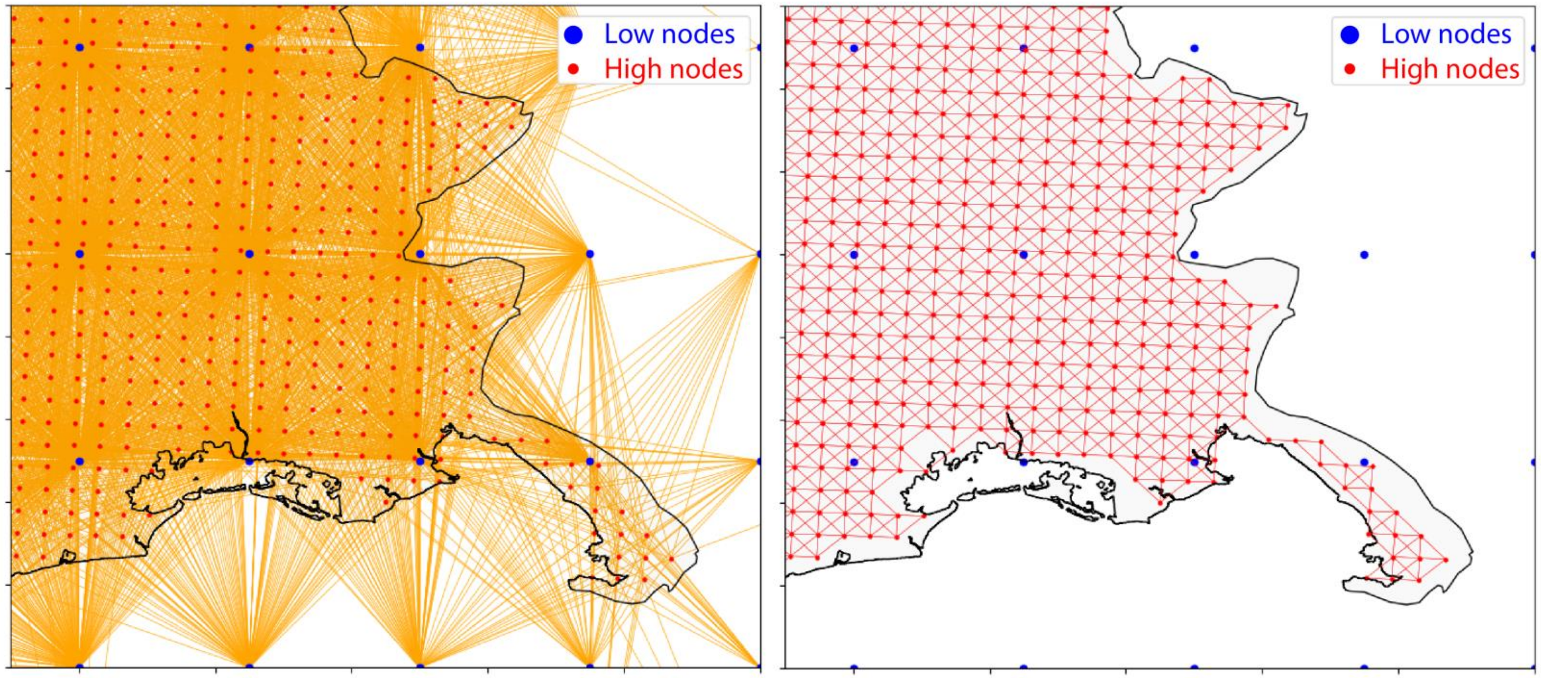
3. MAIN CHALLANGES



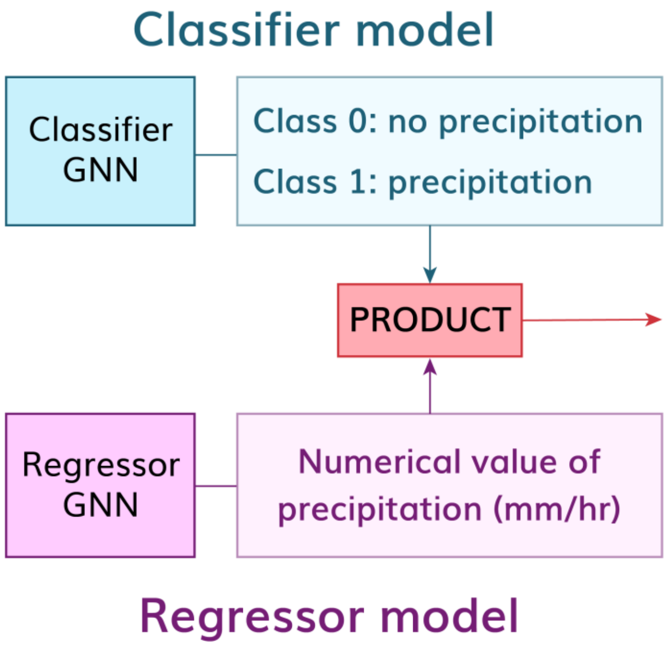


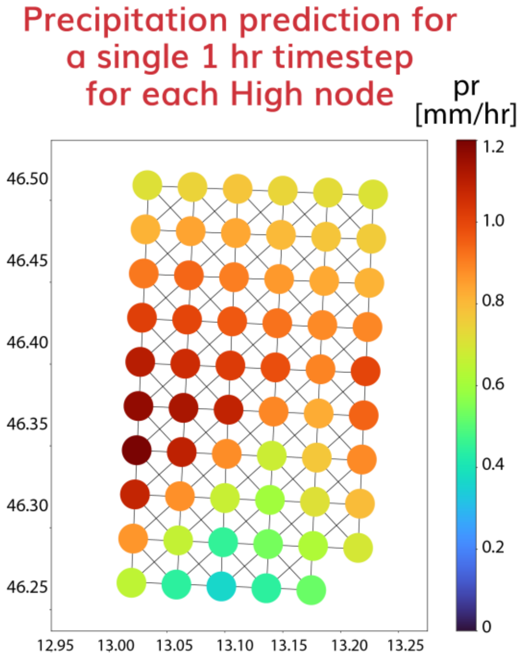
4. GRAPH CONCEPTUALIZATION

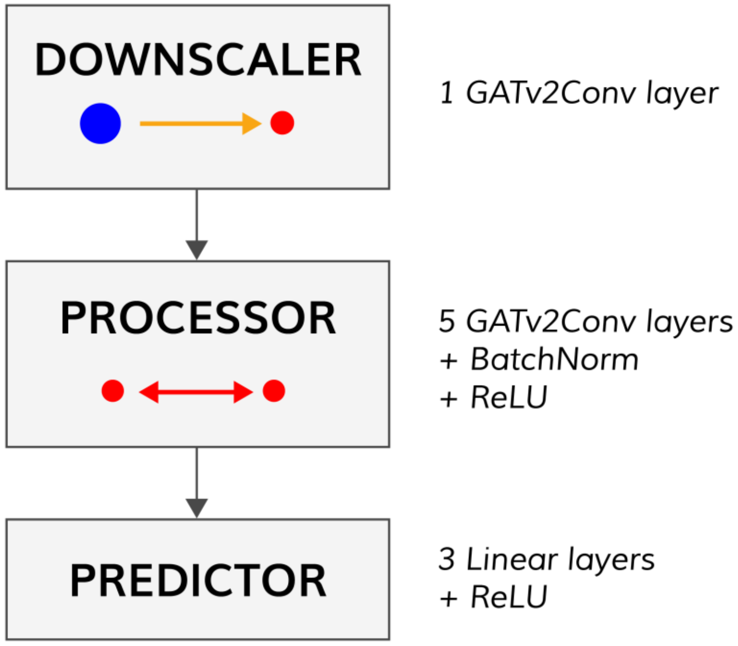
- Low nodes (~25 km)
- High nodes (3 km)
- → Low-to-High edges
- ↔ High-within-High edges



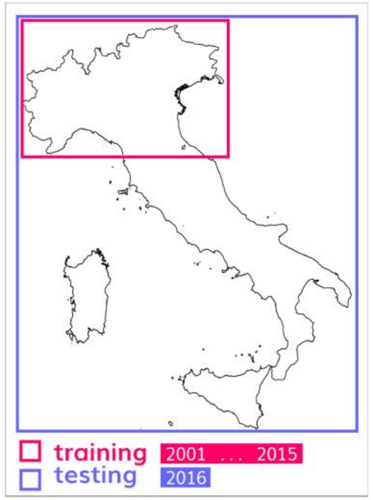
5. DEEP LEARNING MODEL



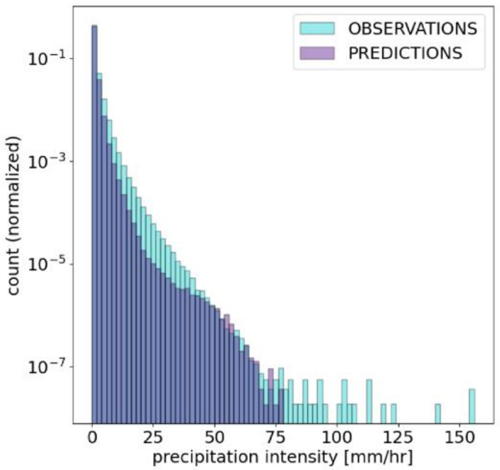




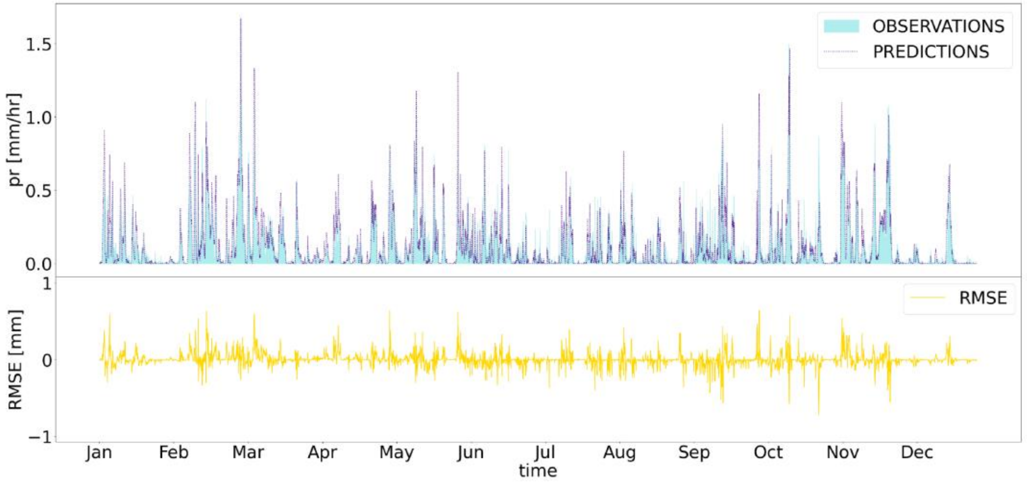
6. RESULTS



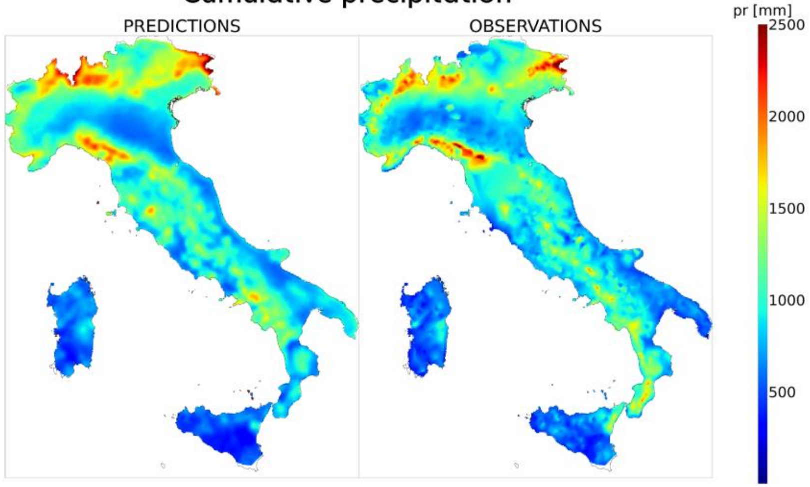
Histogram



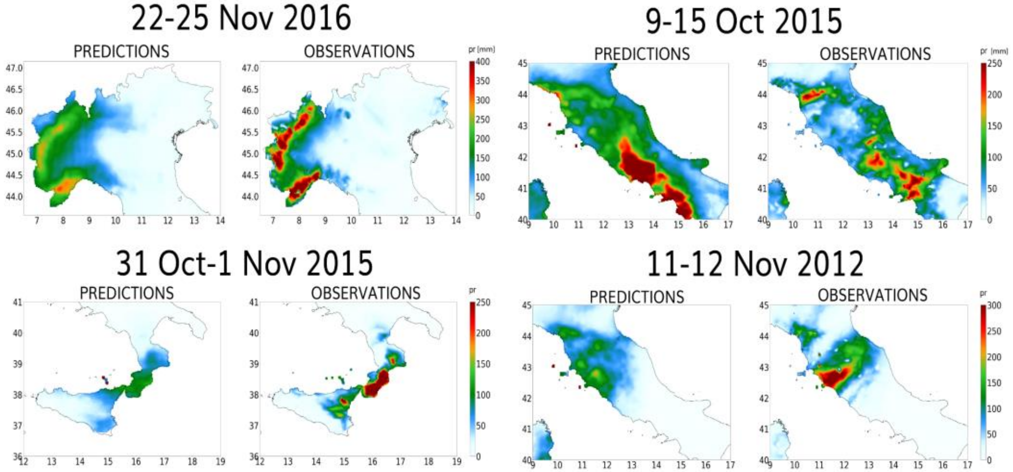
Time series



Cumulative precipitation



Exreme events



7. FUTURE STEPS

- Explore different DL architectures and training losses to improve:
    1) the spatial downscaling capabilities;
    2) the quality of the distribution estimation.

- Further investigate the transferability potential.

- Use model-generated predictors as input to the framework trained on reanalysis data to predict High Precipitation weather Events (HPEs) and compare the results with those of conventional dynamical downscaling methods.

THANK YOU!

For questions or suggestions:

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