

# Long-Range Forecasting of 2m-Temperature with Machine Learning

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# Motivation

## **Why Long-Range Temp. & Precip. Forecasts?**

- Temperature and precipitation are important climate variables that can have adverse effects on the economy and society
- Sectors affected include: Agriculture, forestry, fisheries, energy, health, tourism
- Long-range forecasts can assist in mitigation and preparedness of anticipated impacts

# Motivation

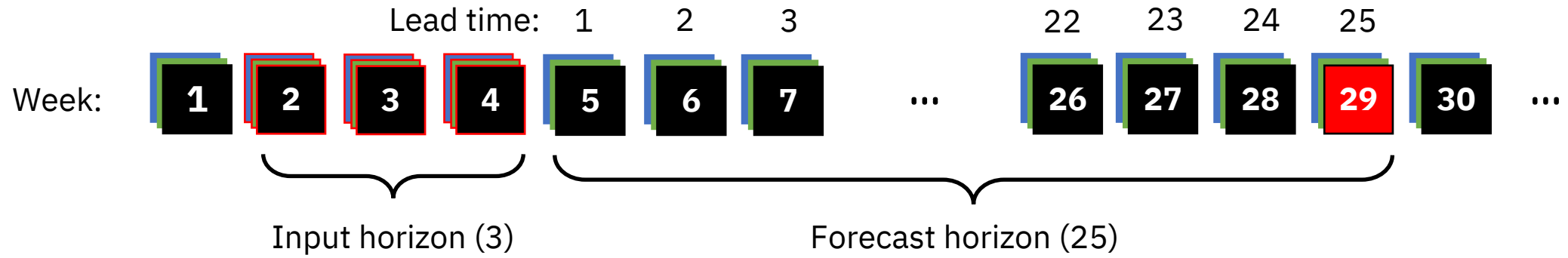
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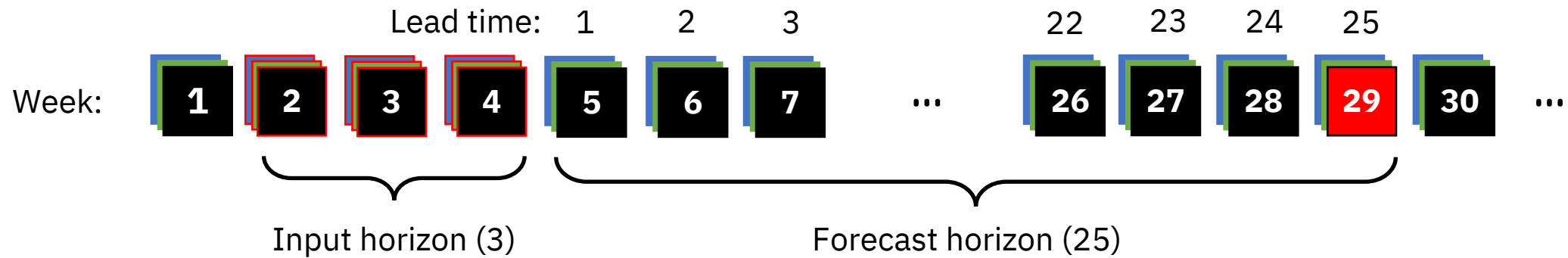
## **Why Use Machine Learning?**

- ML approaches require less time and resources to train than numerical climate models
- Predictions from ML approaches can be interpretable (e.g. Toms *et al.*, 2019)
- In some cases, ML can improve upon numerical climate models (e.g. Ham *et al.*, 2019)

# Single-Target CNN & LSTM



# Single-Target CNN & LSTM



**Dataset:** ERA5 Reanalysis

**Predictor Variables:**

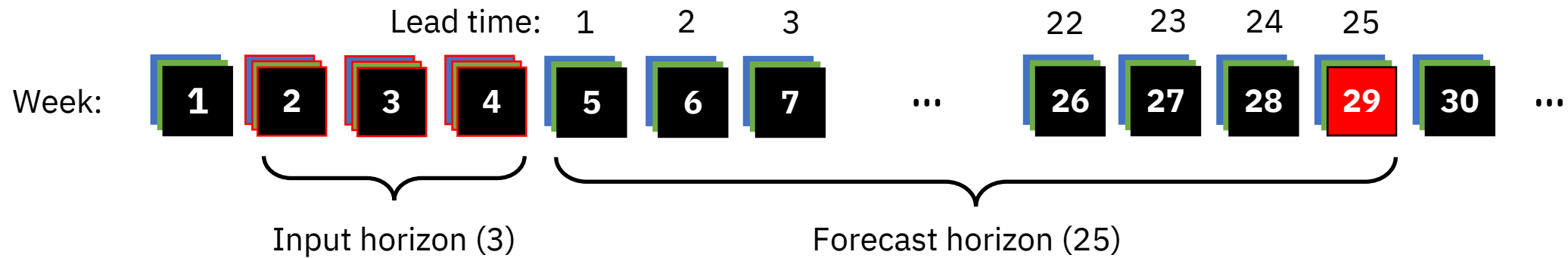
- 2m Temperature
- 150mb Geopotential
- 500mb Geopotential

**Predictand Variable:** 2m Temperature

**Spatial Resolution:**  $3^\circ \times 3^\circ$

**Temporal Resolution:** Weekly

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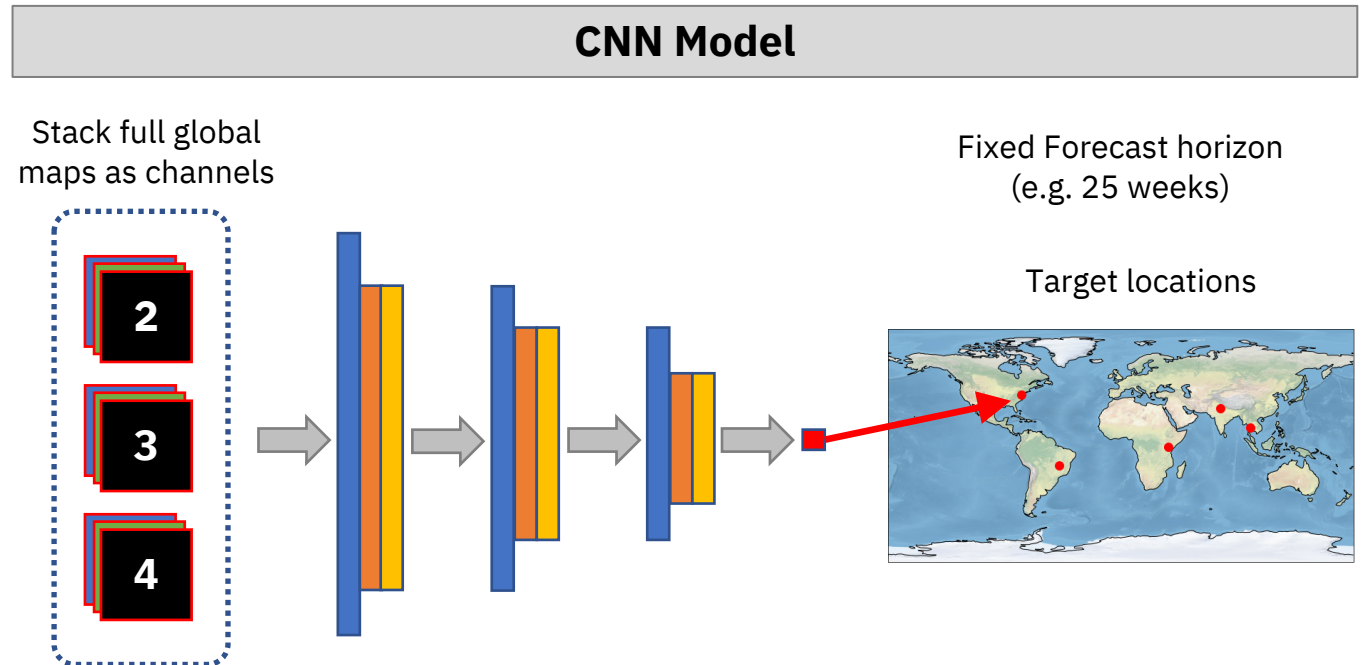
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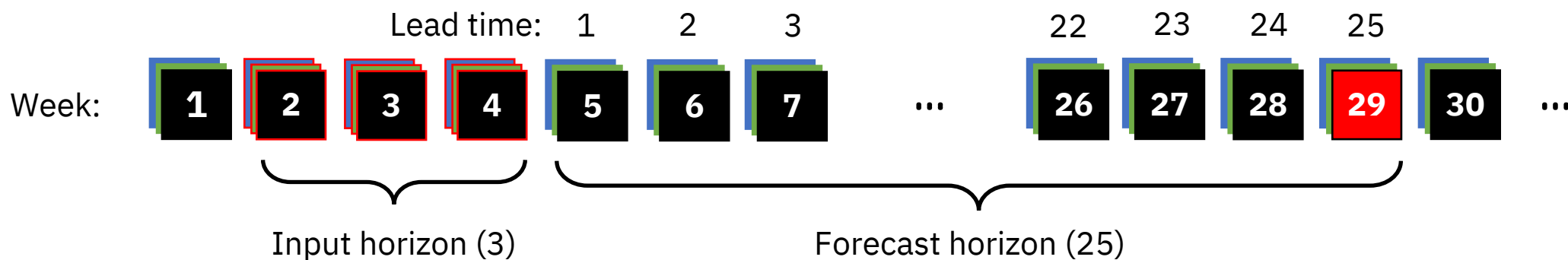
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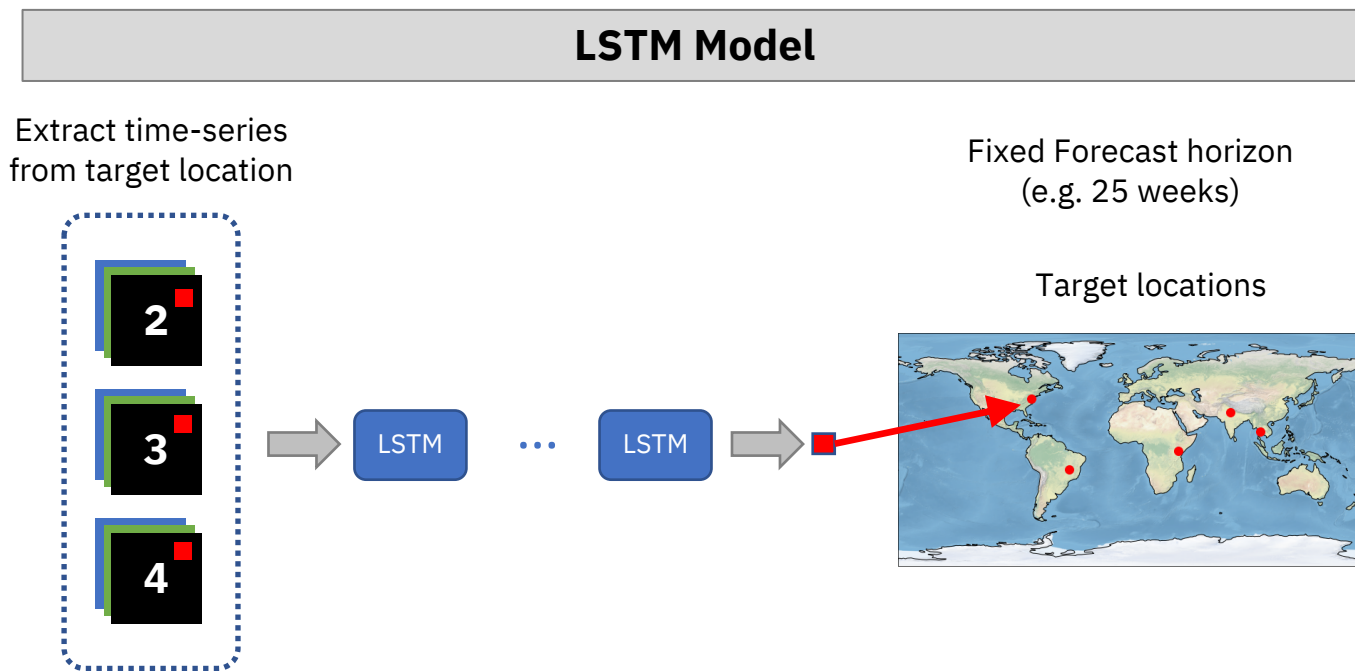
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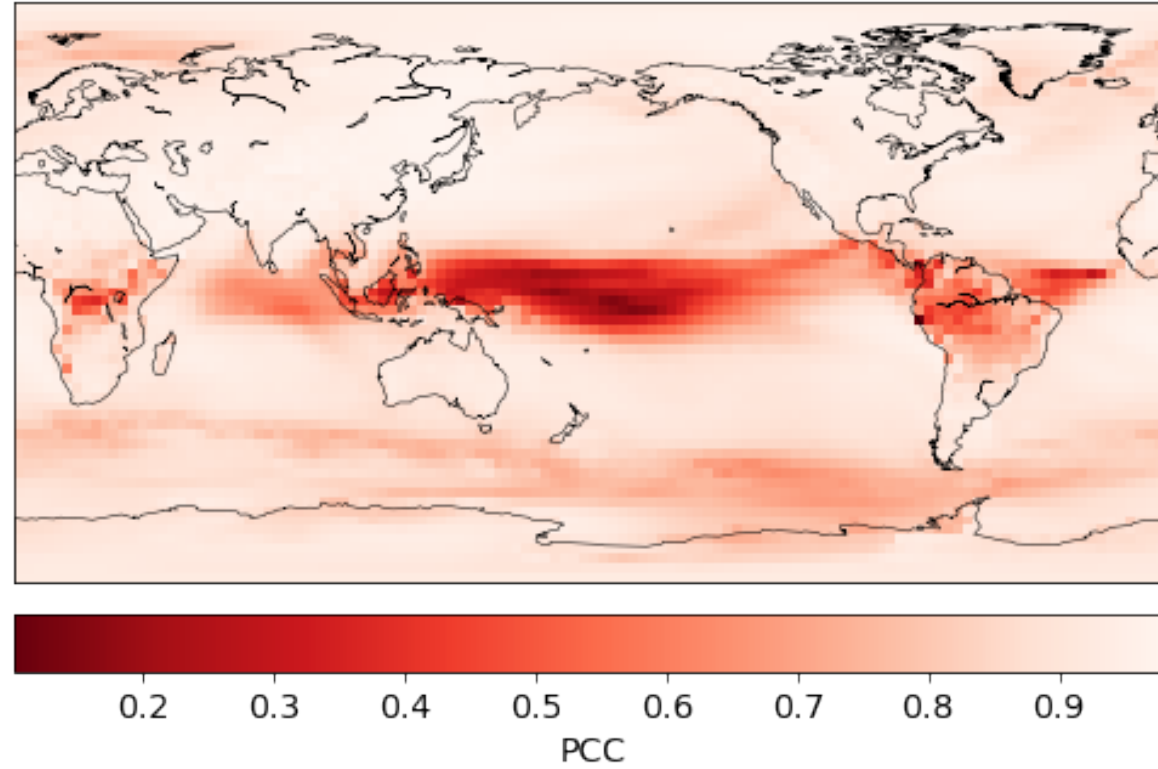
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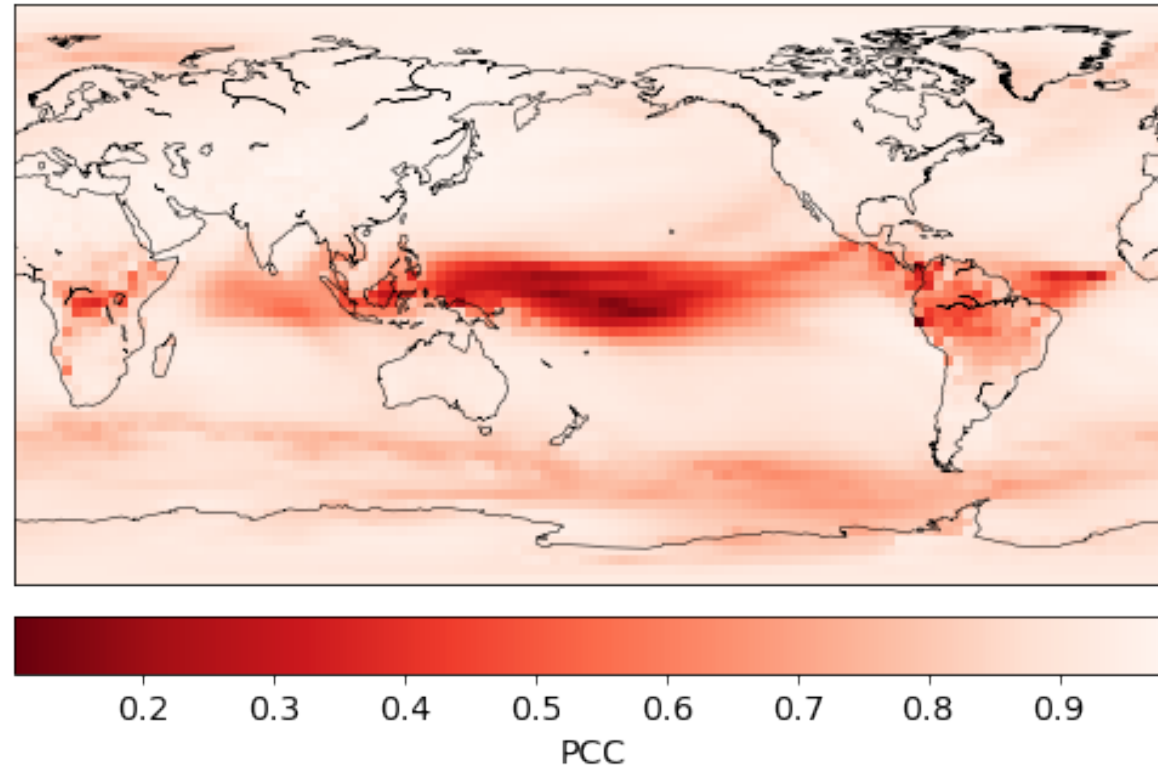
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# Climatology PCC



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**Low latitudes:** Honolulu, USA (21.3°N, 157.9°W); Panama City (9.0°N, 79.5°W)

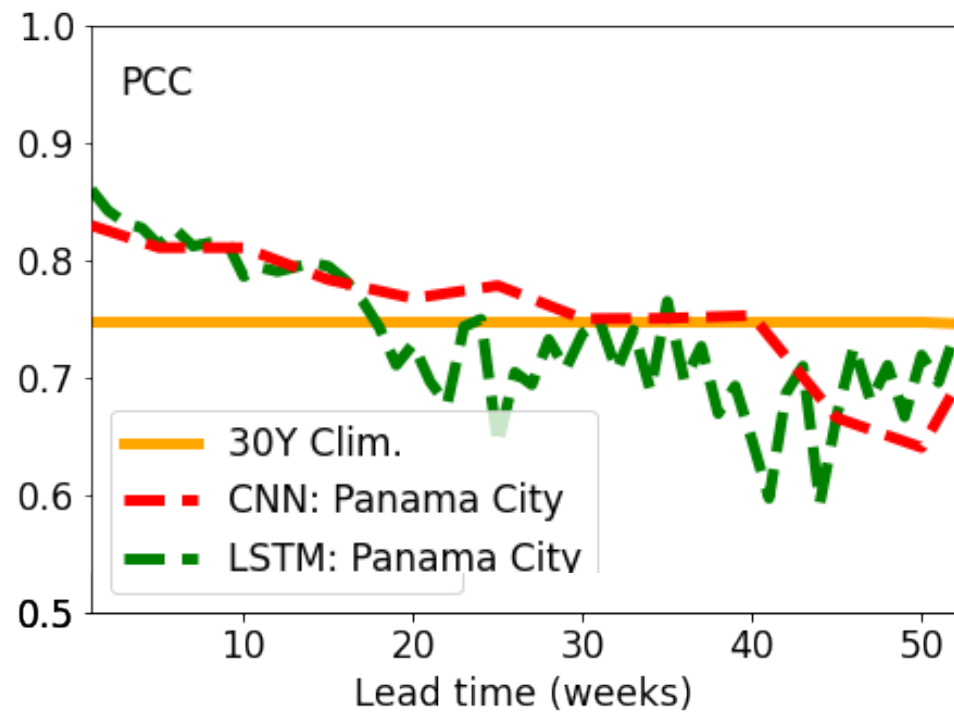
Singapore (1.4°N, 103.8°E), Middle of the Pacific Ocean (4.4°N, 167.7°W)

**Mid/High latitudes:** Moscow, Russia (55.8°N, 37.6°E); London, UK (51.5°N, 0.1°W)

Christchurch, NZ (43.5°S, 172.6°E); Perth, Australia (32.0°S, 115.9°E)

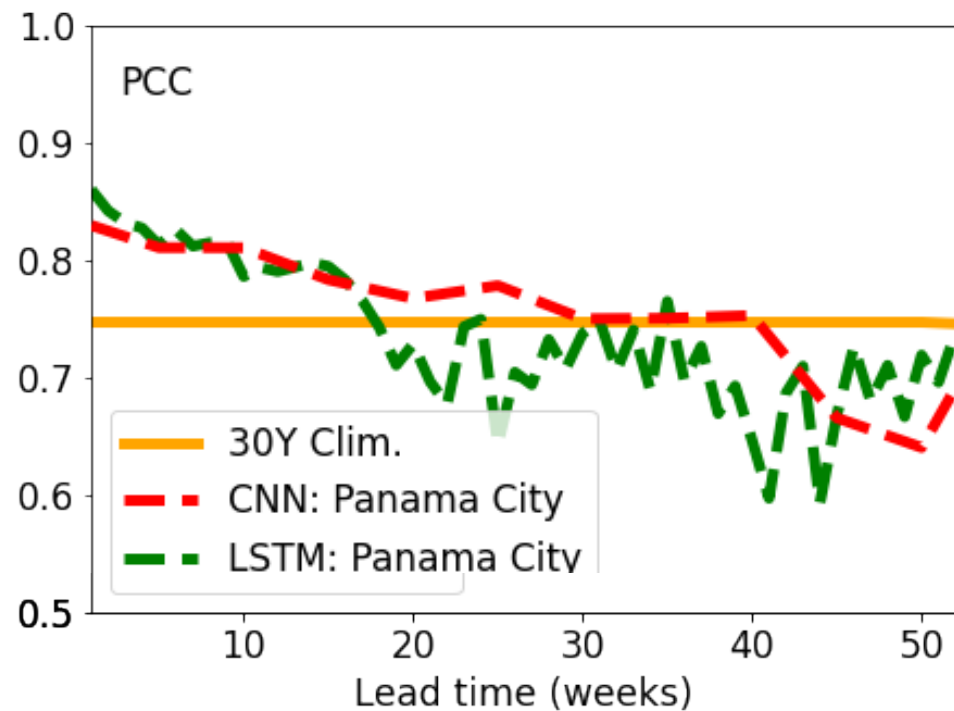
# Results

## Panama City (Low Latitude Location)



# Results

**Panama City (Low Latitude Location)**



**Perth (Mid/High Latitude Location)**

