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TOWARDS A DATA-DRIVEN UNDERSTANDING OF CLOUD STRUCTURE FORMATION

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Project Page:

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MOTIVATION

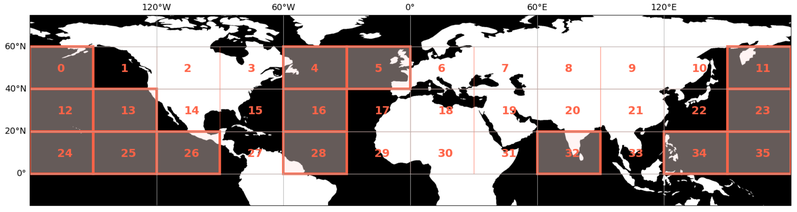
- Physics of cloud formation is one of the highest uncertainties in climate modeling

CONTRIBUTIONS

- Neural networks can produce two-dimensional cloud fields from physical data, even one day in advance
- Data-driven method to generate a physical explanation of cloud structures

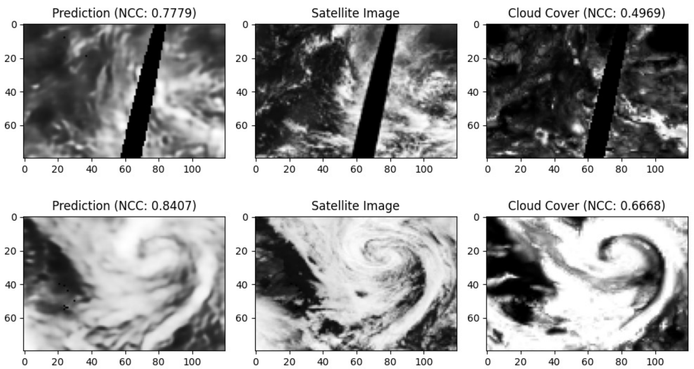
DATA

- Real satellite images paired with ERA5 reanalysis data
- Using patches of 30° longitude and 20° latitude mainly over water



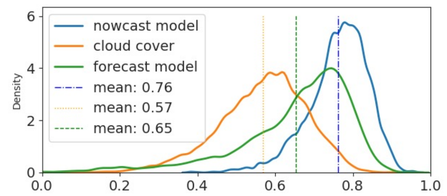
NOWCASTING CLOUD PREDICTION

- Using U-Net architecture to predict visual cloud appearance based on physical data
- Train individual network for each region to capture unique characteristics of different geographical areas



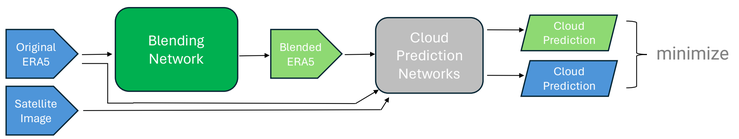
SIMILARITY ANALYSIS

- Measure similarity to real satellite images over whole validation dataset
- Our prediction is around 33% more similar than the cloud cover used in ERA5
- Even 24h forecasting surpasses cloud cover



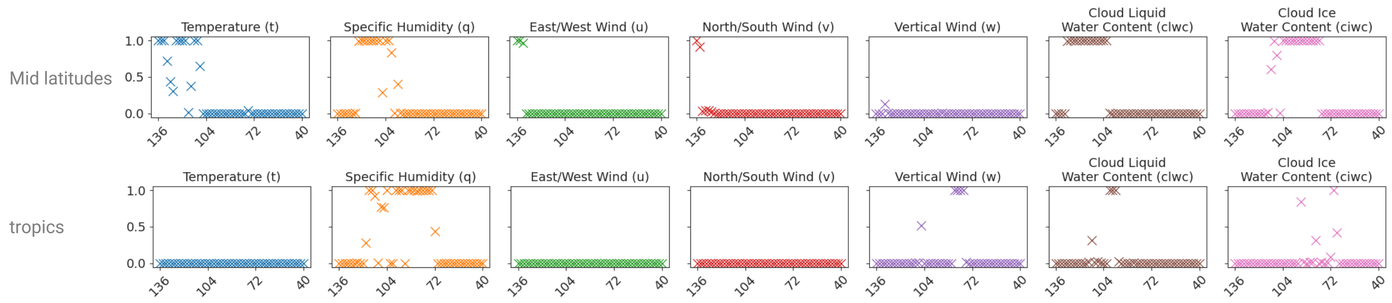
PREDICTIVE INPUT IDENTIFICATION

- Establish a correlation between physical quantities and cloud appearance in data-driven manner
- Train a network to minimize used channels of physical data while obtaining correct cloud structure prediction



NOWCASTING - PREDICTIVE INPUT INDENTIFICATION

- Importance scores for various quantities and height levels for two different regions



24H FORECASTING - PREDICTIVE INPUT INDENTIFICATION

- Use physical data 24h prior to predict current cloud structure
- Predictive quantities differ a lot to quantities used for nowcasting prediction