Bachelor paper

Subject of the paper is methods for simulation of weather and climate (mobility).

Tools

https://climate.apache.org/
https://open-meteo.com/
https://open-meteo.com/en/docs/climate-api
https://www.ecmwf.int/ →One of the most widely known weather forecast models, also provides real time data
https://www.meteomatics.com/en/weather-api/ → paid API, but free trial available. Also free API version with limited historical data (formats of response: https://www.meteomatics.com/en/api/response/)
https://openweathermap.org/api → free 1000 calls / day → ML
https://climate.copernicus.eu/climate-datasets → free climate data
https://weewx.com/#:~:text=WeeWX%20is%20a%20free%2C%20open,weather%20sites%20or%20web%20servers. → open source software
https://pysteps.readthedocs.io/en/stable/index.html → python framework for short-term ensemble prediction systems
https://microsoft.github.io/ClimaX/ → Microsoft foundation model for weather and climate science
https://www.ncei.noaa.gov/products/weather-climate-models/climate-forecast-system → Operational real-time CFS model data
https://github.com/google-deepmind/graphcast → model

Algorithms

Artificial neural network algorithms and deep learning algorithms are the most dominant algorithms to simulate weather.
Cellular Automaton: This technique is employed to model dynamic systems with simple rules. It can be used to simulate certain weather phenomena such as cloud formation, precipitation, and wind patterns.
Finite Element Method (FEM): FEM is a numerical technique used for solving problems in engineering and mathematical physics. It can be applied to simulate fluid dynamics and the behavior of atmospheric elements like air and water, thereby aiding in the realistic representation of weather patterns.
Meteorological Data Integration: Developers often incorporate real-world meteorological data into their simulations, using APIs from weather services or databases. This integration allows for more accurate and dynamic weather simulations, including temperature, precipitation, and wind conditions based on real-time or historical data. (https://open-meteo.com/)

OpenGL or Vulkan: These are graphics rendering APIs that can be used to create visually appealing and realistic weather effects, including rendering of clouds, water, and atmospheric phenomena.
Combining Machine Learning (ML) and Wireless Sensor Networks (WSNs)
→**https://onlinelibrary.wiley.com/doi/full/10.1002/dac.4687** → IOT
https://en.wikipedia.org/wiki/Ensemble_forecasting
Algo https://www.mdpi.com/2079-9292/12/4/1007

Topics

https://ncas.ac.uk/learn/what-is-a-climate-model/#:~:text=Scientists%20divide%20the%20earth%20into,individual%20weather%20systems%2C%20like%20storms.
https://cloud.google.com/blog/topics/sustainability/weather-prediction-with-ai - info about ai model and weather
https://gamestudies.org/0801/articles/barton - weather simulation based on game perspective and not real time info
https://www.ijert.org/research/weather-forecasting-models-methods-and-applications-IJERTV2IS120198.pdf - list of useful global and regional models + technique how to create a weather model
https://www.nature.com/articles/s41598-021-96872-w
https://www.mdpi.com/2073-4433/13/2/180
https://www.mdpi.com/article/10.3390/atmos13020180/s1 → csv files
https://www.nature.com/articles/s41598-021-96872-w → Developing machine learning algorithms for meteorological temperature and humidity forecasting
Machine learning-based algorithms for weather Forecasting → paper in github
https://www.sciencedirect.com/science/article/pii/S1877750320305895 → Machine learning based algorithms for uncertainty quantification in numerical weather prediction models (useful for improving the accuracy of the model → Machine learning
https://www.ieice.org/ken/paper/20190115o18l/eng/ → energy consumption modeling with weather data
https://www.marktechpost.com/2023/07/24/a-study-on-various-deep-learning-based-weather-forecasting-models/ → explanation of tools

More in detail

Step (short-term ensemble prediction system) computation algorithm → Orfeo

Openweather ML API → Jason

ClimaX → Orfeo

GraphCast → Jason

Conclusion → both

Bronnen → both