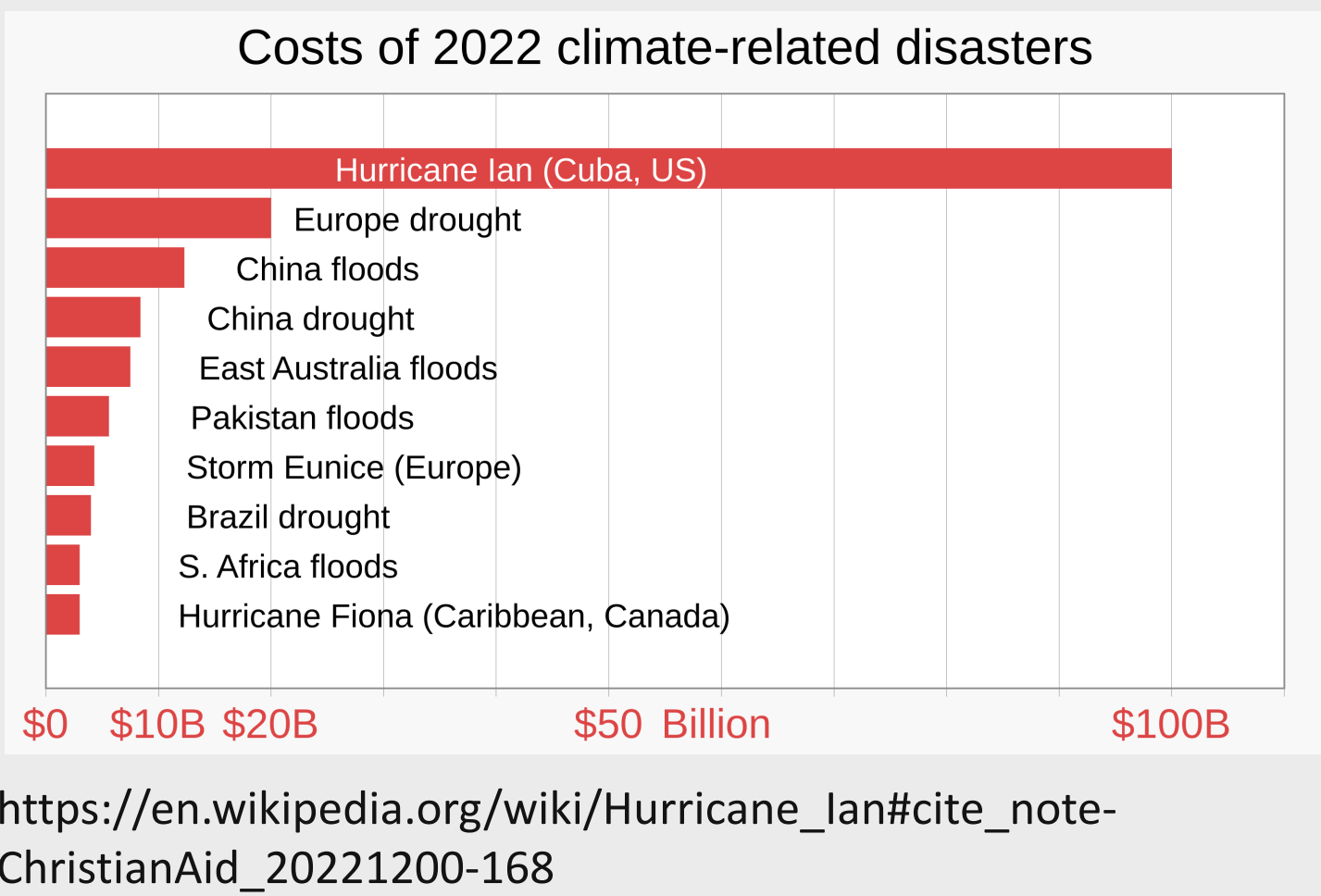# HURRICAST: SYNTHETIC TROPICAL CYCLONE TRACK GENERATION FOR HURRICANE FORECASTING

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INTRODUCTION

Costs of 2022 climate-related disasters

https://en.wikipedia.org/wiki/Hurricane_Ian#cite_note-ChristianAid_20221200-168

➤ Florida holds the top spot in both total insured property value exposed to hurricane winds and coastal property exposed to storm surge.

➤ With a staggering $3.6 trillion in insured properties, approximately $2 trillion of which are residential, all of Florida's properties are at risk of hurricane damage.

➤ Coastal property, comprising around 79% of the total, is particularly vulnerable to hurricane risks.

➤ Furthermore, a significant portion of these $40 billion in properties may be particularly susceptible to storm surge damage.

FPHLM: Florida Public Hurricane Loss Model

➤ The Florida Public Hurricane Loss Model (FPHLM) is a hurricane catastrophe model developed by experts in meteorology, oceanography, hydrology, engineering, computer science, GIS, statistics, finance, and actuarial science.

➤ The model comprises five major components: wind hazard, coastal flooding, inland flooding, vulnerability, and insured loss cost. It has over a dozen sub-components.

➤ The FPHLM estimates loss costs and probable maximum loss levels for personal and commercial residential property from hurricane events, including building, appurtenant structures, contents, and additional living expenses.
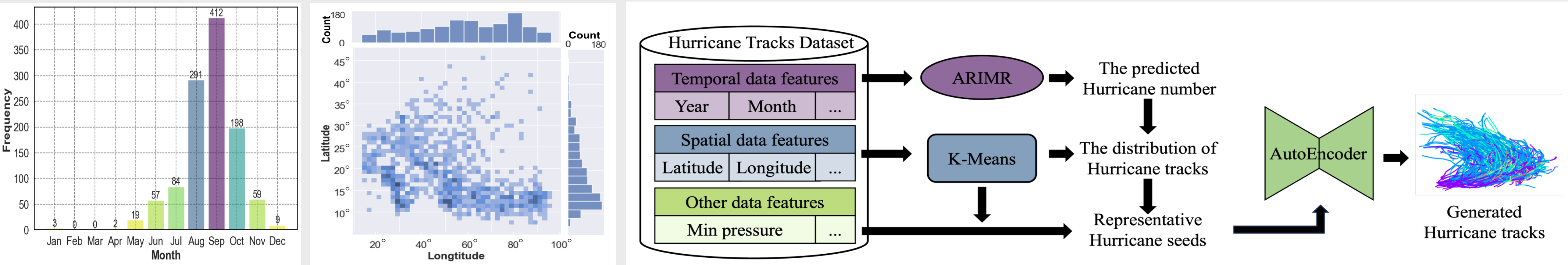
MOTIVATION: Hurricane Forecasting   Data is all you need! ➜ AI Model?

➤ Hurricane best track database (HURDAT2), Atlantic basin 1851-2024, 1284 historical hurricane data

METHODOLOGY:

➤ Hurricane Prediction Method: HurriCast uses a hybrid method combining statistical models with data-driven methods.

➤ Core Models: ARIMA for forecasting hurricane frequency, K-Means for analyzing track distribution, and Autoencoder for simulating hurricane.

➤ Autoencoder Model Function: Simulates comprehensive hurricane coverage with precise inputs and rigorous training.

RESULTS:

1. Historical vs. generated tropical cyclone;
2. Historical vs. generated 100 years frequency
3. Historical vs. generated annualized frequency at Florida

FUTURE STEPS:

1. Other machine learning tools are investigated to generate stochastic hurricane tracks, such as Generative Adversarial Networks (GANs) and Long Short-Term Memory (LSTM) networks.

2. Other hurricane characteristics, like storm size and moving speed, will be incorporated in this study, to achieve more refined and accurate hurricane track simulation results.

3. Damage control using edge devices.

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