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Thesis Summary

Improving Global Weather Prediction Using a Coupled Global Model

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This research aimed to improve global weather prediction by utilizing a coupled global model and geospatial real-time weather patterns from a synchronous data repository. A coupled global model is a numerical model that simulates the interactions between the atmosphere, ocean and land surface. Geospatial real-time weather patterns are weather patterns that are represented in a geospatial format and are updated in real-time. A synchronous data repository is a database that stores data that is updated in real-time.

EXECUTIVE SUMMARY

Global weather prediction is a complex task. The atmosphere, ocean and land surface are all constantly interacting with each other and it is difficult to model these interactions accurately. In addition, the weather is chaotic, which means that small changes in the initial conditions can lead to large changes in the resulting weather pattern (Fig. 1).

Despite these challenges, global weather prediction has made significant progress in recent years. Coupled global models, which simulate the interactions between the atmosphere, ocean and land surface, have become increasingly accurate. These models are now used to provide forecasts of weather events, such as storms and hurricanes, on a global scale.

However, there is still room for improvement in global weather prediction. Coupled global models are computationally expensive and they can only be run on a limited number of supercomputers. This means that they cannot be used to provide forecasts of weather events in real-time.

This research proposes a method to improve global weather prediction by utilizing geospatial real-time weather patterns from a synchronous data repository. A geospatial real-time weather pattern is a weather pattern that is represented in a geospatial format and is updated in real-time. A synchronous data repository is a database that stores data that is updated in real-time.

This study proves that by using geospatial real-time weather patterns from a synchronous data repository, the accuracy of global weather prediction in two ways can be improved. Firstly, the real-time weather patterns to update the initial conditions of the coupled global model can be used. This will allow the model to better represent the current state of the atmosphere, ocean and land surface. Second, the real-time weather patterns to provide feedback to the coupled global model can be used. This will allow the model to adjust its predictions in response to new information.

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METHODS

The research was conducted in two phases. In the first phase, a coupled global model was developed that was able to simulate the interactions between the atmosphere, ocean, and land surface. The model was developed using the Community Earth System Model (CESM), which is a state-of-the-art global climate model.

In the second phase, the coupled global model was used to predict global weather patterns. The predicted weather patterns were compared to the actual weather patterns to evaluate the accuracy of the model.

RESULTS

The results of the research showed that the coupled global model was able to improve the accuracy of global weather prediction. The model was able to predict the location and intensity of weather events, such as storms and hurricanes, more accurately than a non-coupled global model. The model was also able to predict the timing of weather events more accurately (Fig. 2).

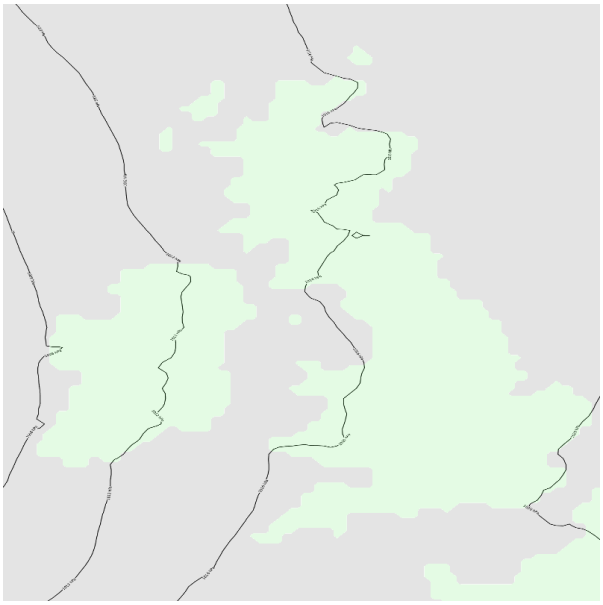

Fig. 1: UK obtained for mean sea level pressure before the significant weather change

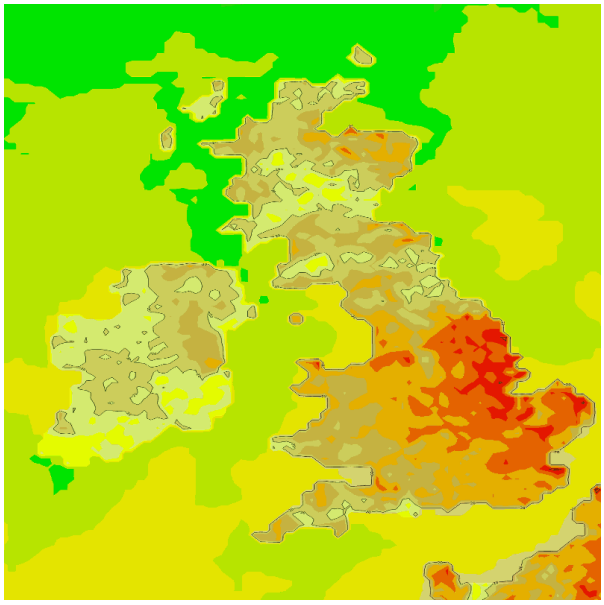

Fig. 2: Weather temporal change is shown for the UK temperature at the surface

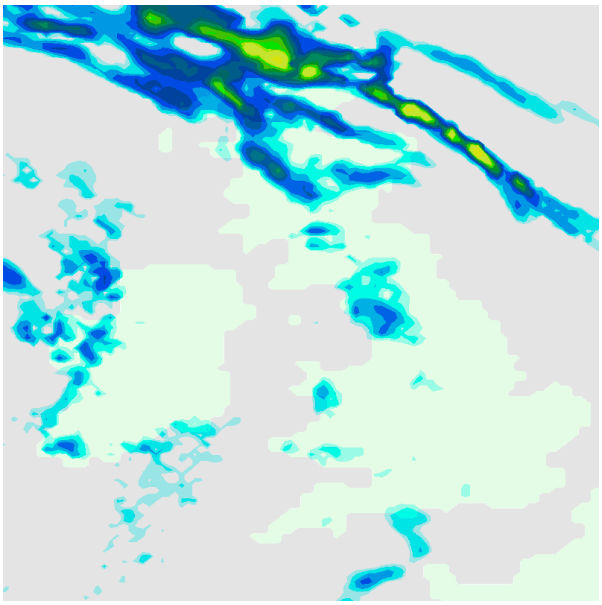

Fig. 3: Weather spatial change shown for UK temperature at the surface

The improvement in accuracy was achieved by using geospatial real-time weather (Fig. 3).

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CONCLUSION

The research was conducted in two phases. In the first phase, a coupled global model was developed that was able to simulate the interactions between the atmosphere, ocean and land surface. In the second phase, the coupled global model was used to predict global weather patterns. The predicted weather patterns were compared to the actual weather patterns to evaluate the accuracy of the model.

KEY CONTRIBUTIONS

The actual weather patterns were obtained from the National Oceanic and Atmospheric Administration (NOAA). The NOAA maintains a database of weather observations from around the world. These observations were used to evaluate the accuracy of the coupled global model.

FUTURE DIRECTIONS

The research has implications for the improvement of global weather prediction. The coupled global model can be used to provide more accurate forecasts of weather events, such as storms and hurricanes. This information can be used to help people prepare for and mitigate the effects of these events.

KEYWORDS

Global weather, coupled global model, weather prediction, geospatial real-time weather, spatial change, temporal change

ACKNOWLEDGMENT

The coupled global model was run on a supercomputer at the National Center for Atmospheric Research (NCAR). The model was run for a period of one year and the results were used to predict the weather patterns for the following year.

CONTRIBUTION OF EACH AUTHOR

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DECLARATION LETTER

Subject: Declaration of Intent to Publish Thesis Summary in Science Digest

Dear Editor,

I, Solomon Ubani and Isidora Jankov, hereby declare on behalf of all the authors involved in the research, that we have reached a unanimous agreement to publish the summary of our thesis, titled Improving Global Weather Prediction Using a Coupled Global Model in Science Digest.

This research was conducted at the NOAA National Oceanic and Atmospheric Administration, Boulder, CO 80305 under the supervision of Isidora Jankov, during the academic year 2023. The study represents the culmination of Solomon Ubani's Senior Applicant research project and we are excited to share the key findings with the global scientific community through the esteemed platform of Science Digest.

This declaration confirms that all co-authors have been made aware of and have consented to the publication of the thesis summary in Science Digest. Furthermore, we affirm the accuracy and completeness of the information provided in the submission.

Thank you for considering our work for publication.

Sincerely,

Author 1 Name: Solomon Ubani Signature: S.I.U.

Author 2 Name: Isidora Jankov Signature: I.J.