FORECASTING AND NOWCASTING OF SEVERE STORMS

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I. INTRODUCTION

The effects of severe weather storms can be costly in terms of property destruction and tragic loss of life. These severe storms are usually deep depressions, active fronts, tornadoes, thunderstorms and severe local storms that can result in heavy rains, floods, destructive winds, hail and lightning damage, etc….

Forecasting and nowcasting of these severe storms is crucial and is the only solution to protect human being and their properties.

II. PRESENTATION OF RESEARCH

Numerical weather prediction models are computer simulations of the atmosphere. They take the analysis as the starting point and evolve the state of the atmosphere forward in time using understanding of physics and dynamics .The output from this models provides the basis in the forecasting and nowcasting of severe storms.

III. RESULTS AND CONCLUSIONS

Forecasting of severe storms begins with the understanding of the ingredients that the atmosphere requires. Forecasting of severe storms involves predicting conditions beyond the range of linear extrapolation of current conditions.

During the assimilation process, information gained from the observation is used in conjunction with numerical model's most recent forecast for the time that observations were made to produce the meteorological analysis. This is the best estimate of the current state of the atmosphere. The National Weather Service provides forecast and watches/warning/advisories for all areas of Rwanda to protected life and property and maintains commercial interests.

Thunderstorms can cause strong winds, dangerous lightning strikes leading to power outages and widespread hail damage. For severe thunderstorms, this typically means from hour or so ahead to few days and covers spatial regions out to the order of thousands of Kilometres.

Being a country of one thousand hills; Convective clouds which are the sources of thunderstorms formation are present all the time of the year in Rwanda.

The aviation industry is sensitive to severe storms; Fog and/or exceptionally low ceilings can prevent many aircraft landing and taking off. Similarly turbulence and icing can be hazards whilst in flight. Thunderstorms are a problem for all aircraft, due to severe turbulence and icing, as well as large hail, strong winds, and lightning, all of which can cause fatal damage to an aircraft in flight. On a day to day basis airliners are routed to take advantage of the jet stream tailwind to improve fuel efficiency.

Electricity and water resources companies rely on weather forecasts to anticipate demand which can be strongly affected by severe weather storms. Following seasonality, severe dry weather can cause a surge in demand of electricity and water, as lake levels fall. Similarly, in wet seasons increased water levels implies increased water for generations of these utilities.

Increasingly, private companies pay for weather forecasts tailored to their needs so that they can increase their profits or to avoid large losses. For example, agriculture demand an elaborate seasonal forecast region by region with anticipated dry spells indicating the onsets and cessation of the rains.

Although a forecast model will predict realistic looking weather features evolving realistically into the distant future, the errors in the forecast will inevitably grow with time due to the chaotic nature of the atmosphere. The detail that can be given in a forecast therefore decreases with time as these errors increase. There becomes a point when the errors are so large that the forecast is completely wrong and the forecast atmospheric state has no correlation with the actual state of the atmosphere.

However, looking at a single forecast gives no indication of how likely that forecast is to be correct. Ensemble forecasting uses lots of forecasts produced to reflect the uncertainty in the initial state of the atmosphere. The uncertainty in the forecast can then be assessed by range of different forecasts produced.

The forecasting of weather in 0-6hour is often referred to as Nowcasting. It is in this range that the human forecaster still has an advantage over computer Numerical Weather Prediction (NWP) models. In this time range it is possible to forecast smaller features such as individual shower clouds with reasonable accuracy, however these are often too small to be resolved by a computer model. A human given the latest radar, satellite and observational data will be able to make a better analysis of the small scale features present and so will be able to make a more accurate forecast for the following few hours**.**

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