MATHEMATICAL MODELLING OF TORNADOES

GRADUATE MODELLING SCHOOL

UNIVERSITY OF ZULULAND

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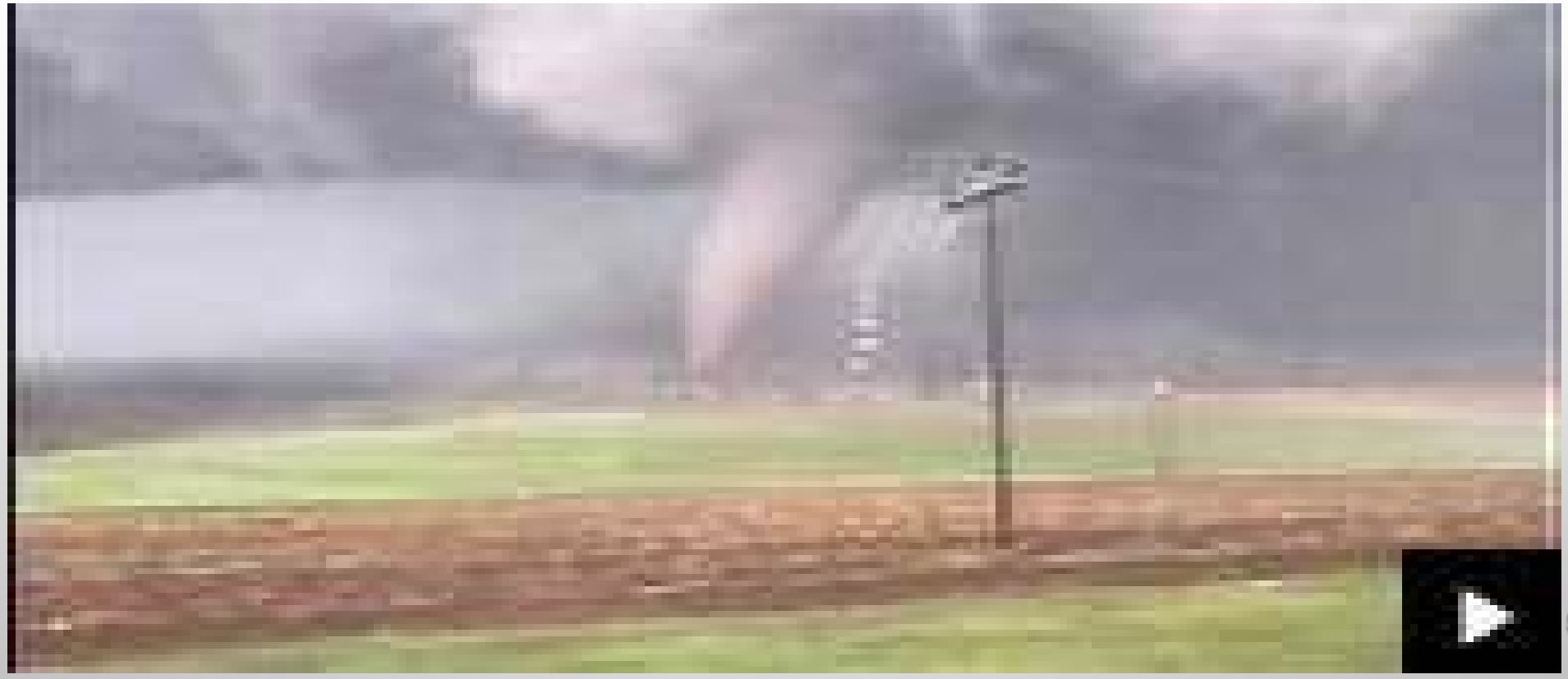

BACKGROUND

- In November 2019 an F5 tornado ripped through New Hanover in Pietermaritzburg in the Province of Kwazulu-Natal, South Africa, and caused massive damage.
- A few days later another “tornado” was reported in Bergville in the Midlands, in the same province.
- A month later another tornado ripped through Ulundi, which is just over 100 km away.
- In Gauteng province, within weeks of each other “a type of tornado”, occurred.
- This year 2020, a tornado was reported in the province of Mpumalanga in Ermelo.
- Some reports say 17 tornadoes ripped across South Africa in the last decade, excluding the ones mentioned above

INTRODUCTION

- There are two movies that were made about tornadoes, “Twister” and “Stormchasers”
- When one listens to the news and watches the videos several things take our attention:

1. Extreme weather is becoming a common phenomenon is South Africa, particularly in Kwazulu-Natal province
2. There are usually debates of whether a weather phenomenon is a tornado or not a tornado. So what is a tornado?
3. Tornadoes don’t seem to be lasting long but causing great damage.

INTRODUCTION

- What causes a tornado to form?
- What are the characteristics of a tornado?
- What is a suitable mathematical model for a tornado?

DISCUSSIONS

- TORNADOES ARE MEASURED ON THE FIJUTA SCALE FROM F0-F5, F5 BEING THE STRONGEST, BUT THEIR STRENGTHS CAN ONLY BE MEASURED AFTER THEIR DESTRUCTIONS NOT BEFORE
- THEY CAN BE PREDICTED BUT THEIR TIME SPAN IS TOO SHORT DUE TO THE RAPID DEVELOPMENT. THIS CREATES A PROBLEM FOR WARNING SIGNALS.
- THERE ARE SOME DEBATES THAT TORNADOES ARE FORMED DUE TO ATMOSPHERIC INSTABILITY
- IT IS DIFFICULT TO DETERMINE HOW FAR THEY WILL TRAVEL BEFORE THEY DISSIPATE AWAY

TASK FOR GRADUATE MODELLING CAMP

- REVIEW SOME LITERATURE ON MATHEMATICAL MODELLING OF TORNADO
- DESCRIBE THE MECHANISM FOR THE FORMATION AND DISSIPATION OF TORNADOES
- DISCUSS SEVERAL MATHEMATICAL MODELS AND COMPARE THEM WITH YOUR BACKGROUND INFORMATION
- DEMONSTRATE A SIMULATED MATHEMATICAL MODEL FOR A TORNADO