TORNADO DAMAGE ANALYSIS OF A FOREST AREA USING SITE SURVEY OBSERVATIONS, RADAR DATA AND A SIMPLE ANALYTICAL VORTEX MODEL

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I. INTRODUCTION

In this work an analysis of tornado damage is performed over a forest area using site survey observations, radar data and a simple analytical vortex model to simulate the wind field. The area was affected by the Castellcir tornado (in the Barcelona province, NE Spain) on the 18th October 2006. The synoptic and mesoscale conditions of the event are discussed in another ECSS 2007 presentation (Aran et al 2007).

II. METHODOLOGY

A ground survey analysis, completed by a helicopter overview of the affected area, allowed locating about one-hundred fallen or uprooted trees (Figure 1) in a complex topography forest area. Some of the trees could be used to estimate the wind direction and intensity in terms of the Fujita-intensity scale (Fujita, 1981). The path was about 5 km long and the intensity reached F2 in some areas but was mostly F0 and F1.
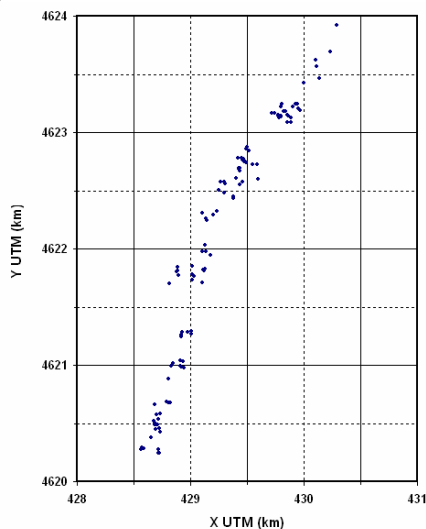

FIG. 1: Locations of damaged trees according to the site survey.

Though available Doppler radar observations of tornado winds indicate a high level of complexity, an analytical approach using a combined Rankine vortex model with different degrees of sophistication has been suggested in the past to model low level tornado winds (see for example the pioneer studies of Letzmann, quoted by Peterson, 1992; Holland et al. 2006; Wurman et al. 2007). Based on this perspective a similar model has been used to compare the observations with the simulated wind field. Figure 2 shows an example of wind field with a maximum tangential and inflow radial wind speed both of 20 m/s at 20 m from the vortex centre moving eastward at 10 m/s. In this study radar observations of the parent storm that spawned the tornado are used to estimate the translational speed of the vortex.
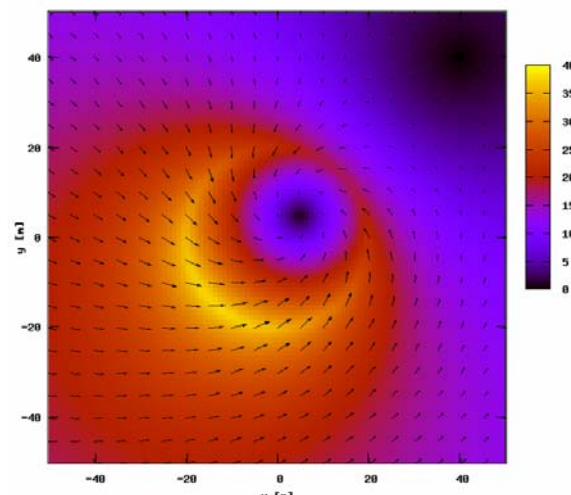

FIG. 2: Tornado winds (m/s) modelled using a simple vortex model.

III. CONCLUSIONS

Preliminary results indicate a variable level of agreement between a simple wind field tornado model and damaged tree observations. Specific examples will be discussed examining factors such as local topography. Further research is required in order to exploit the full potential of this technique which may help to improve site surveys of forests areas.

IV. REFERENCES

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