BANDED CONVECTIVE SYSTEMS RELEASING DRY SYMMETRIC AND INERTIAL INSTABILITIES

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I. INTRODUCTION

On 16 February 2007, the Front Range of the Rocky Mountains in Colorado, USA, and the mountain areas experienced strong winds (45 m s^{-1} gusts), snow (up to 25 cm in the mountains and 8 cm in Fort Collins), hail, graupel, and lightning. Many of the mountain roads were closed for two days, which would have been one of the busiest ski days of the year. Given that the ski industry loses $800,000 an hour when Interstate Highway 70 is closed on a weekend, this storm had a significant economic and societal impact. Some of the high-impact weather associated with this event occurred from convective bands (Fig. 1) formed under the northwesterly flow aloft. These bands occurred on the anticyclonic shear side of the jet stream in a region with deep upper-tropospheric negative absolute and potential vorticities, indicating dry symmetric and inertial instabilities. Both human forecasts and operational numerical weather prediction model forecasts failed to predict the convective bands in this case.

II. OTHER EVENTS

Such an event is reminiscent of three other events that have been documented in the literature over the last twenty years. One of those events was documented in Schultz and Knox (2007) and shown in Fig. 2. Despite this growing body of knowledge, the threat faced from precipitation bands and clear-air turbulence associated with the release of dry symmetric and inertial instabilities remains largely unaddressed observationally, numerically, or theoretically in the atmospheric sciences. As such, the predictability of these bands is unknown.

III. CHALLENGES

There are many remaining challenges to be answered. How often such precipitation bands occur in nature remains unknown. Although diagnosing the existence of these bands after their formation is relatively straightforward using an ingredients-based approach, the dynamics of these bands remains a well-veiled mystery, revealing a substantial challenge for idealized numerical experimentation. Despite this dour scenario for predicting and understanding precipitation bands associated with dry symmetric and inertial instabilities, high-resolution numerical weather prediction models offer some hope that such events could be adequately forecast in the future. Indeed, high-resolution simulations of three of the four cases indicate that such models have the ability to predict such events.

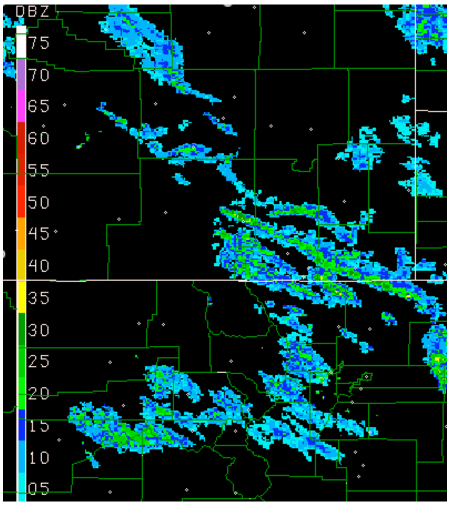

FIG. 1: 1200 UTC 16 February 2007 mosaic radar imagery.

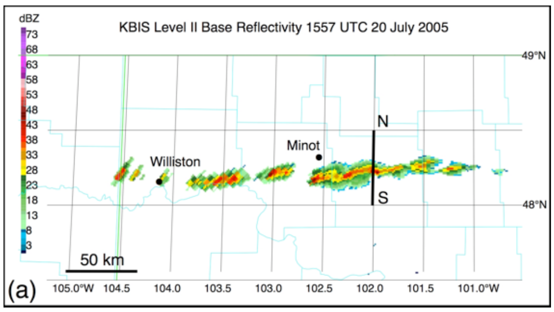

FIG. 2: 1557 UTC 20 July 2005 radar imagery from KBIS radar (Fig. 6a in Schultz and Knox 2007).

IV. ACKNOWLEDGMENTS

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V. REFERENCES

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