UNderstanding **S**evere **T**hunderstorms and **A**lberta **B**oundary **L**ayers **E**xperiment (**UNSTABLE**)

Neil Taylor
Hydrometeorology and Arctic Lab
Meteorological Service of Canada
Environment Canada

David Sills
Cloud Physics and Severe Weather Research Section
Environment Canada

2nd DRI Workshop
January 11th-13th Winnipeg, Manitoba

Environment Canada Environnement Canada

Canada

Outline

- What is UNSTABLE?
- Goals and Science Questions
- Project Area and Instrumentation
- Status and Planning
- Participants

What is UNSTABLE?

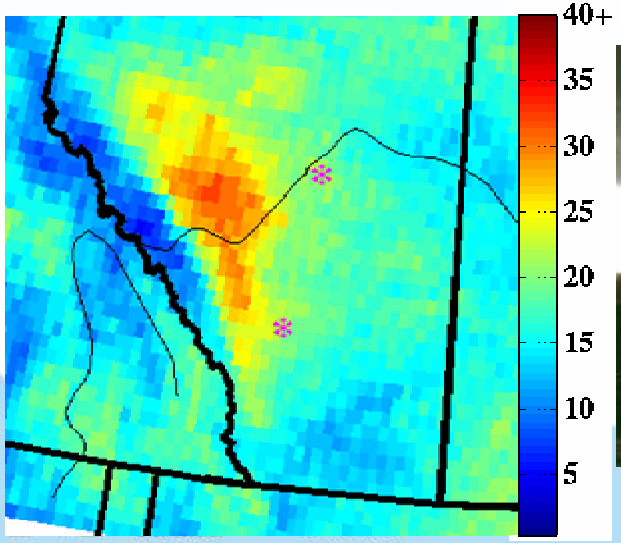
- Field experiment designed to improve understanding of processes important for convective initiation (CI) and severe thunderstorm development over the Alberta foothills

  better understanding Þ better watches/warnings

- Hydrometeorology and Arctic Lab / Cloud Physics and Severe Weather Research Section of Environment Canada with academic and other participation
- Field campaign planned for July 2008
- Builds on previous proposals by the Prairie Storm Prediction Centre and CFCAS proposal from U of Alberta and others

Why UNSTABLE?

- Southern and central Alberta one of the most active thunderstorm regions in Canada – Alberta foothills primary genesis region
- Over $1 billion in insured losses and at least 40 lives lost in Alberta since 1987 due convective weather events
- Two of Canada's five busiest airports (YYC, YEG) and one of most densely populated and fastest growing regions in Canada (Edmonton-Calgary corridor)




Edmonton, July 31st 1987


Pine Lake, July 14th 2000

Canada

Why UNSTABLE?

- We know that mesoscale boundaries and associated processes play a major role in CI - critical to understand behaviour for accurate forecasts of convective precipitation and severe weather
- Previous research has focused mainly on synoptic patterns and related conceptual models for severe weather – still lack understanding regarding mesoscale boundaries and role in CI over foothills region
- Existing synoptic observation network inadequate to resolve processes important for convective initiation – measurements with greater spatial and temporal resolution are required

UNSTABLE Goals

- To better understand processes leading to thunderstorm development over the Alberta foothills (both prior to and during convective initiation) with an aim to extend to the rest of the Canadian prairies
- To improve accuracy and lead time for severe thunderstorm watches and warnings
- To assess the utility of mesoscale models in resolving physical processes over the Alberta foothills and feed information back to modelers to improve their performance
- Through observational, case, and model studies refine current existing conceptual models describing convective initiation and the development of severe thunderstorms over Alberta and the western prairies

UNSTABLE Science Question - ABL

1. *What are the contributions of boundary-layer processes to CI and the development of severe thunderstorms in the Alberta foothills?*
   - Diurnal evolution and characterization of boundary layer especially with respect to water vapour?
   - Mesoscale boundaries and circulations, role and influence on storms / climatology?
   - 4D characterization of dryline importance?
   - Relationships between synoptic and mesoscale processes?
   - Are existing conceptual models adequate?

UNSTABLE Science Question - SFC

2. What are the contributions of surface processes to CI and the development of severe thunderstorms in the Alberta foothills?

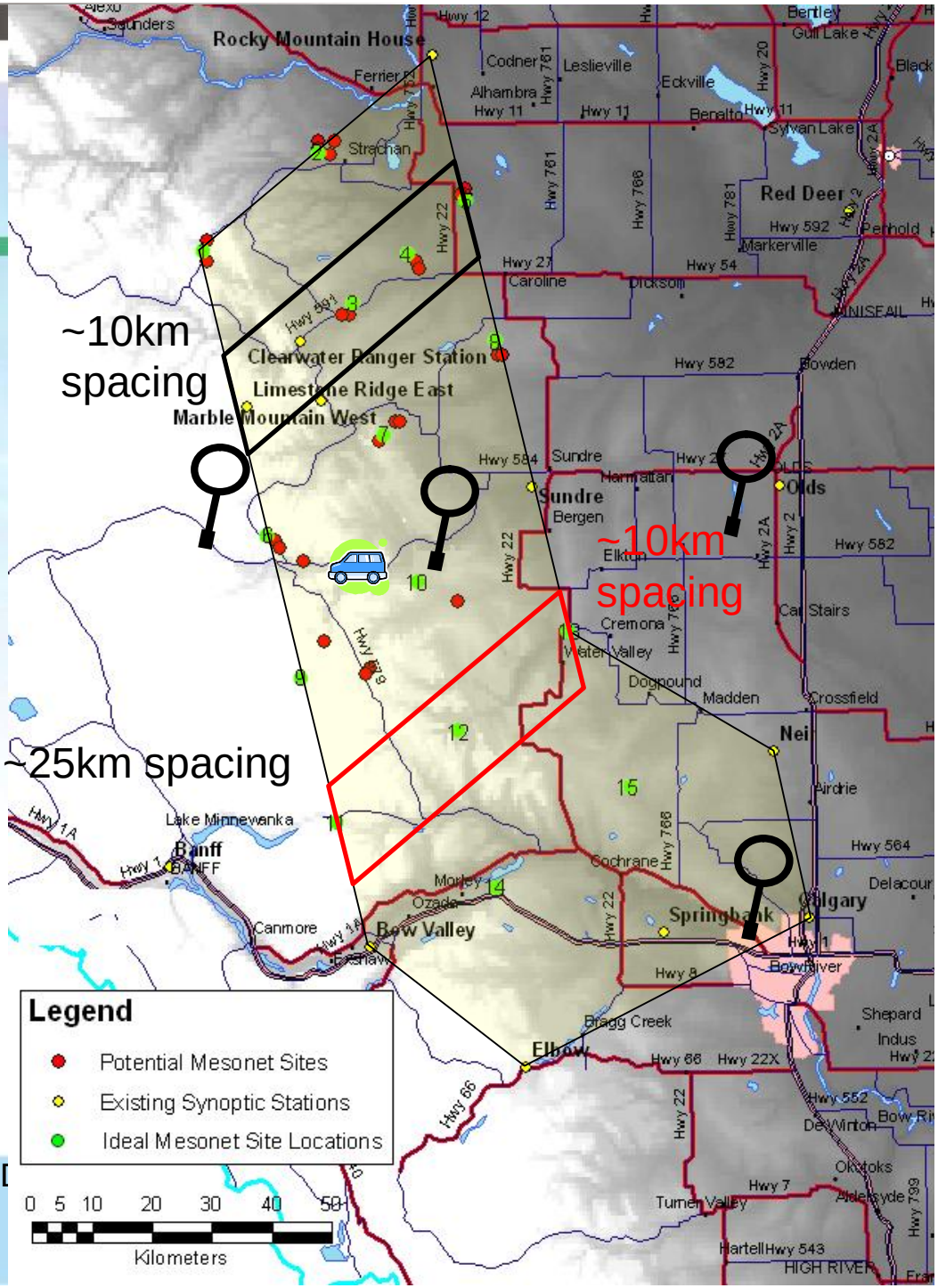
- Sensible/Latent heat fluxes and resulting boundary-layer stratification?
- How important is evapotranspiration in the region? Relative to horizontal moisture advection?
- Relative contributions of soil moisture, topography, vegetation type, land use, crop phenology to boundaries/circulations and convective initiation?

UNSTABLE Science Question – Obs./NWP

3. *To what extent can the observational network and numerical models resolve and accurately represent the boundary-layer and surface processes that contribute to CI and the development of severe thunderstorms in the Alberta foothills?*
   - Capabilities of remote sensing and surface observations to detect important mesoscale features?
   - How can observational network be improved?
   - Can GEM REG/LAM models resolve and represent important boundary-layer and surface processes? Is GEM LAM better than GEM REG?
   - Would better observational data improve model results?

Project Area

- ~25 station mesonet
- 4-5 radiosonde locations
- Mobile mesonet
- Profilers
- GPS PW?
- Soil moisture?
- SFC Flux?
- Tethersonde?
- Aircraft?
- Instrumentation will depend on funding and contributions from participants



Mobile Mesonet Station

EC Mobile AWOS to be used in BAQS-Met 2007 and UNSTABLE 2008.
Unit was tested in Alberta summer 2006 and performed well.

Status and Planning

- ü Preliminary mesonet site selection summer 2006
- ü ATMOS and mobile mesonet tests summer 2006
- ü Science questions have been circulated to potential participants
- Science plan to be drafted early 2007
- EC (other?) funding requests
- Science workshop ~late spring 2007(?)
- Further mesonet site selection and land use agreements spring/summer 2007
- Logistics plan, finalize participation and instrumentation, funding, mesonet sites, hire students, deploy mesonet stations,...

Confirmed and Potential Participants (So Far)

Environment Canada

- Hydrometeorology and Arctic Lab (HAL), Meteorological Service of Canada (MSC)
- Cloud Physics and Severe Weather Research Section (CPSWRS)
- Air Quality Science, Prairie and Northern, MSC
- Climate Processes Section, Saskatoon
- Prairie and Arctic Storm Prediction Centre (PASPC)

Other expression of interest and/or potential instrumentation

- University of Manitoba, Centre for Earth Observation Science (CEOS)
- York University
- University of Alberta
- University of Calgary
- Weather Modification Incorporated (WMI)

Thank you!