Illustration of Meteorological Issues – CALMET Diagnostic Meteorological Model

Bret Anderson

Air Planning Branch

USEPA Region 7

Real Life Scenario

- KDHE conducted initial screening of their list of BART eligible sources and notified sources of results. CENRAP's NOOBS CALMET dataset used for initial screening process. Sources shown to be significant were given the option to conduct "refined" screening analyses by the incorporation of observations.

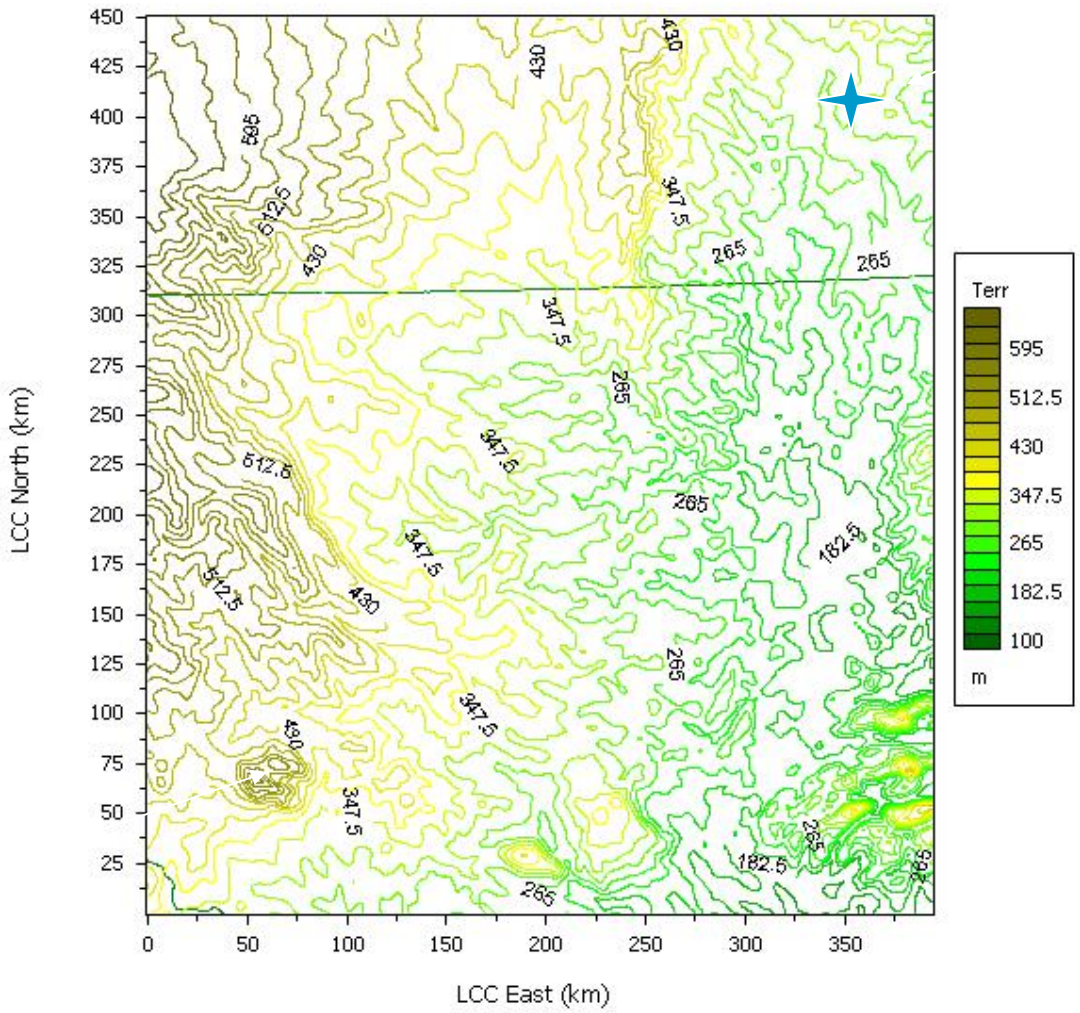
- Initial comparison between results from NOOBS and "refined" screening yielded significant differences. In some instances, NOOBS screening showed very high visibility impacts as compared to no visibility impacts with the incorporation of observations on a number of days. This suggested significant differences in the windfields between the two analysis procedures.

Real Life Scenario

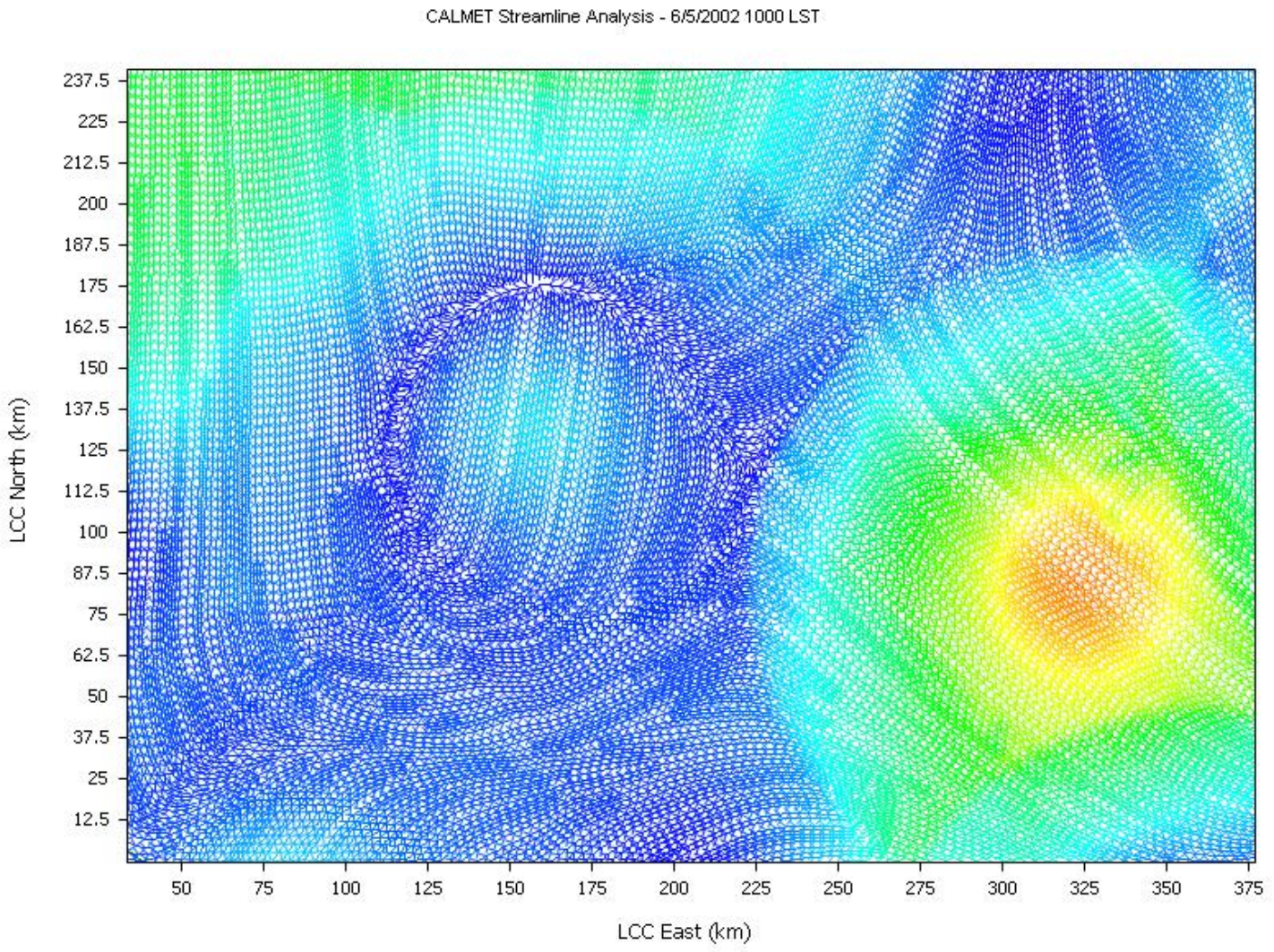
- Sources submitted formal protocols to KDHE for approval of procedures. KDHE solicited input from EPA Region 7. In order to support KDHE with their concern about the "refined" meteorological procedures, EPA cited requirements of Section 8.3(d) of the GAQM for performance evaluations for data sets.

- Sources responded negatively to Section 8.3(d) requirements:
  1. "We have never had to do that before. Why are you making us do that now?"
  2. "How do we do that? There is no formal guidance on how to conduct a performance evaluation."
  3. "What tools are available to allow us to do that?"
  4. "We are not going to pay for our consultant to do what sounds like a research project to me."

BART Modeling Domain



Example CALMET Hybrid Windfields



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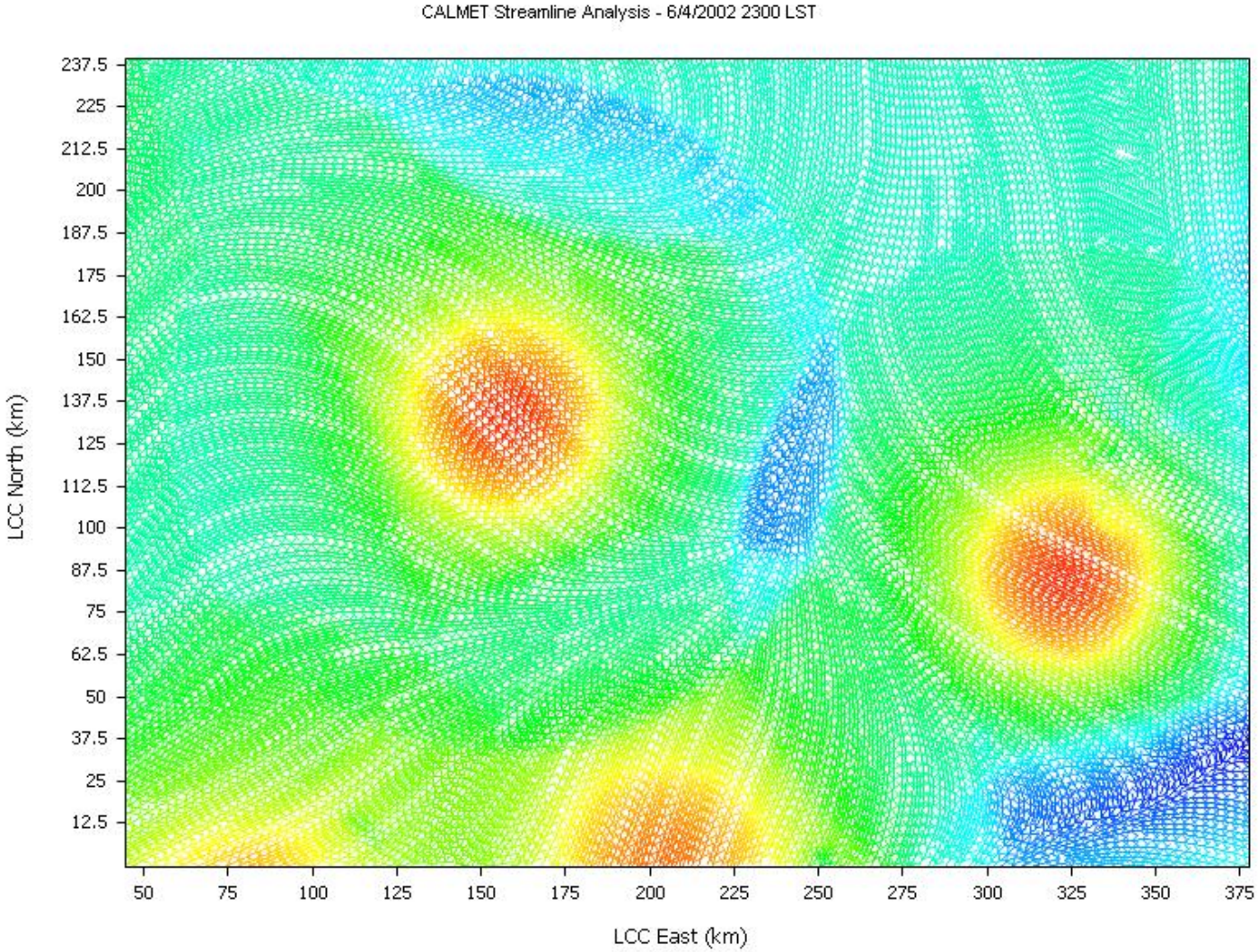
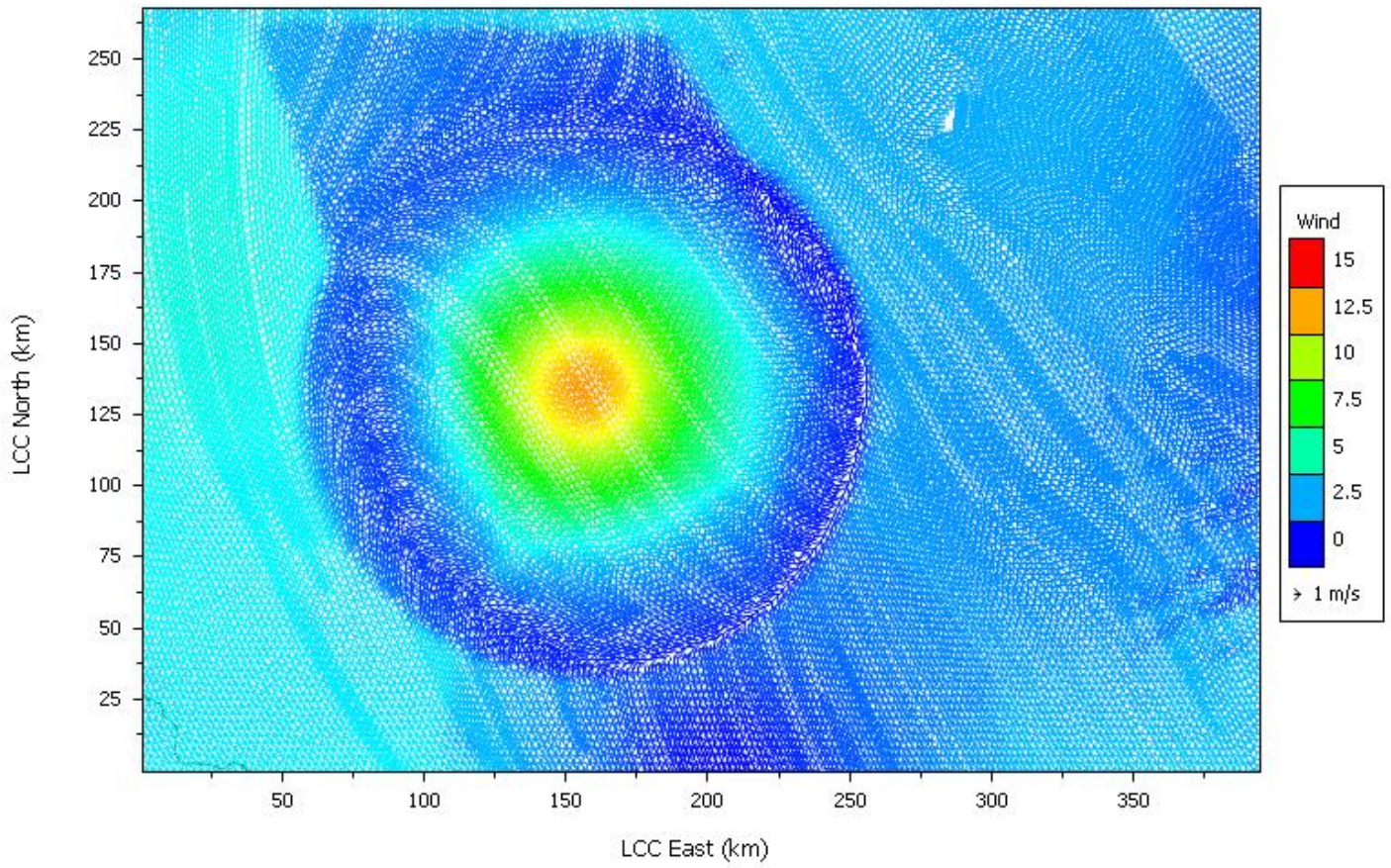
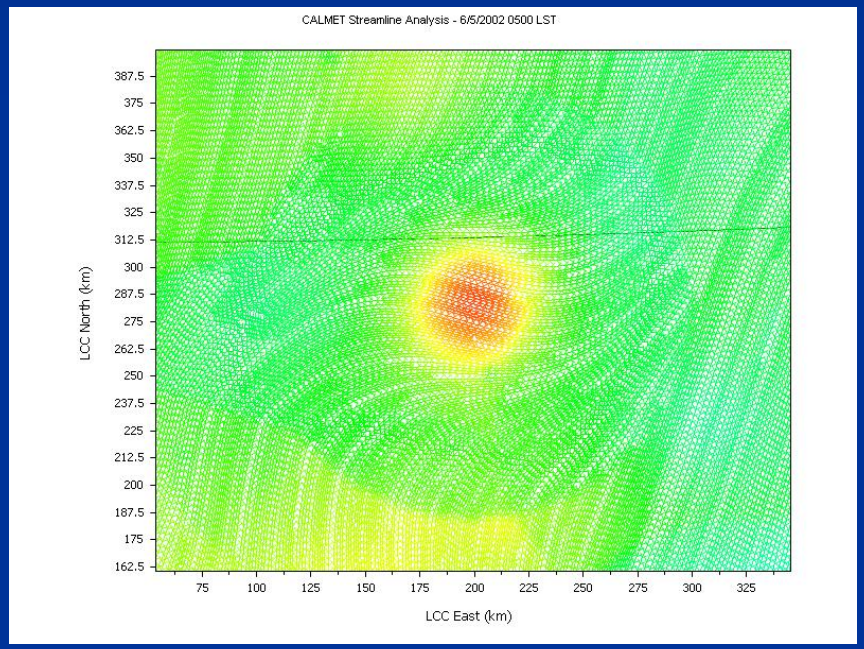


And My Personal Favorite…

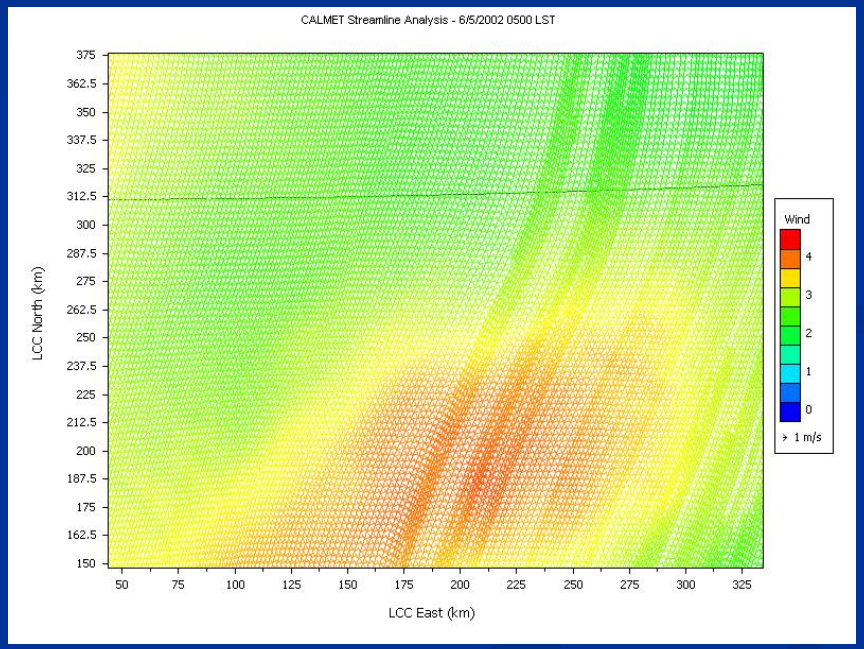


Comparison of CALMET Windfields

Hybrid Field – “OBS Run”



“NOOBS Run”



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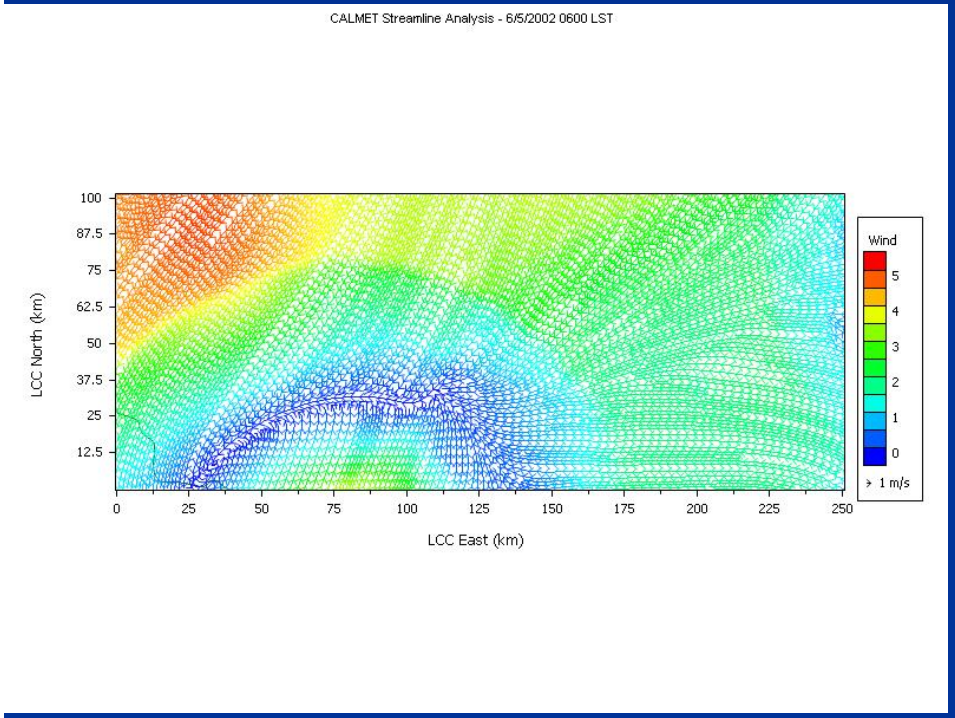

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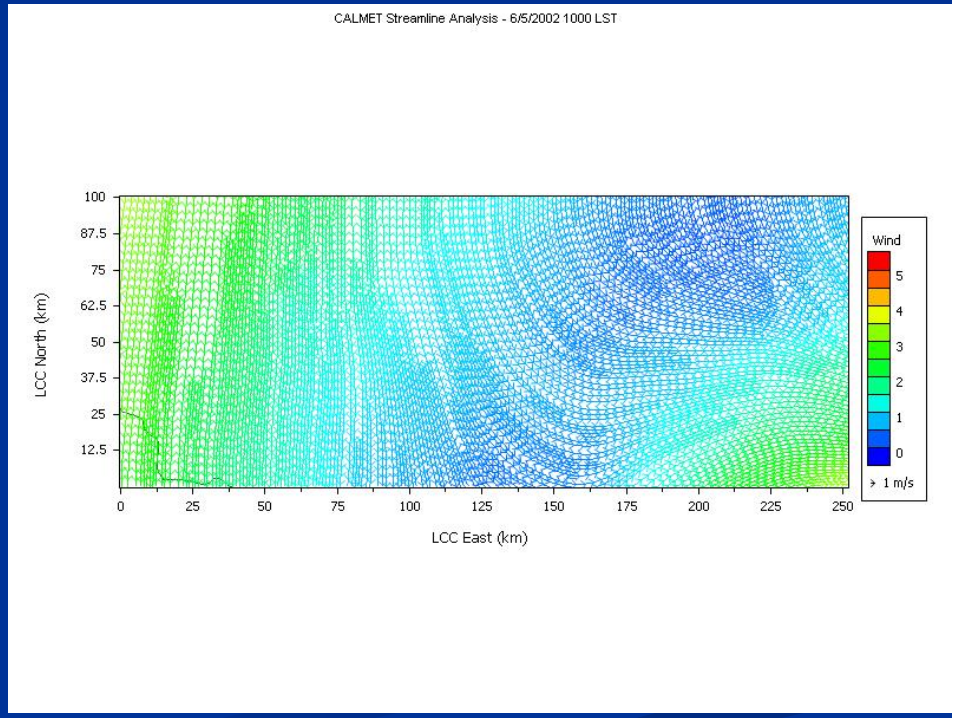
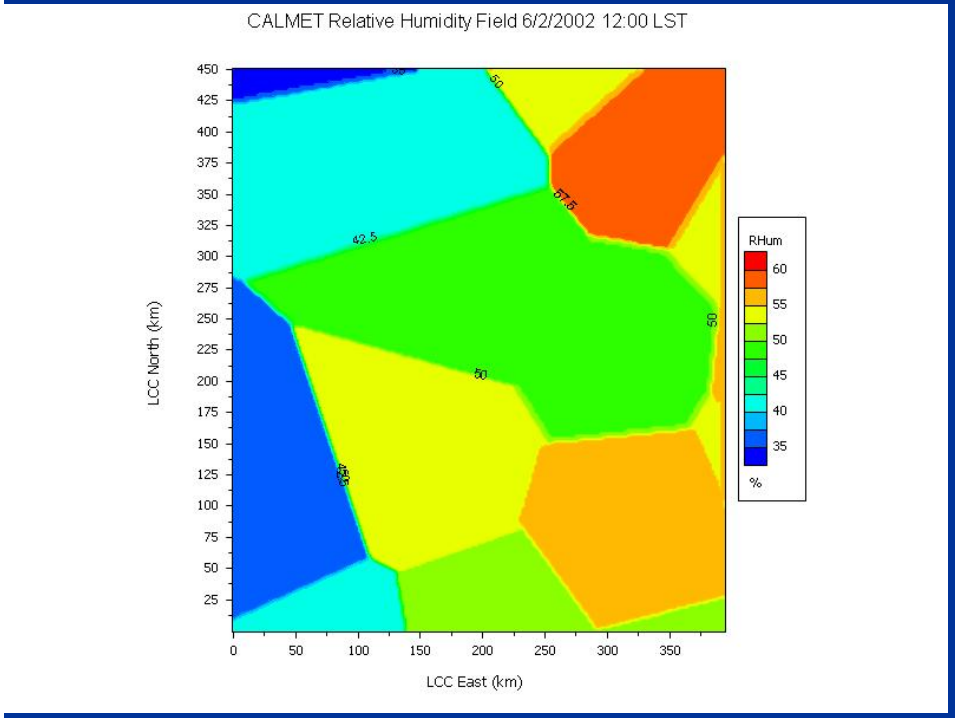
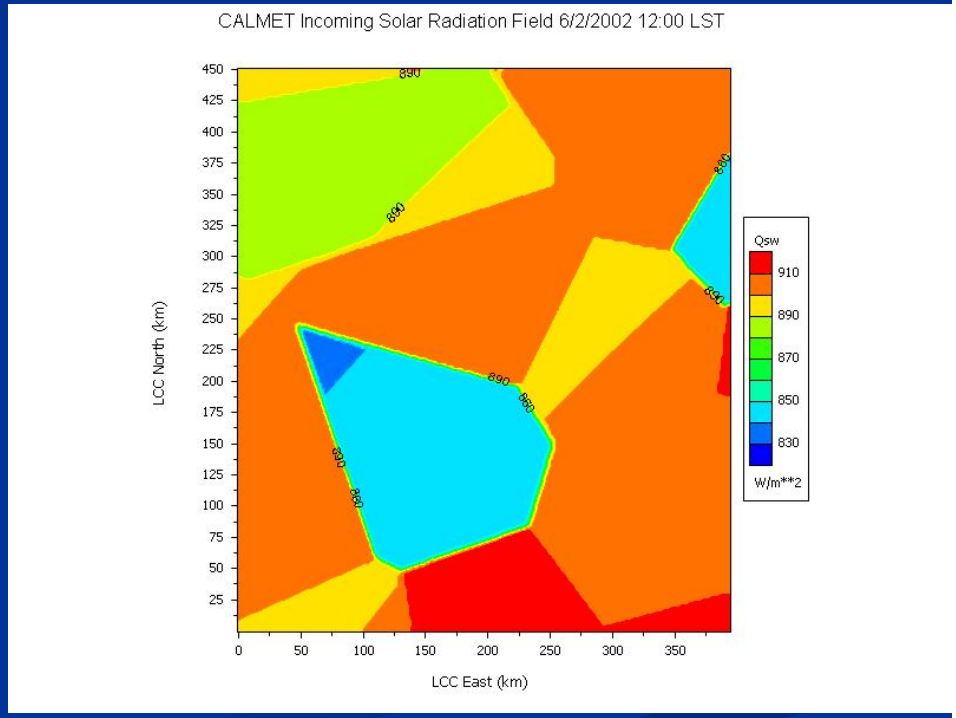


2-D CALMET Fields



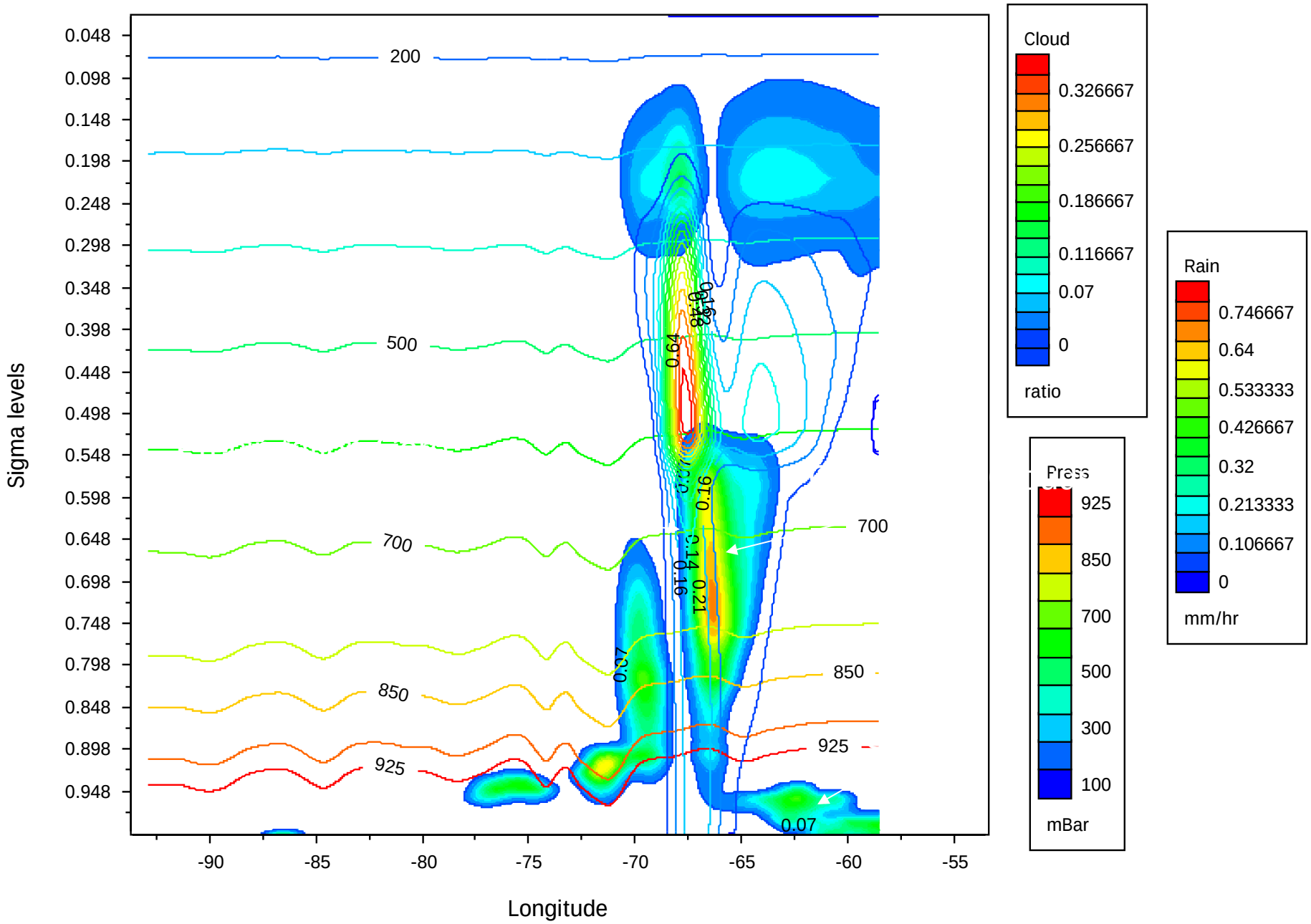


Technical Issues with CALMET "No Observations" Mode

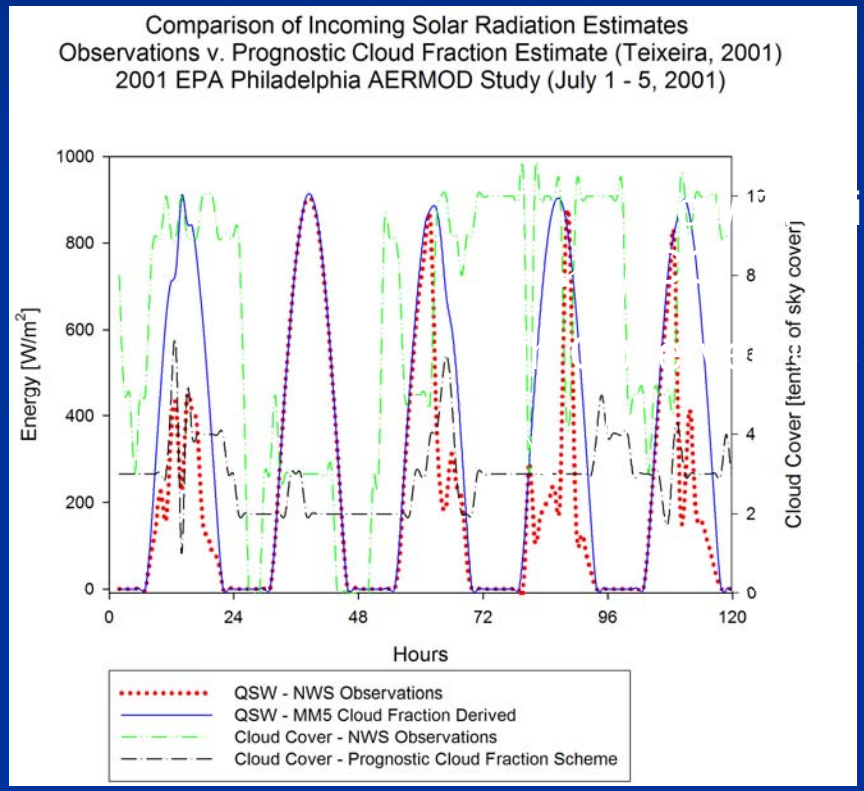
Current CALMET Cloud Diagnosis

- CALMET Cloud Diagnostic Scheme derived from Naval Research Laboratory Global Prediction System (NOGAPS) convective cloud diagnostic scheme
- Total cloud cover estimated from 850mb relative humidity.
  - Marine stratus layer would not be diagnosed between 65W – 60W longitude because marine stratus layer is below the 850 mb level.
  - Convective clouds above 850mb level would not be diagnosed from 65W - 58W longitude because clouds are above 850 mb level.
  - Results would be higher daytime insolation and increased atmospheric instability and higher convective boundary layer estimates.

3-D Cloud Water/Rain Mixing Ratio - MM5



Issue – Radiation Balance and Boundary Layer Parameters



icted

- Solar radiation estimated in CALMET and AERMET using derivatives of Holtslag and von Ulden (1983) energy budget model.
- Requires cloud cover to attenuate incoming solar radiation, otherwise will be calculated using solar constant.
- Sensible heat flux, Monin-Obukhov length, surface friction velocity, convective boundary layer height, and convective velocity scale are all sensitive to changes in solar radiation.
- Without observed cloud cover, must be estimated from hydrometeoric mixing ratios from prognostic weather models.
- Comparing PG stability class from CALMET using observations v. no observations, average of 1 stability class difference was observed. Maximum of 4 stability class differences was observed for the same hour.

Additional Issues with CALMET Use of MM5 Data

- Replaces winds below MM5 first half-sigma level with extrapolated logarithmic profile winds (ignores MM5 surface winds).
- Replaces temperatures below MM5 first half-sigma level using vertical potential temperature profile (ignores MM5 surface temperature).
- Latest versions of MM5 report winds at 10 meters and temperatures at 2 m.