AIR QUALITY AND GREENHOUSE GASES

Problems for ARS to Address

Air Quality Components

- Particulates
- Ammonia
- Volatile Organic Compounds (VOC's)
- Hydrogen Sulfide
- Greenhouse Gases
  - Carbon dioxide
  - Methane
  - Nitrous oxide

Spatial and Temporal Dynamics

- Air quality components vary in time and space

$PM_{2.5}$ Problems

- $PM_{2.5}$ research with respect to emissions from CAFO's should focus on collecting data for process-based model development
- Greater scientific clarity on the role that fugitive dust plays in $PM_{2.5}$ emissions
- Understand the potential oversampling by current $PM_{2.5}$ sampling devices

Recommendations by AAQTF May 2008

Greenhouse Gases and VOC's

- Agricultural Nitrous Oxide and Methane
  - Develop field measurements and models to valid N emissions from different cropping systems
  - Determine ways to increase N fertilizer efficiency, alternative N management systems and methods to reduce N_2O emissions
  - Effect of different manure management systems on N_2O emissions
  - Develop total GHG accounting for agricultural lands and markets

Recommendations from AAQTF Oct 2007

Greenhouse Gases and VOC's

- Volatile Organic Compounds
  - Expand research efforts on measurements and quantification of emissions of volatile (VOC's) and semi-volatile (SVOC's) and their fate in the atmosphere
  - Research should address the feedbacks of VOC's on plant production

Recommendations from AAQTF Oct 2007

Greenhouse Gases and VOC's

- Spatial and Temporal Variation in GHG's
  - Quantify the spatial and temporal variation and it's uncertainty among soils, topography, and climate
  - Develop appropriate methods for scaling up from site measurements to regional scales

Recommendations from AAQTF Oct 2007

National Pork Board Priorities

A. "Air Quality –air emissions. The Pork Board is helping fund a National Air Emissions Study (NAEMS) to quantify the amount of potential air pollutants that are emitted from different swine buildings and manure storage structures. This information may be used by federal or state regulatory agencies to establish limits on emissions from swine operations to protect ambient air quality and human health. It will be important for the Pork Board to continue to participate in the interpretation and application of the data gathered as part of the NAEMS to ensure that any regulatory limits are based on sound science."

B. NAEMS is also on dairy and poultry operations

National Pork Board Priorities

- "Efforts have been made by groups outside of the swine industry to have the federal and state regulatory agencies regulate swine manure and air emissions from swine operations as hazardous wastes under federal hazardous waste programs. This could pose significant problems for producers in terms of costs and administration necessary to comply with hazardous waste requirements. Efforts should be made to specifically research this issue to determine if the nature and volume of emissions and manure constituents in fact are at a threshold that justifies such classification and regulation."

National Pork Board Priorities

- "The potential for odor generation from swine operations has been one of the primary issues that persons raise when objecting to swine operations in their area. Unfortunately, odors and odor measurement has been and remains a somewhat subjective determination. Work should continue to address methods for objectively and accurately quantify potential odor emissions from swine operations and develop cost effective and practical odor control mechanisms."

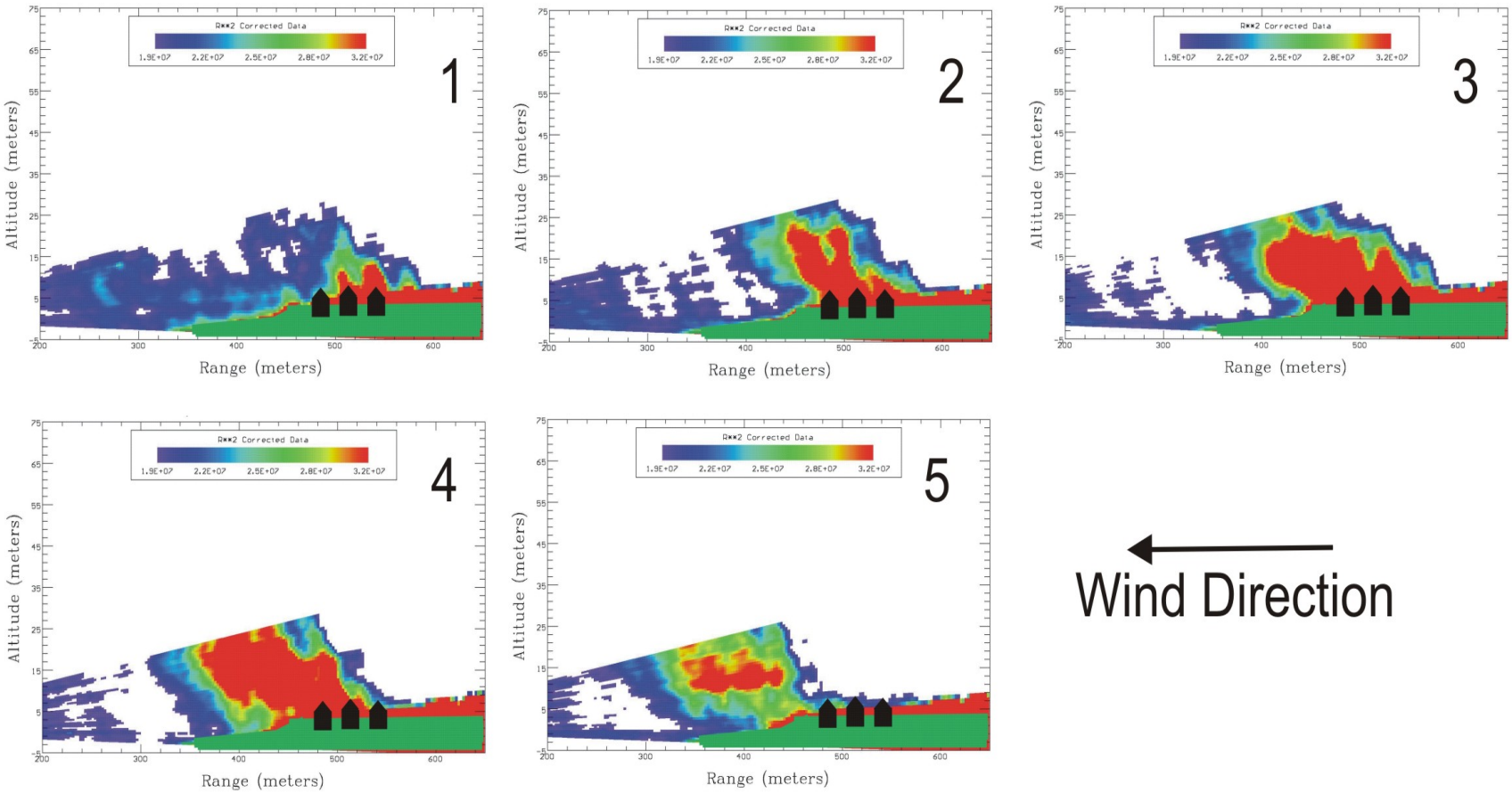
Greenhouse Gases and VOC's

- Biofuel Production
  - Lifecycle analyses and GHG/C accounting for biofuel production
  - Impacts of soil carbon dynamics on GHG emissions

Recommendations from AAQTF Oct 2007

Example

Lidar Observations of Emissions from Hog Barns

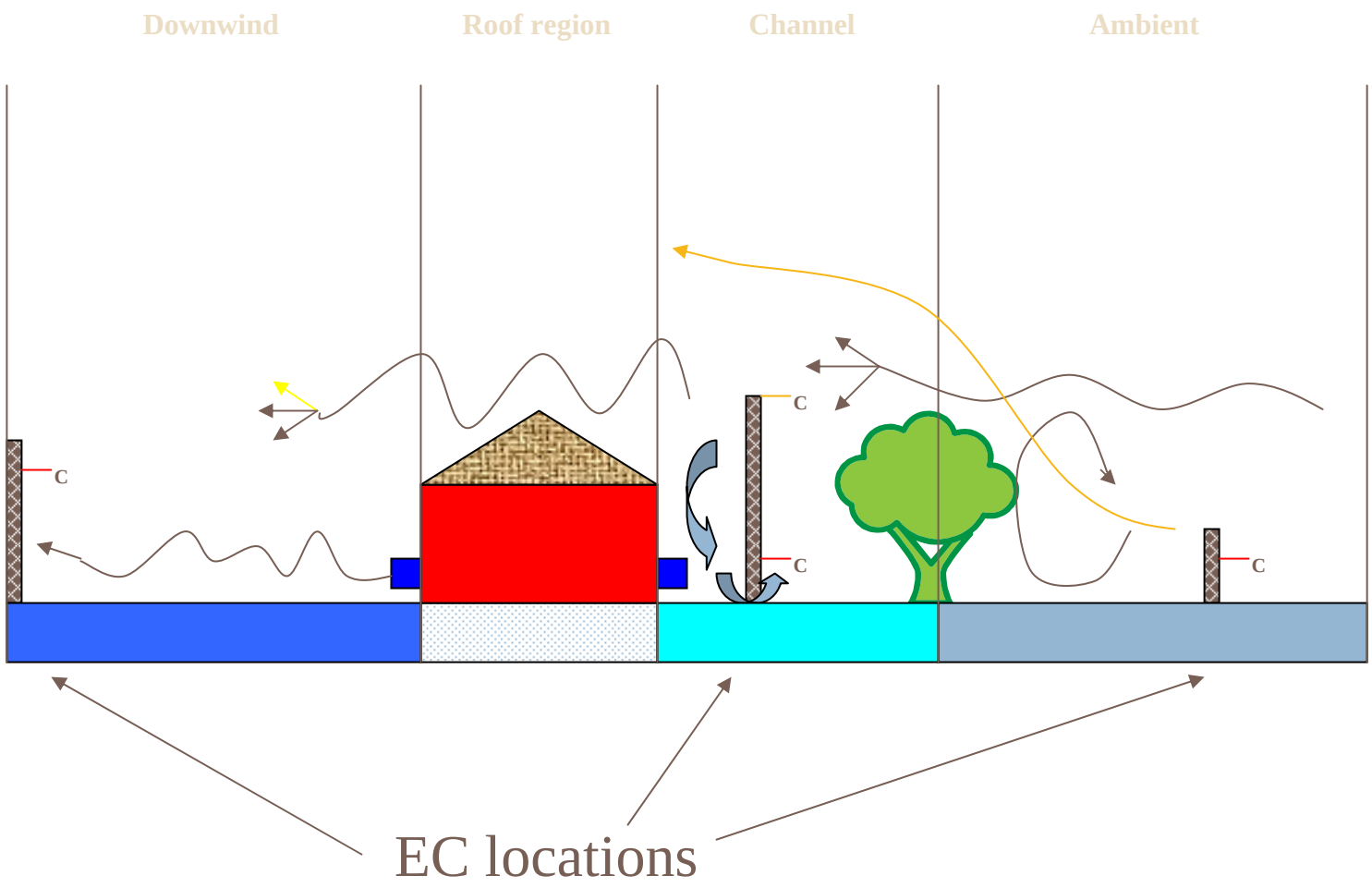


Experiment

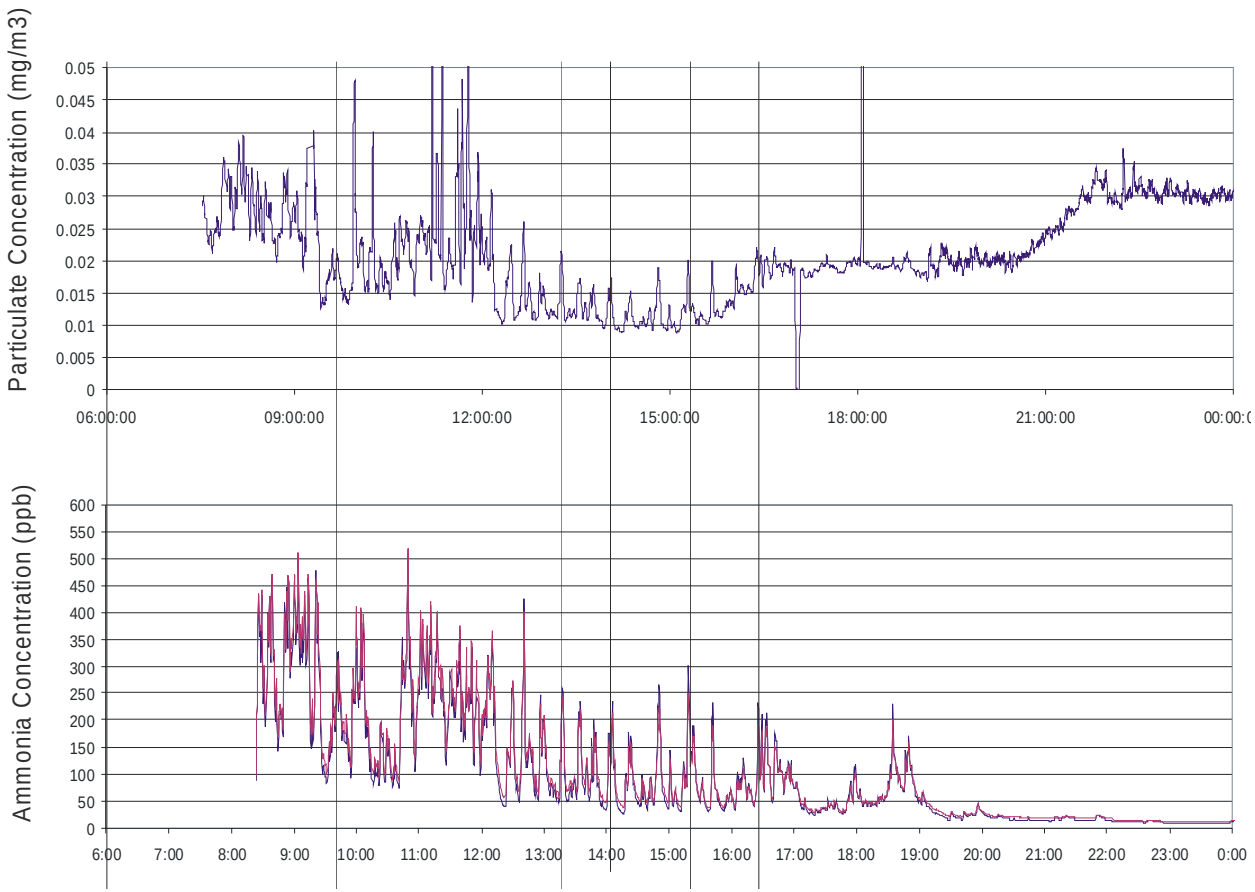

Sparkle Eagle Pullet
3 buildings
150,000 birds
~ 600 x 54 x 40 ft
North
WC
Top/Bot
Amb
HWY 17
NH3/particulate sensor
Lidar
EC Towers
Windbreak


Mean wind from the south
EC tower
Fans
10 m

Summary

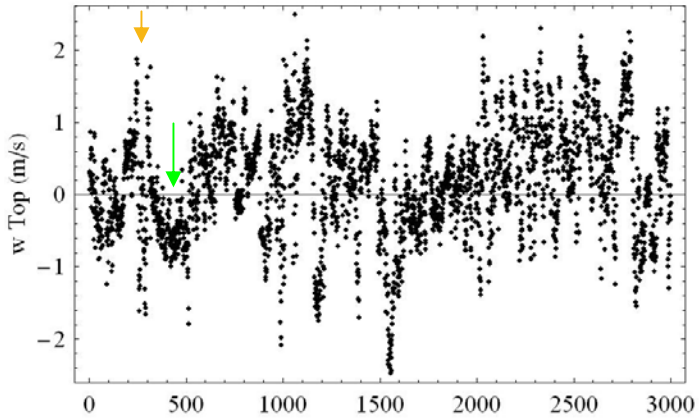


Ammonia and Particulates

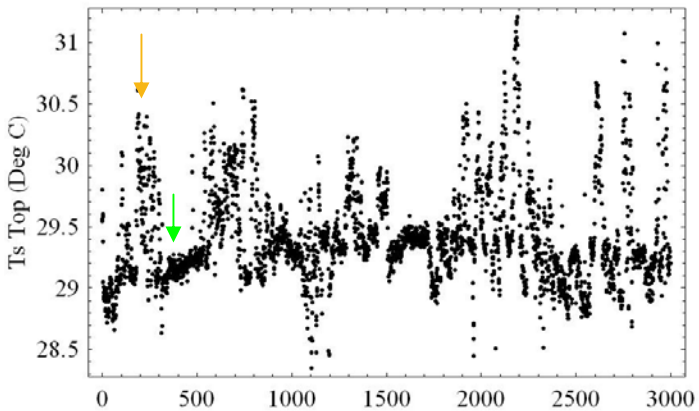


Intermittent Behavior of Emissions

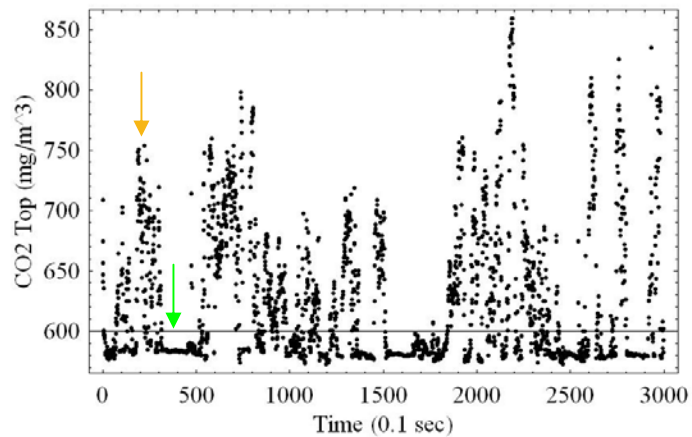
Vertical Velocity

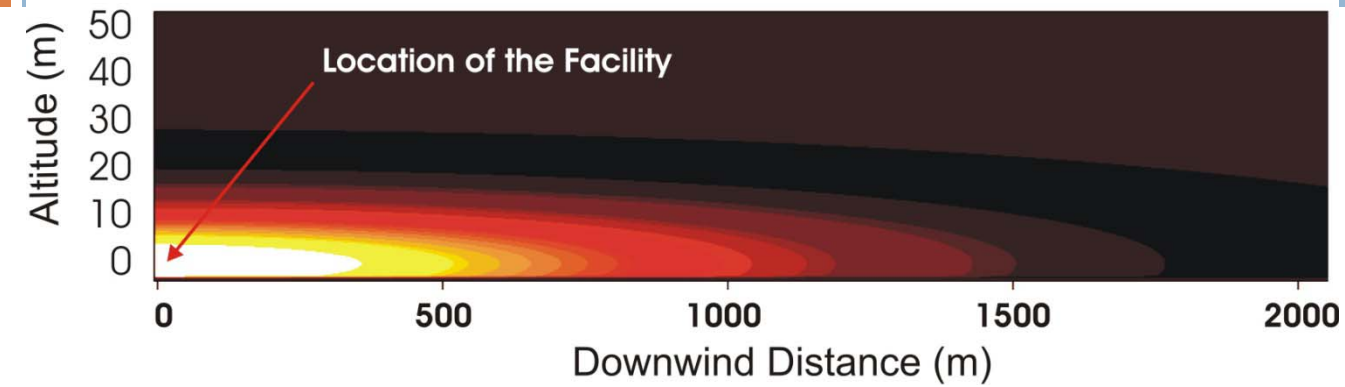


Temperature

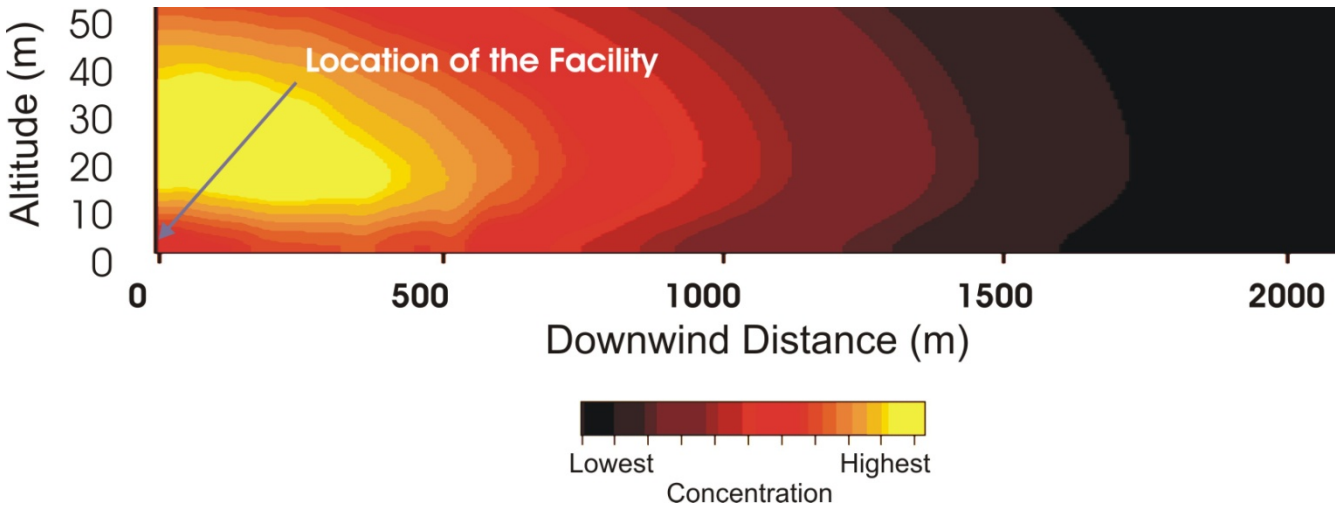


CO_2



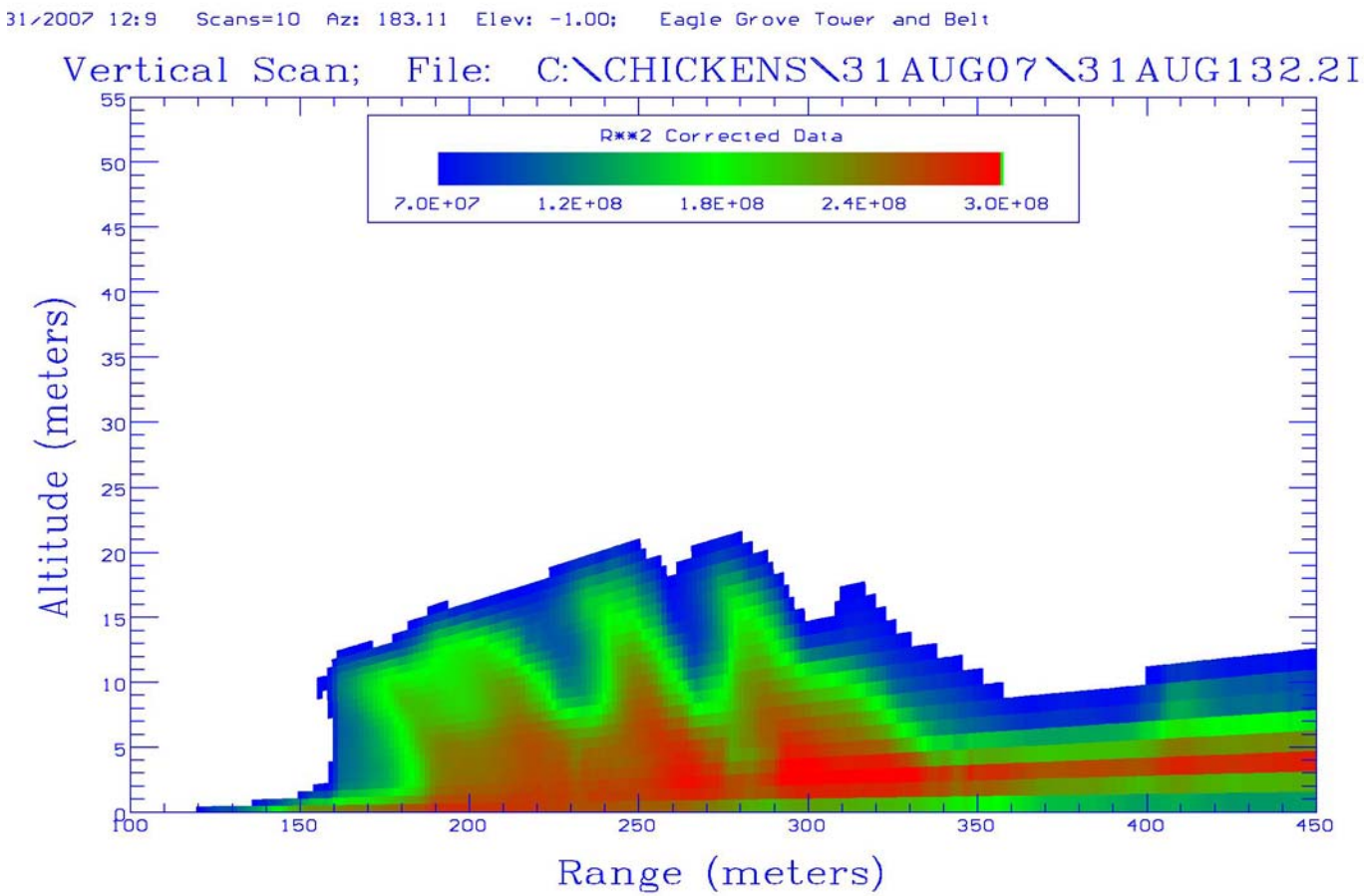


Conventional Gaussian Plume

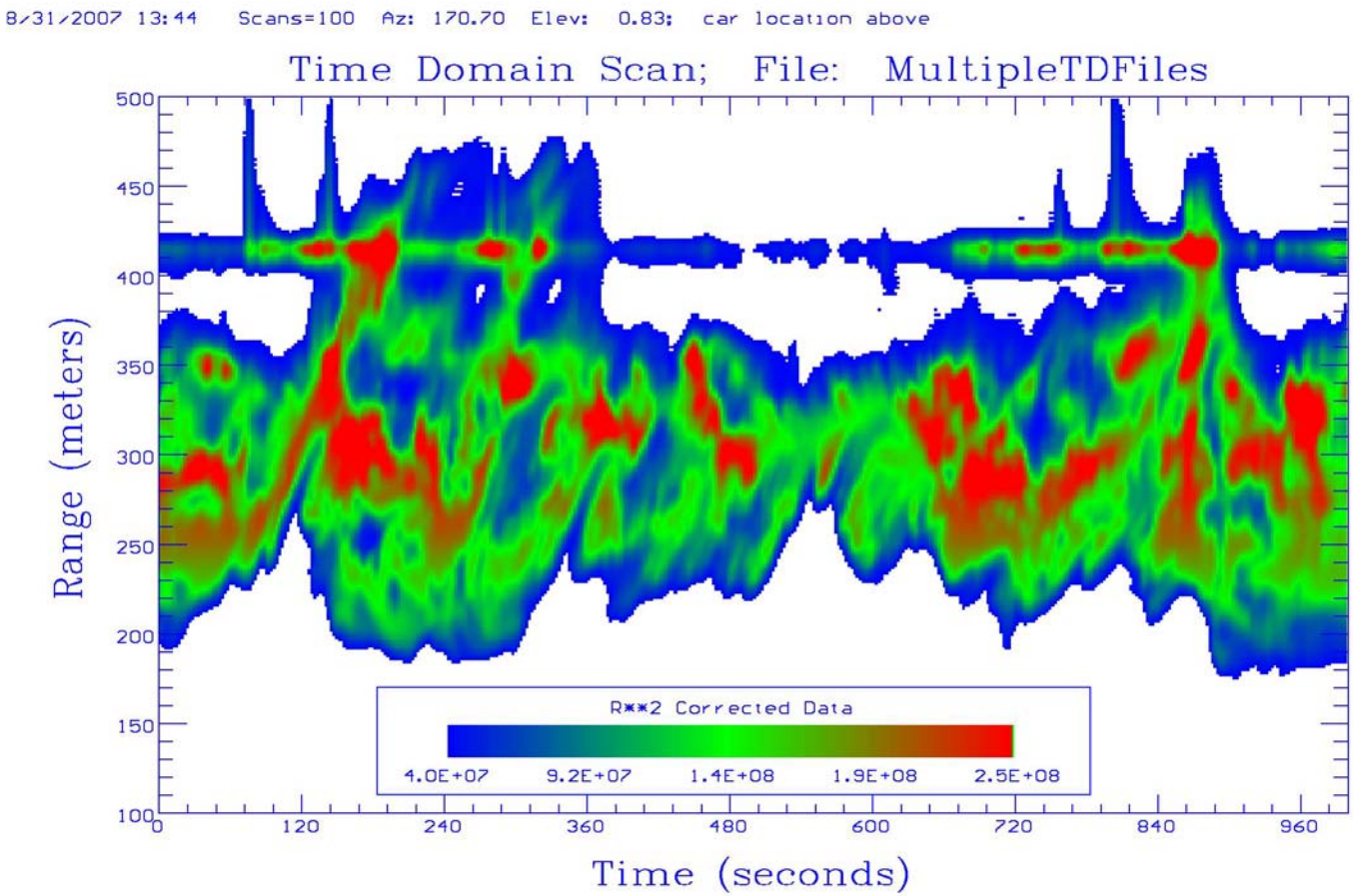


Averaged Lidar Measurements

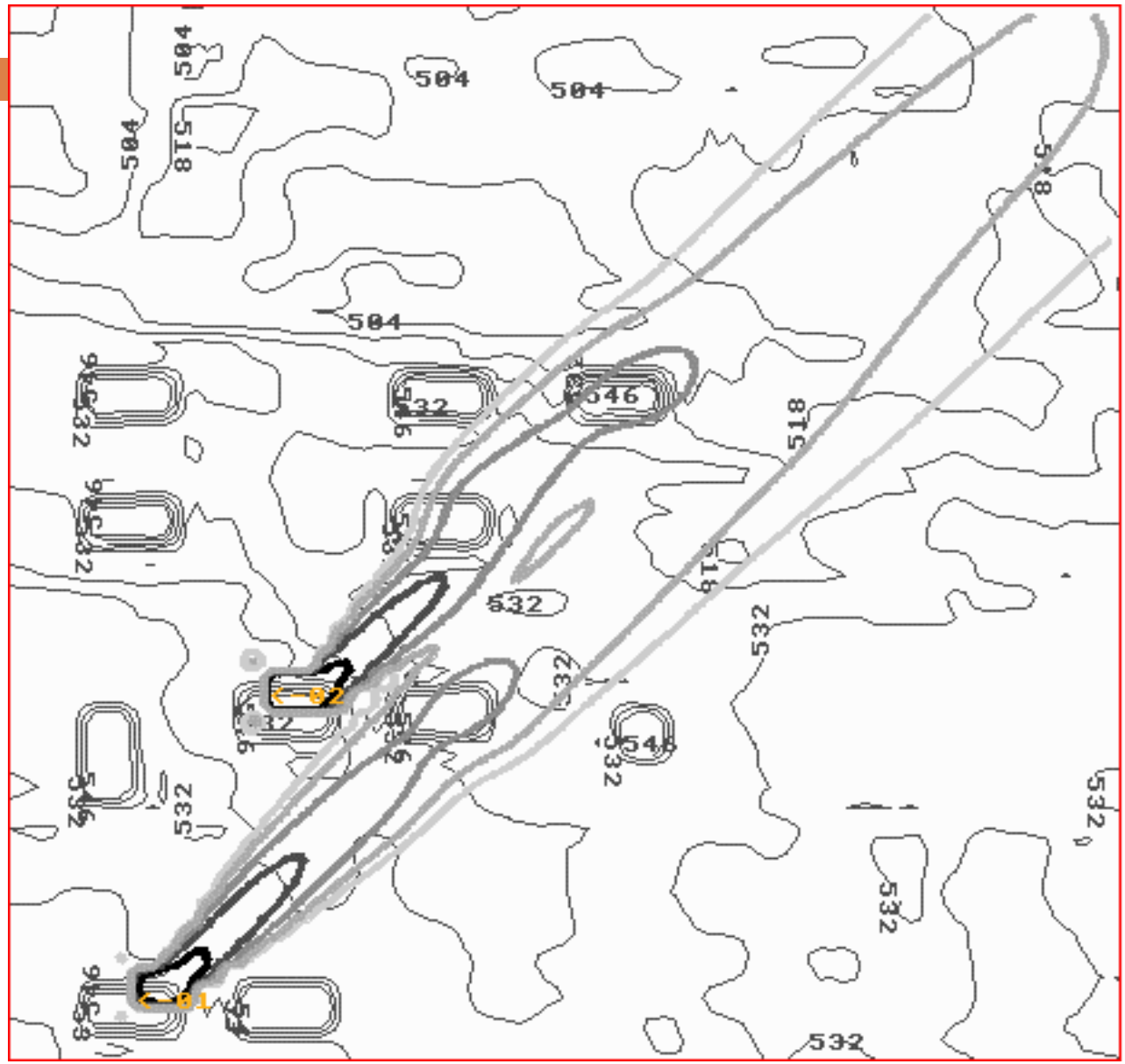
Lidar View Between the Buildings



Between the Buildings



Atmospheric Dispersion

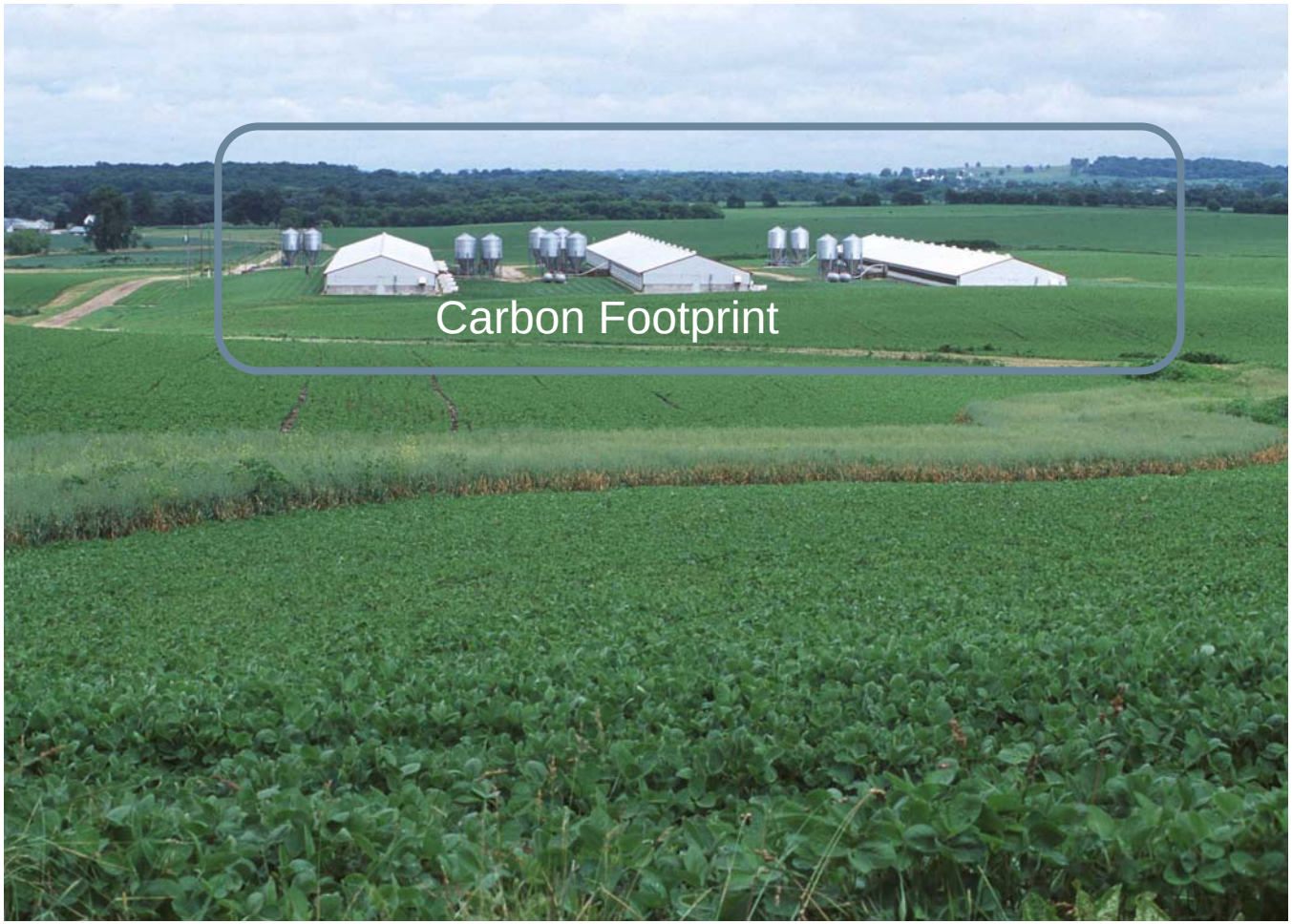


1000 m

RIMPUF Demonstrati
TIME: 11.11.1997
Wind Field:
dathrw

Contour Lines
[mg (*min) / m 3
.10E+04
.30E+03
.10E+03
.30E+02
.10E+02

Livestock Facilities



Production Facility with Lagoon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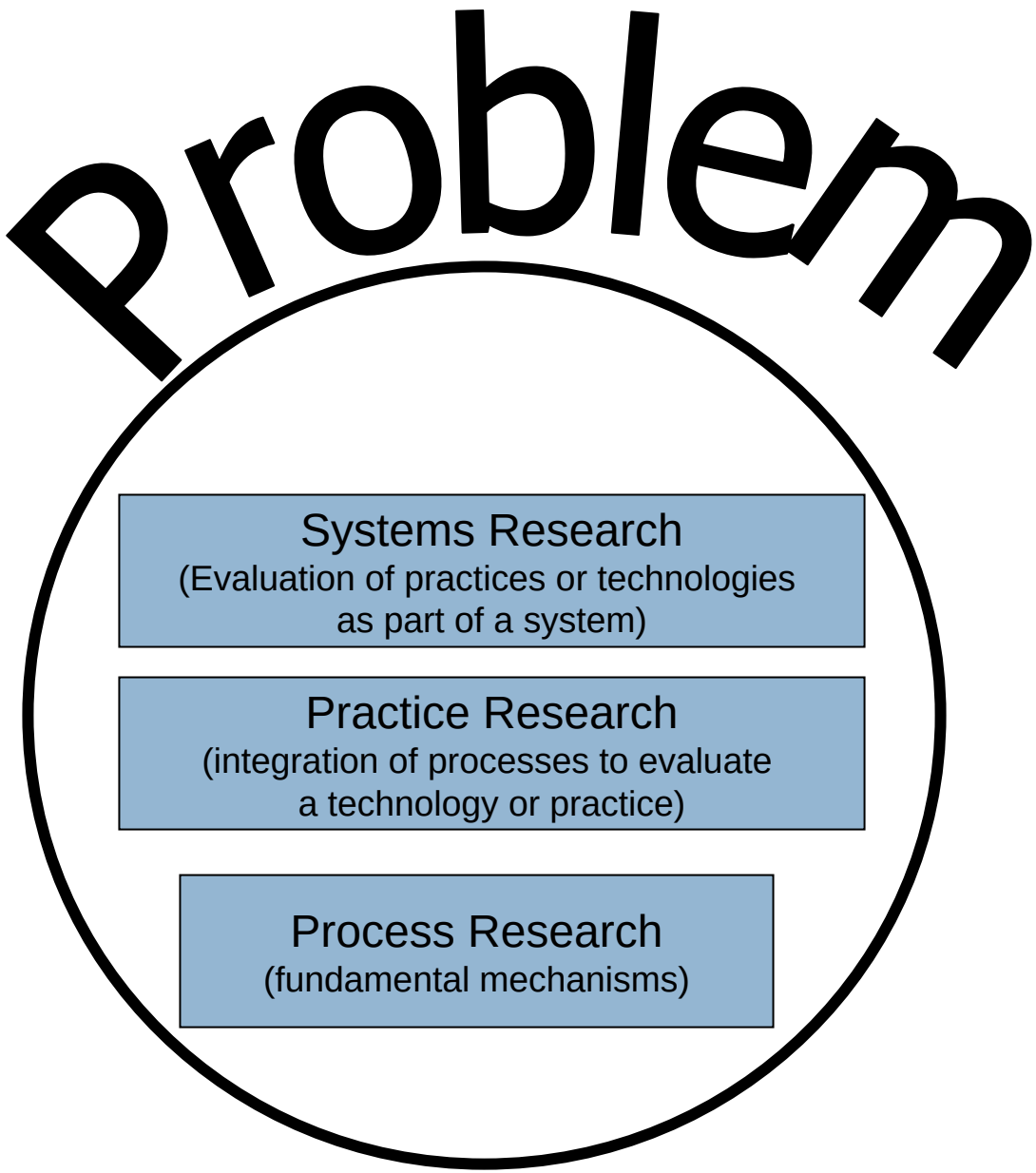
Problem Solving Approach



Reducing Agricultural Emissions to the Atmosphere

- Understand the processes that affect the emission of particulates and gases from agricultural systems
- Practices can be developed that reduce the emissions and dispersion of particulates and gases
- Incorporate practices into agricultural systems to reduce impact on the environment from emissions and determine their impact across a range of space and time scales