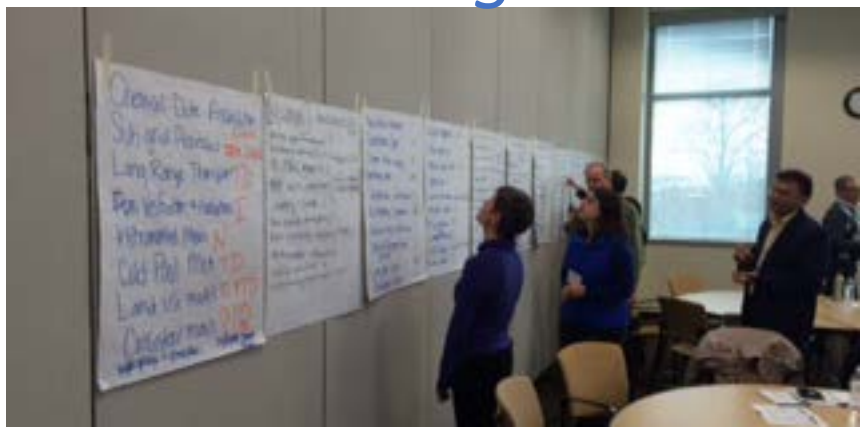
Regional Modeling
Breakout Discussion Summary

Process & Outcome

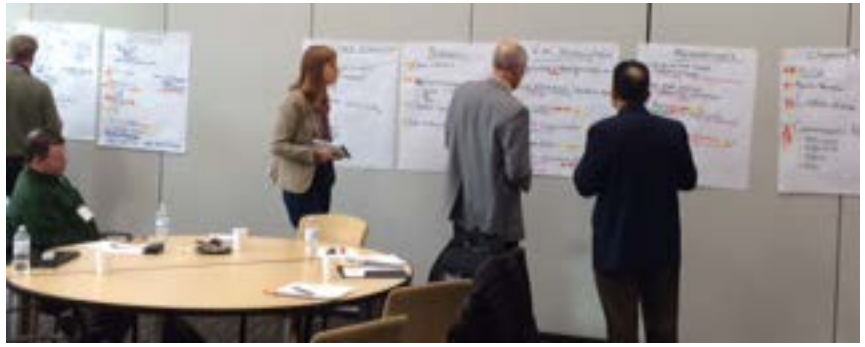
Brainstorming

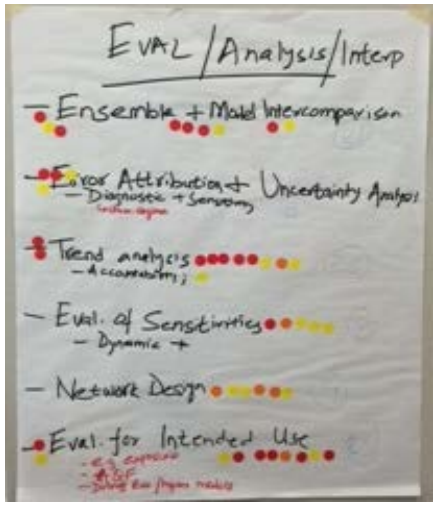
Convergence



More Convergence to 7 topics

Voting





Outcome: Convergence to Big Picture Topics

1. Emissions
2. Transport and Dynamics
3. Chemical Mechanisms and Aerosol Processes
4. Numerics
5. Scale Interactions
6. Evaluation/Analysis/Interpretation of Model Results
7. Measurement Needs

Inputs

Process Representation

Structural aspects

Model use

4-6 “projects” identified within each of these topics that were then voted on

1. Trend Analysis

- Emissions trends
  - Consistent methodology
  - Trends in sensitivity to emissions
- Accountability: Policy changes -> Emission changes → changes in ambient pollutant levels
  - Evaluation of past modeling projections
- Attribution: what drives these trends?
  - Changes in LRT contributions
  - Meteorological-adjusted trends (isolate trend signal from interannual variability)
- Modeling: extrapolation of trends for future policy directives

2. PBL

- Stable boundary Layer
- Convective Boundary Layer
- Boundary layer evolution and interaction w/ emissions
  - If a larger fraction of the emissions were to be allocated to the convection-active periods would that change bias characteristics?
- Cold pools

3. Spatial/Temporal Allocation of Emissions

- On-road and non-road emissions
  - Use of emerging data to improve space-time emissions characterization
  - Speed distributions, age distributions
  - “Event” specific Traffic information
  - How to categorize construction vehicles, recreational vehicles, and temporal grouping based on use – activity; emission rates (spatial and temporal categorization)
  - Better characterization during exceedance episodes
  - Data is available – transferability to OUR models (MOVES to air quality model)
  - Will require fine resolutions (~1 km) model calculations – resolving hotspots

  - Characterization of emission biases

4. Evaluation for Intended Use

- Measuring effectiveness of model's utility for decision-making
  - How to measure reliability/confidence in models
  - Success of models for regulatory metrics (i.e. RRFs, ozone & PM design values)
  - Exposure assessment
  - Air Quality Forecasting
  - Linking with ecological models
  - Linking with hydrological models
  - Flexible protocols for differing uses of models – danger of protocol permanence

5. Condensation Rules for Chemical Mechanisms

- Current tools do not support easy updates to mechanisms – current approach is inefficient
- Condensing from explicit mechanisms to ones suitable for practical use/purpose (i.e. regional modeling)
  - Model applications will dictate how complex the mechanism needs to be (e.g., regulatory vs forecasting applications)
    - AQF application with data assimilation may not require detailed representation
  - Ability to incorporate new information/chemical understanding

    NOx cycling

    Nighttime

    Marine
  - Automated updating of chemical mechanisms on IUPAC or JPL
  - Linked gas-aqueous-aerosol phase chemistry

    — Integration with SOA & heterogeneous chemistry

6. Air-Surface Interactions

- Bi-directional surface flux
- Dry deposition – an important sink
  - solubility
- Land use uncertainty: surface categorization (land use, vegetation, albedo, snow cover, SST, soil moisture, linking with biosphere/land surface models; parameterization AND models
  - Recent examples of coupling Regional ocean model with atmospheric models for SST
- Land/sea breeze
- Air-sea exchange
  - Deposition to water surfaces
  - Marine halogen emissions

7. Ensemble Modeling & Model Inter-comparison

- Appropriate methods for ensemble generation
- Detailed inter-comparison of models at process-levels
  - Process-level error attribution
- Deriving probabilistic estimates from ensemble results for policy-making
  - Uncertainty characterization
- Policy implications of using different models
- Ensemble forecasting

8. Vertical Profile Measurements

- For advancing model evaluation and network design
  - Aircraft
  - Tethersonde
  - Lidars
  - Celiometer
  - Solar Occultation Flux (SOF): estimating VOC emission flux
  - Tall structures
  - Profiles within/above canopies

9. Fires : wild + prescribed

- Emissions magnitude
- Spatial and temporal allocation
- Plume rise
- Speciation
- Fuel types & burning stage
- Prediction using soil moisture, satellite data and weather
- in-plume chemistry
- Interaction of fire emissions with other sources (e.g., fires near roadways)

10. Use of Satellite Observations

- Fire detection
- Trends
- Emission evaluation
- Uncertainty in Satellite data
- Data assimilation; use in exposure assessment
- Near-real time emission data
- Evaluation for appropriate use

Pros: spatial coverage

Cons: accuracy, level of quantitative agreement relative to models?

Conclusions

- Great discussions !
- Some worthy projects even outside the Top 10
  - Most can help evolve Regional Modeling over the next 5 years.

Statement

1. Project title
2. Problem statement (1 paragraph)
   - Why this research is needed
   - Background information on the science deficiency
3. Proposed research (1 paragraph)