# Green Group Notes:

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**Charge to Breakout Groups:**

1. **What have you heard that most excites you?**

System, complication

Broad base enable technology

Community working together; EF organized effort

Unidata synergy

Organized to break barrier for education

Accessibility

Efficiency science

Common format for verification; R2O

Hear everyone's challenges; EQ must come

Community data/tool base well organized

Climate community to assess weather data, model and schemes

Efficiency and unified repository, format, visualization, verification

EQ to make DA more efficient

2. **What are the key challenges for advancing Data Assimilation and Ensemble Forecasting?**

Accessibility and transparency for DA/EF/model algorithms, what tradeoffs.

Hubs for experience including failure.

Bad data transfer tools available (for WRF), changing ways of doing research; what it takes to change minds/culture?

Reproducibility

Community to the same playfiled

Data is essential; data hub

Assemble ensemble from multiple institutions

Event based or triggered ensemble

Tape existing science

3. **What are the science drivers for advancing 2)?**

Fundamental Physics in the schemes

What are the limits of predictability

Model error, why multi-physic is doing better

To use EF to improve model physics to understand predictability


Different sources of error and uncertainties, to properly represent them in the model, multiscale interactive error

To better quantify model and IC error and uncertainties

Data/model output to help better understand the model error

What observations do we need? Data impacts?

4. **What infrastructure advances (i.e., data, tools, software, frameworks, hardware) are needed?**

Web-based interface

Data exuberances, visualization of large data

Abstract data

5. **What is the appropriate level of community coordination and governance structure is needed to facilitate all of the above?**

Demonstrated what works

Collecting exiting organized activities; governing structure internal and external;

Data, Assimilation, model, cyber, education workgroup

Regional is more challenging

Valued by the institutions of the PIs

Look at social engineering on how collaborative research benefits all parties

Can ECMWF work?

6. **What do see as the broader impact of EarthCube?**

Entrain differ areas of expertise; breakdown barrier

Impacts on other discipline, not just black box

Reduce spinup for education and research spinup

Potentially extends to broader communities

7. **What do see as the next steps?**

Money

Prototyping to bring ideas together; use case scenario, to build the future EQ

Starting governing body

Select EQ initiatives from interested PIs

Use field experiments as an example

how to bring new players even without funding

8. **What have we missed in terms of areas to emphasize and people who should be included in the discussion.**

Private sector

More CS group

Rapporteur: Hacker

1. What was most exciting during the workshop?
   a. Vis/system development as an opportunity (Luke)
   b. Enabling technology and access to broad community expertise (JH)
   c. NSF funding for community rallying point (Ming)
   d. Similarity to Unidata (Unidata)
   e. Research and education pathway efficiency, involving younger researchers (Bill)
   f. Accessibility (Gretchen)
   g. Path to efficient research. Common formats for verification (DTC perspective). Enabling R2O (Tara).
   h. Hearing everyone's challenges from an unfamiliar part of the AS community (Rich).
   i. Idea of community database and toolsets (Chris B).
   j. Opportunity for climate community to learn from weather community (Liang).
   k. Potential for data access and repository for communication tools (Craig).
   l. Research efficiency via data access (Xingqua). Challenges are enormous.
2. Key challenges for advancing DA and ensemble fcsting?
   a. Accepting black box in favor of accessibility, versus maintaining transparency and digging in deeper (Gretchen). E.g. physics schemes (Chris).
   b. Using existing and future tools that reach across internet (e.g. OpenDAP) to initialize models (WRF), etc, rather than using the traditional approaches (Unidata).
   c. Need for reproducibility (Ming).
   d. Community buy-in to initiate the culture change (Josh).
3. Science drivers for advancing DA and EF?
   a. Model physics (Chris B, Liang).
   b. Limits of predictability (Bill).
   c. Model error. Model uncertainty. Errors versus error variance.
   d. Verification.
   e. Use of ensembles.
   f. Sources of uncertainty/error and how feed into predictability (Ming). Scale dependent predictability.
   g. Determining what observations are really needed in current and future observation network (Rich).
4. What infrastructure advances (tools/soft/hard) needed?
   a. Storage in general (Bill).
   b. Data redundancy and retention strategies.
   c. Data extraction, data abstraction.

    d. Software to deal with distributed storage.
5. What is appropriate level of community coord and governing structure?
    a. Unclear at this point.
    b. Need to look around at successful efforts.
    c. Can learn from experts in grass-roots organization.
6. Broader impacts of EC?
    a. Possibility to entrain external expertise to address our problems.
    b. Impact on other disciplines by demonstrating power and potential for models. Demonstrate success that results from broader cooperation.
    c. Improves student spinup to focus on learning theory and pursuing research.
    d. Some similarities to Google.
    e. Ability to look at data at different depths enables layperson through expert, many levels of education.
7. What are the next steps?
    a. Regional ensembles are good use-case with many university partners (Rich). Models on demand. Middleware exists to trigger model run depending on phenomenon. Look to ITR initiatives for some of the pieces. LEAD project. Need a prototype environment.
    b. Exploring and generalizing use cases.
    c. Scenarios.
    d. Awardee/PI meetings from solicitations to leverage and expand communication.
8. What are missing emphases and people to include?
    a. Private sector
    b. CS
    c. Past ITR PIs (e.g. LEED)