

User-relevant Verification

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What is verification?

- Evaluation of the **quality** (as opposed to *value*) of forecasts

Forecast quality and value are not equivalent and have a complex non-linear relationship, even in the simplest of situations

- At a basic level forecast verification is

The comparison of forecast values to observed values

Purposes of verification

Administrative
Scientific
Economic

From Brier and Allen, 1951

Purposes of verification

Administrative
Scientific
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Postulate:

- *Most verification, to date, serves only the first purpose (**administrative**)*
- *This is especially true for verification of operational systems*

Current situation

- *Relatively little advancement since the days of the "Finley affair" when many metrics were developed*
- Measures-based approaches applied in practice
- Operational verification focuses on "management" needs and model-centric applications of verification
 - *i.e., not on diagnostic or user-focused approaches*
- Focus is on
 - *A few traditional measures*
 - *Aggregated statistics*
 - *A few parameters (e.g., 500 mb ht, T, PoP)*

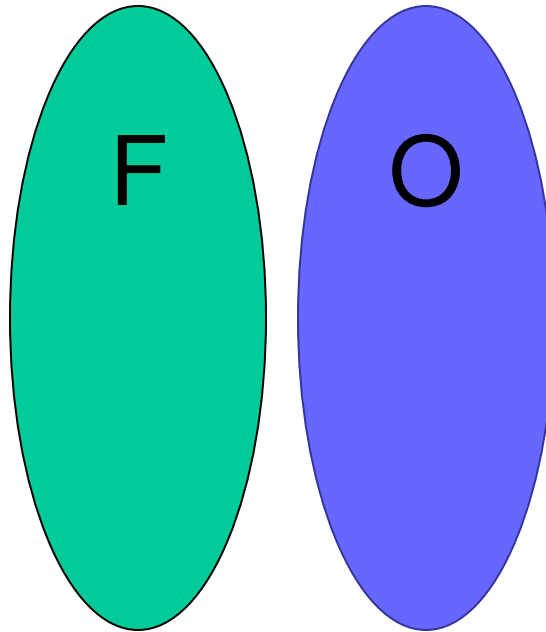
Current situation cont.

- Model verification “drives” choices in model parameterizations, development, etc.

Ex: verification of models using RMSE or anomaly correlation applied to 500 mb heights leads to particular choices in model development and evolution (which may – or may not – be intended)

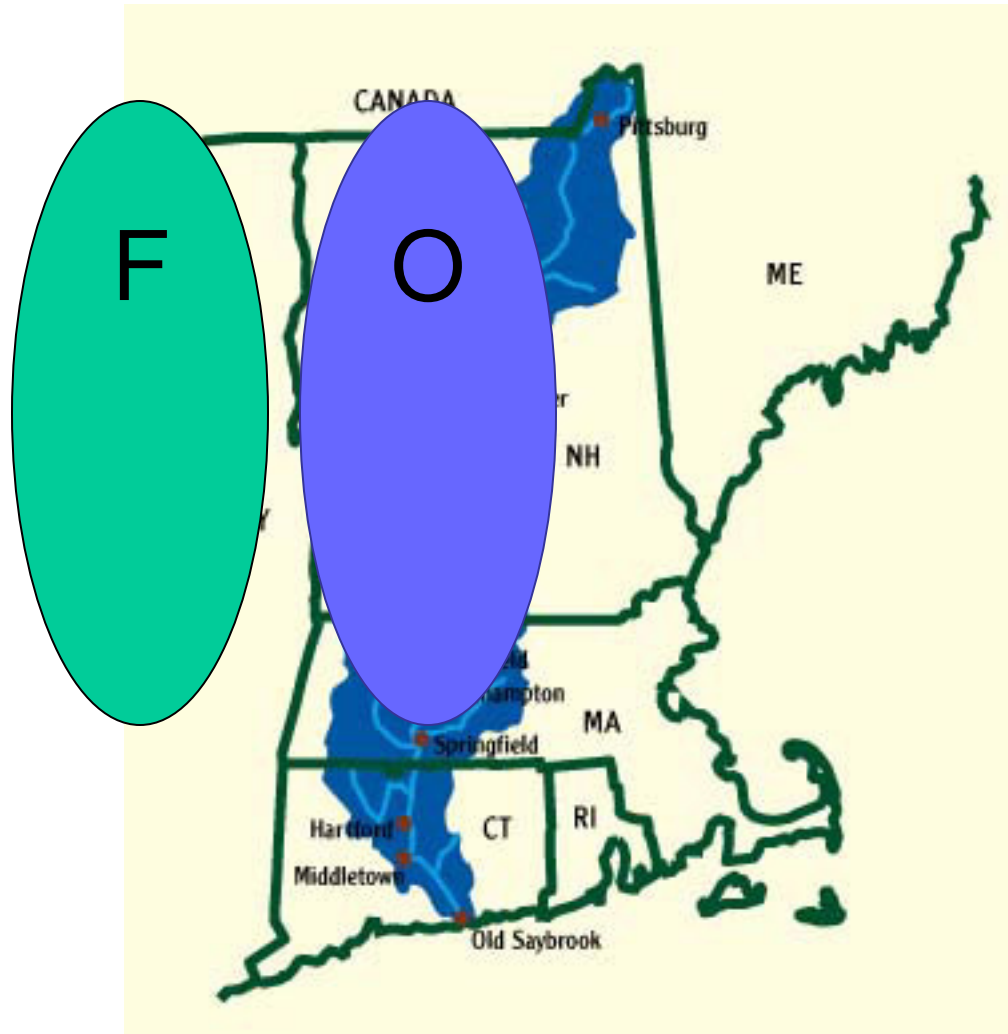
- Uncertainty in verification measures is rarely estimated
- Forecast use/value rarely considered

*User-focused verification:
Good forecast or Bad forecast?*

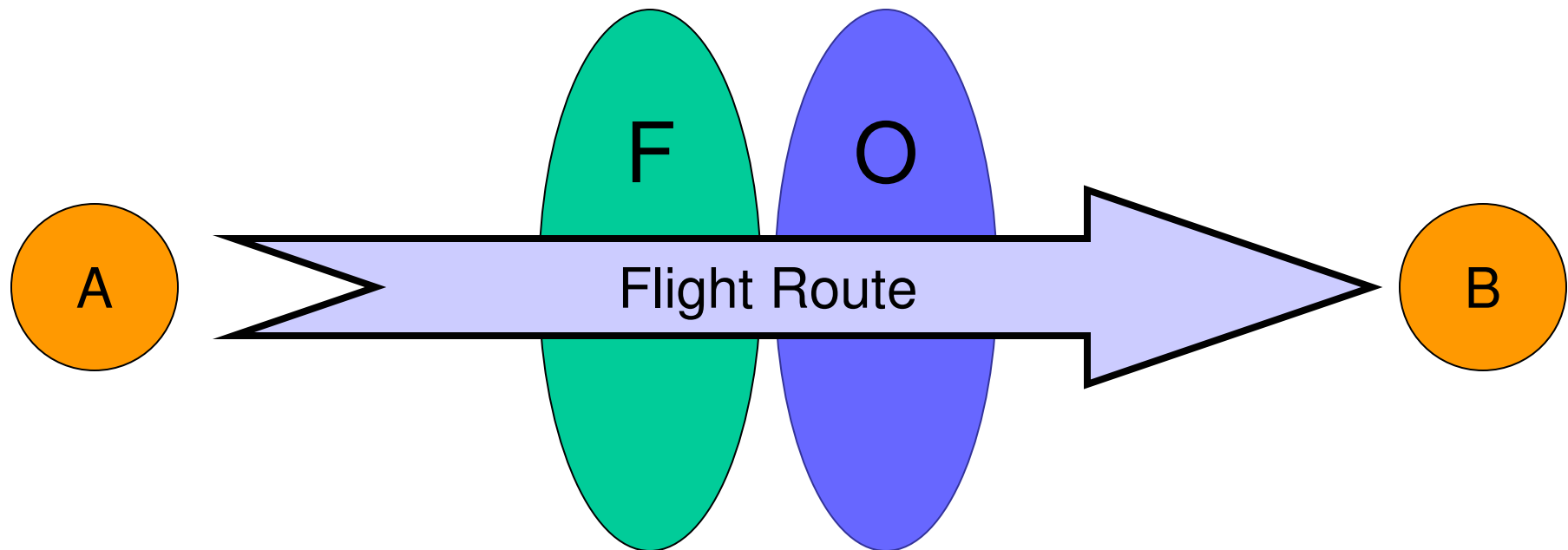


User-focused verification: Good forecast or Bad forecast?

If I'm a water manager for this watershed, it's a pretty bad forecast...



User-focused verification: Good forecast or Bad forecast?



If I'm an aviation traffic strategic planner...

It might be a pretty good forecast

Different users have different ideas
about what makes a good forecast

Why do users need verification information?

- Improve forecasts
- Determine whether to use a forecast or forecasting system
- Heeding/ignoring warnings Interpretation of forecast (“What does a forecast of 32 really mean?”)
- Input to decisions and/or decision-support systems
 - *Economic and forecast value implications*

User-relevant verification provides the link between weather forecasting and forecast value

Goal

Framework for moving from current ***measures-focused*** approaches to approaches that are ***user-focused***, and eventually to estimates of forecast value that rely on the user-focused approaches.

Intermediate steps: ***Diagnostic*** and ***Features-based*** approaches;
identification of users' needs

Five levels: 0 to 4

Levels of user focus

Level 0: Conventional measures-based approaches; admin purposes only

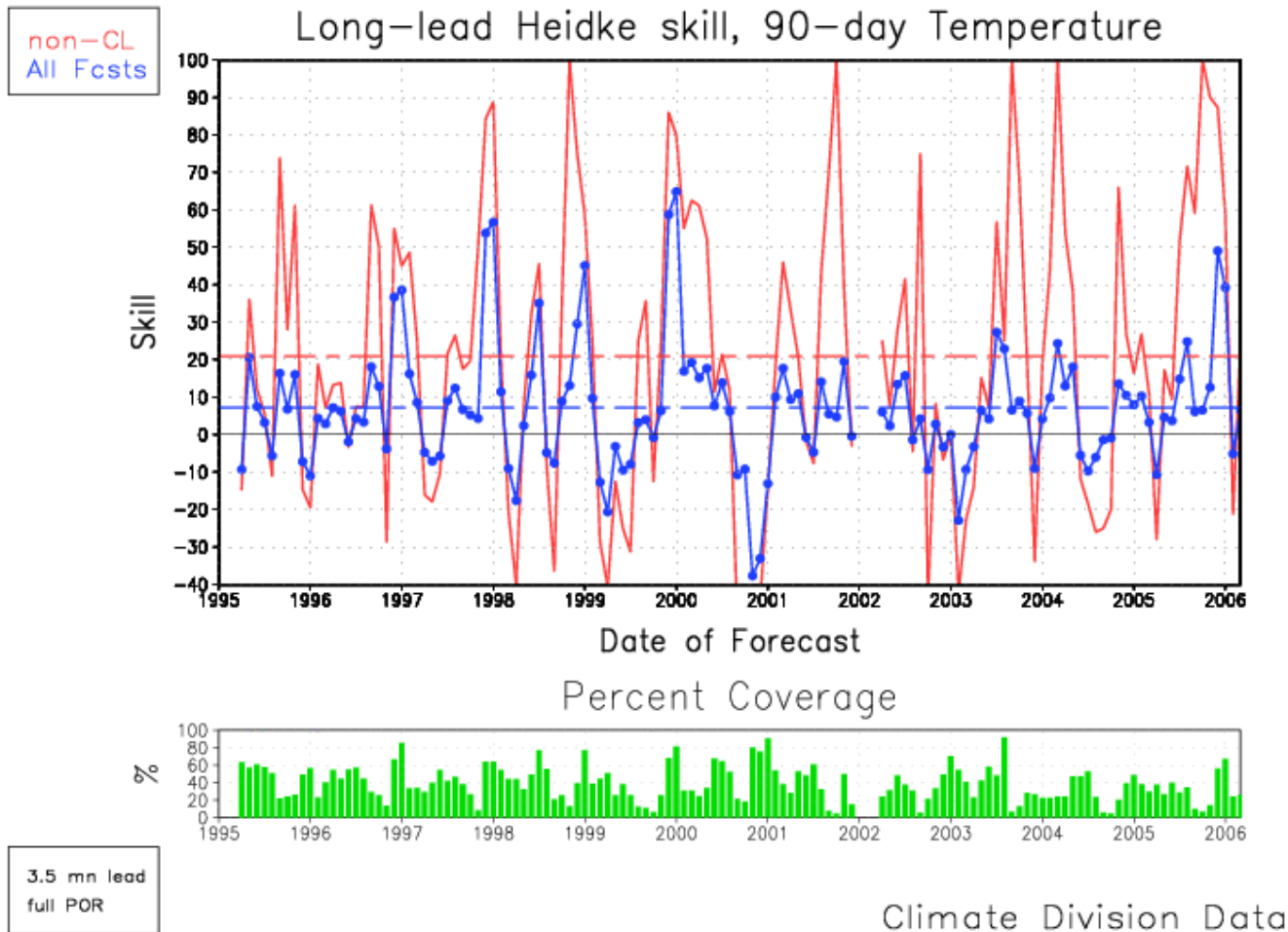
Level 1: Broad diagnostic approaches applied; user-selectable information

Level 2: Features-based approaches applied; enhanced diagnostic information

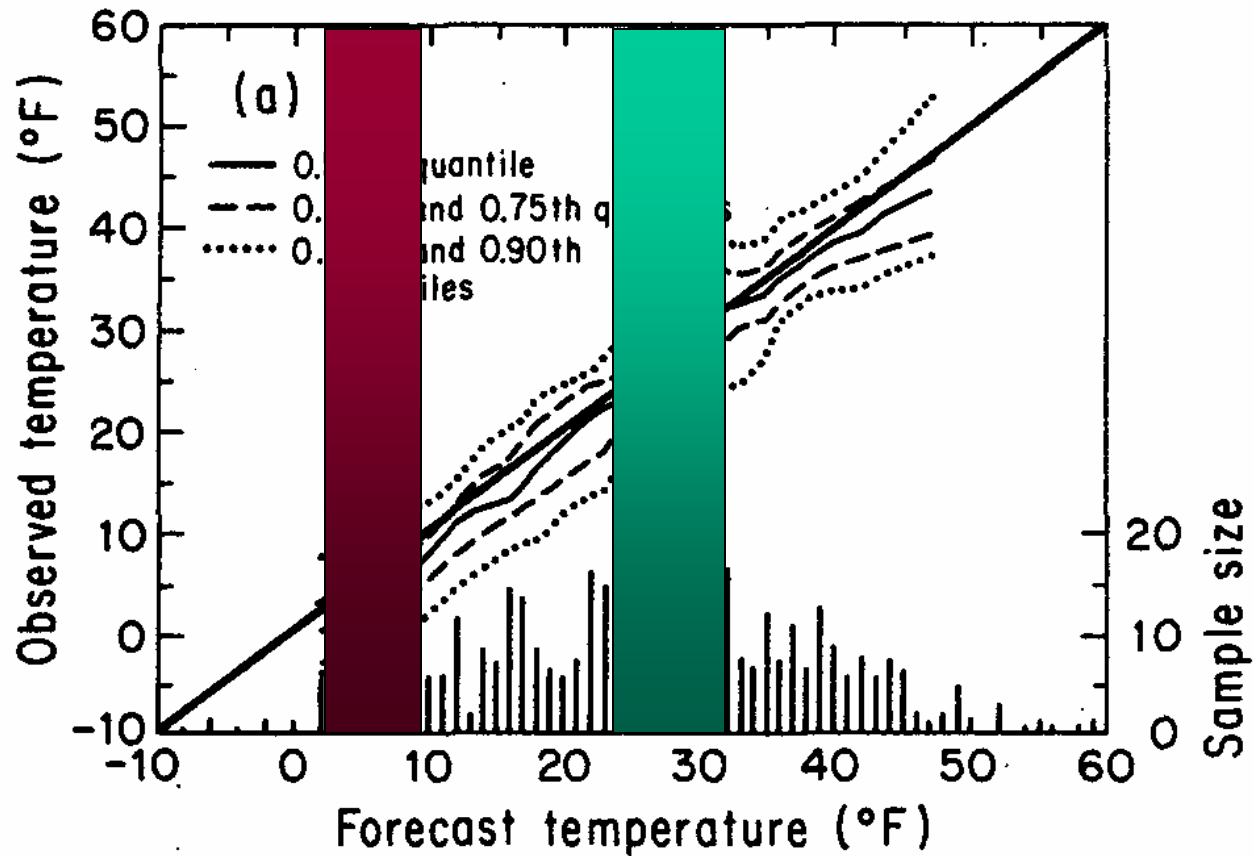
Level 3: User-specific verification approaches and measures

Level 4: Forecast value estimated, making use of user-focused verification information

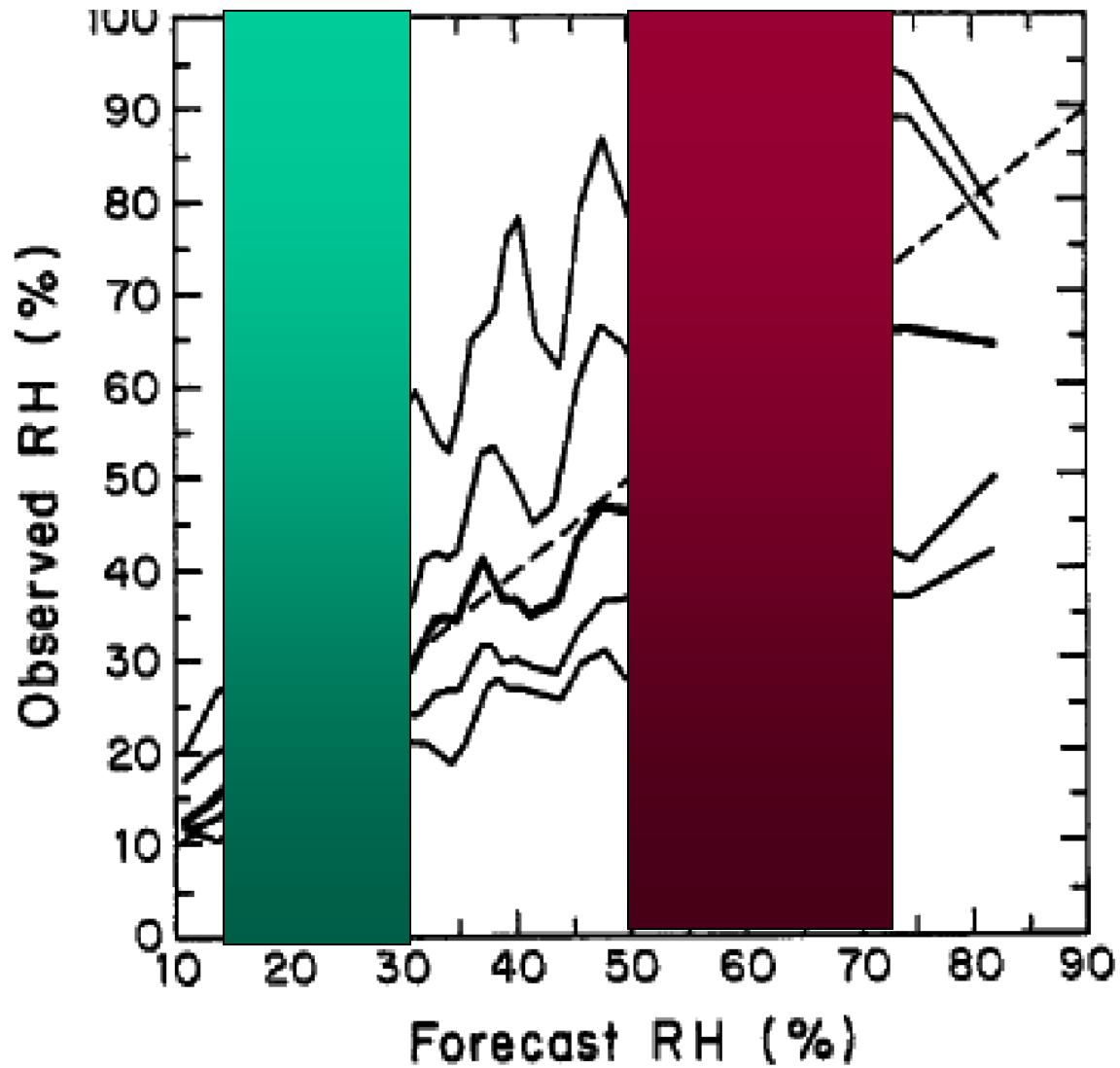
Level 0 example



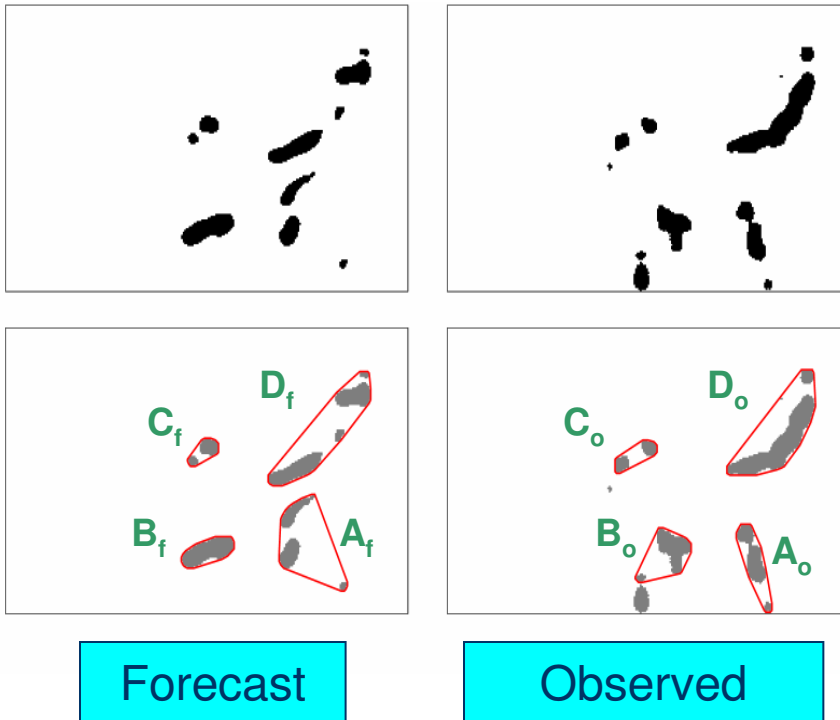
Level 1 example



Level 1 example



Level 2: Object-based verification example



POD = 0.27

FAR = 0.75

CSI = 0.34

Locations:

Forecast objects are

- Too far North (except B)
- Too far West (except C)

Precipitation intensity:

- Median intensity is too large
- Extreme (0.90th) intensity is too small

Size:

- Forecasts C and D are too small
- Forecast B is somewhat too large

Matching:

- Two small observed objects were not matched

Research outline

Near-term research

- New diagnostic methods (e.g., ways to view and summarize forecast distributions; Level 1)
- Features-based approaches (Level 2)
- Connections with specific groups of users (e.g., aviation, water resources)
 - *Develop common language*
 - *Create process for identifying verification attributes*

Research outline

Longer-term research

- Continue development of diagnostic and features-based approaches (Levels 1-2)
- Investigate decision-making strategies for specific users; translate into verification attributes (Level 3)
- Utilize user-specific verification attributes in forecast value studies (Level 4)
- Investigate the relationship between forecast quality (as measured by these attributes) and forecast value (Level 4)

Thanks!!!