April 28, 2020 Theory Working Group Call

Attendees: Christy Rollinson, Will Pearse, Jason McLachlan, Mike Dietze, Peter Adler, Jaime Ashander, Amanda Gallinat, Hassan Moustahfid

Agenda:
1. RCN virtual meeting update. Peter will give a 5 minute summary of what the group has been doing and will be doing moving forward
    a. Peter's plans - history of working group. Original goals and what has happened since then. Hypotheses, common language, top 3 things synthesis for a future manuscript
        i. Vocabulary
        ii. Christy/Mike - revise Christy's slide? Yes
        iii. Scale
        iv. Small footnote - contributed alot to EFI forecasting standards
2. NASA RFI on Earth System Predictability Research and Development
    a. RFI: https://beta.sam.gov/opp/bbff69a73f38423e9a0328494c14dab2/view
    b. Google Doc to craft letter - either join to help draft text or join to read/sign [LINK REMOVED]
3. Manuscript updates and plans to move forward.
    a. Look at the Common Framework Slides [LINK REMOVED]
    b. For reference, the hypotheses are here [LINK REMOVED]
4. Action Items Listed in April 2 Call to Do Before This Call
    a. Add (i) the top 3 things you have learned so far by discussing hypotheses for forecasting with the rest of the group/people from different disciplines and (ii) the top 3 things you want to communicate to others in a manuscript about these ideas. Put these ideas and get more details on **this Google doc** [LINK REMOVED]
    b. Jaime, Amanda, Christy (and anyone else interested) will brainstorm a bit about how to make 3-D figures (perhaps similar to Monica Turner's 1998 figure - see Slide 6 in the Common Framework) to convey grain, extent, and forecast horizon as a way to convey a bit more information/synthesis of the ideas we discussed
    c. Peter will reach out to Giorgio, Nick, and Jono about their slides since they couldn't make today's call
    d. Take a stab at thinking about Christy's slide 7 and how it might apply to your system
    e. Notes from discussion of the top 3 things people have learned:
        i. Amanda:
            1. Have more of a discussion between parsing between predictability and transferability. Have clear definitions of predictability and transferability

      2. Think about testable hypotheses to apply to the theory of forecasting instead of thinking about it from individual disciplines

      3. Use the uncertainty figure from Mike to help frame this

  ii. Christy:

      1. 2 steps. Conceptualization vs operationalization

      2. Make definitions clear. Forecasts horizon and how it transcends across time and space

  iii. Jason:

      1. Long time scales are his interest.

      2. Meteorology forecasting. Next day forecasts and large scale/climate are predictable. Intermediate scale/time hard to predict

      3. Do continued improvement in near term forecasting add up to better long term forecasting or not?

      4. Shape may be different than pulling long term forecasts shorter

  iv. Hassan

      1. What is useful for the end-users

  v. Will - group discussion:

      1. Difference between transferability and predictability is really important. This framework has helped to understand the differences people have had in our group working through this

      2. Predictability vs forecast

      3. Transferability - ability to take modeling framework and apply in a different system. Prediction - use model to make prediction in time for that same system. The line gets blurry for when you are talking about a different system. How do you identify the boundary?

      4. Collect data from a number of locations create model using half the locations and test model/validate model with the other half of the locations

      5. Degree of independence or degree of difference between the test set and training set

      6. The theory of what it looks like when a forecast is going to fail or when we reach the forecast horizon.

      7. Forecasting framework and uncertainty. If we understand uncertainty it might help us to know when the forecast fails

      8. Maybe model transfer well if you can accommodate through random effects and you don't have to change the functional form of the model

      9. Can extract in statistical way or though the process.

10. East vs west side cascade predictions as compared to cascade vs Pacific
11. Christy: Transferable - same processes different parameters. Prediction - how well do you do. Same parameters plus data assimilation. Mike: Push this a little further. Not just transferability of parameters. Can you predict/explain which coefficients need to be there at all. What terms do you include in the model?

    vi. Dietze et al 2017 predictability paper. Has a table in it. When do we expect process error to dominate, etc
1. List of papers - can Mike share the papers that are looking at predictability from first principles. Papers from NEFI project. Most are in preprint

    vii.

5. Plan to schedule calls for May-August