

February 1, 2021 Joint Methods & CI Working Group Call

Attendees: Mike Dietze, Ethan White, Carl Boettiger, Jody Peters, Abby Lewis, Jake Zwart, Kelly Heilman, Alexey Shiklomanov, Quinn Thomas, Leah Johnson, Libby Mohr, Rob Kooper, Hassan Moustahfid

Agenda/Notes:

1. EFI Task Views
 - a. Use [Task View 1 on Reproducible Workflows](#) as a guide
 - b. Uncertainty Quantification & Propagation, Modeling & Stats
 - i. Status - feel good for most of it. Stuck on uncertainty and DA.
 - ii. Jake has done a lot on the DA section
 1. Jake added unused text that came from another project, so not specific to this Task View. Would be good to go through this to make it more inline with this Task View.
 - iii. Uncertainty - there are a lot of notes. Need some help if there are stand-alone tools that can describe those
 - iv. <https://uqworld.org/> - from Mike. Doesn't know the tools well, but the webpage and resources grew out of initiative he had been involved with
 - v. Abby taking prelims this semester so will be taking a step back to focus on that. So won't be able to dedicate a lot of time before mid-April
 - vi. 3 general things in this section
 1. Quantifying uncertainty in predictions
 2. Using uncertainty for model evaluation - comparing cross entropy
 3. Propagating uncertainty into future steps
 4. Mike has been thinking fo parts 1 and 3 most.
 5. Using uncertainty in evaluation could be in a different task view. Decision support could have an evaluation section. Definitely want this somewhere. It hasn't been set up in this Task View yet. Could fit here, but needs a lot to be added
 - vii. Conceptually describe vs R package as a standard IO to accomplish a Task.
 - viii. Task view is a combination of both. But what balance do we want to strike
 - ix. Definitely point to packages in this Task View and the other Task View to point to tools people are using
 - x. Are people using tools to quantify uncertainty?
 1. Don't think about what tools can do it or the modeling tools that CAN'T. If you take R package for least squares - what are the limits to what they can do. Can estimate standard error. Then think about other packages that fill in the holes. How far can you get with common tools?
 - xi. Task Views are not supposed to exhaustive list. Give people the vocab that they need to search for the tools they need to do. BUGS, JAGS,

- NIMBLE - graphical models. Once you know those words in the context of Bayes then you can find the tools you need. Then provide a few examples, but don't strive for an exhaustive list.
- xii. DA section -convey there is the Kalman filter with lots available and then there is not anything else, except one off things. This is a rapidly evolving area. Read the lit and make it yourself or subscribe to RSS feed
 - xiii. There are tools available to build multiple algorithms that you wouldn't want to dive into the software engineering by scratch.
 - xiv. DART, Empire - designed to couple to process models to do DA
 - xv. From Kelly: Haven't used this, but this might fall under a "stand alone tool for uncertainty propagation"
 - 1. <https://rjournal.github.io/archive/2018/RJ-2018-047/index.html>
 - xvi. In first part of Task View goes over empirical models with subsections, and process based models
 - xvii. Then have similar structure under uncertainty talking about how to quantify uncertainty and models in general. Different types of quantifying uncertainty with machine learning vs bayesian models
 - xviii. Originally had uncertainty within each of the models above in the Task View. Pulled it out because there are some tools useful in multiple section.
 - xix. Not stand alone tools for many of the uncertainty quantification, instead of giving an example tool, could give an example of the uncertainty
 - xx. From Hassan: <https://uncertainty.readthedocs.io/en/latest/>
 - xxi. Similar conversation for DA? Thinking of tools and ways to frame that?
 - 1. Yes.
 - 2. Have definition of what DA is for the ecological forecasting community too. Different fields, different context may define DA differently.
 - 3. Only adding DA in temporally is DA or can DA be adding data all at once and that is hindcast.
 - 4. Get input on what DA is would be good
 - 5. Jake wrote that DA is application of Bayes Theorem, not necessarily using the theorem but is an example of it (may not be something that everyone agrees on)
 - 6. Useful warning - for people doing DA, if you ask multiple people what DA is, you can get multiple answers
 - 7. Use the same language as the NEON Forecast Challenge, e.g., met data = drivers, etc
 - xxii. Don't want to write a book on ecological forecasting.
 - 1. What is the least/smallest unit people want to consume?
 - 2. Make DA its own Task View?
 - 3. Since DA is such a rapidly evolving field that people are building their own DA

4. Keep DA in and make the length = 3 paragraphs of text for DA text and then point people to other resources to get more details.
- xxiii. Put batch DA up in the Statistical models section. It is about fitting and forecasting. DA section could be sequential.
- xxiv. Some people call this batch DA referring to model fitting. See sequential DA further down.
- xxv. Top of uncertainty section - uncertainty by itself, is that propagation uncertainty that you quantified using the methods above? Map it onto an ecological forecasting workflow. Take workflow that is generic and the Task View is the tools that accomplish the workflow.
1. Could have a box in each section - pick one set of tools and show how they fit together.
 2. Take Mike's Figure 1.1 and make this a more dynamic document that maps functions/specific tools to accomplish different tasks in the workflow.
 - a. This figure needs to be paired with how to build this. There is no clear starting and end point.
 - b. Show the hierarchical layers building layer 1, layer 2, layer 3. Or show where/what you start with.
 - c. Stick a color coded version of Figure 1.1 in this document
 - d. The red section talks about modeling, the blue section talks about uncertainty, the pink section talks about DA
- xxvi. This Task View is quintessential for building a forecast. Whereas the other Task Views are important for completing the tasks. But having a figure like 1.1 go into this Task View.
- xxvii. Have 3 sections that highlights the different parts of the forecasting workflow. Have the figure at the top of each section that highlights the portion of the workflow that is focused on in that section.
1. It is okay if the same tool shows up in multiple sections. E.g. JAGS example
- xxviii. Organize the tools by the difference between analytical and some other. Explain the differences and point out the different tools.
- xxix. Need the precision to the forecasting workflow can make it more crisp.
- xxx. Need a champion. Abby can't do that right now.
- xxxi. 3 tasks
1. Create figure and integrate into the different sections to give direction. Quinn - can work on the figure
 2. Work on uncertainty section
 - a. Ethan can help with uncertainty with frequentist and machine learning. Hassan can help with machine learning as well. Leah can help with the Bayesian section
 3. Put together the DA section
 - a. Jack and Alexey can work on DA section to pare down to the 3 paragraphs

xxxii. Hassan shared this tool. Physical side of things.
https://gmao.gsfc.nasa.gov/products/climateforecasts/GEOS5/DESC/init_ocean_method.php

- c. Visualization/Decision Support Tools, User Interface
 - i. Placeholder while Whitney takes her prelims
 - d. Data Ingest, Cleaning, Management
 - i. Placeholder until we are further along with the other Task Views or have an identified leader for this
2. [NEON Ecological Forecast Challenge](#) CI Update
- a. Received first set of forecast submissions.
 - b. Quinn working on getting the CI working with the distributional submissions for scoring. Have it working now with mean and sd
 - c. Now working on the Shiny App to show mean and SD rather than ensemble members
 - d. Carl found a package that shows if a cron job goes down and pings to Slack which has been really helpful
 - e. Big thing to work on moving forward is a validator for submissions. Check for required columns and validates metadata.
 - i. Make up new gmail address and email the team lead if it was success or if it is failure it lists what the issue is.
 - ii. Right now it is small enough that Quinn is handling issues as they come up
 1. If anyone knows of solutions for validator+email, let Quinn know
 2. For the validator - use the function for metadata - read in xml and validate
 3. Rob uses Slack for this. Issue with email is that you can set up an email that will send and won't get into a Spam folder
 4. From Jake - R emails - <https://blog.mailtrap.io/r-send-email/>
 - a. From Libby: I've used the mailR package to send emails to students - it worked for me!
 5. Need a confirmation message that you submitted.
 6. Forecasts are submitted into an S3 bucket either by a submit button or by code
 7. In PEcAn - Rob asked user to send email and then will send an email.
 8. Need to get the teams a message that forecast submission fails that it failed
 9. If you send an email and if they reply to it, where does it go. Make an auto-reply that this account does not receive emails
3. Forecasting Workflow Updates

- a. Look through the final steps of the Workflow to identify what is covered in the Forecast Challenge and what will be good to keep in mind as a need for the future
- b. Didn't get to this on the call. Will come back to on the next call.