Introduction to Remote Sensing for Scenario-Based Ecoforecasting

Please type your questions in the Question Box. We will try and get to all your questions, but if we don't, feel free to email Amber Jean McCullum your question at amberjean.mccullum@nasa.gov

Session 2 Q&A Transcripts:

Question 1: Is there a citation for Earth System Model?

Answer: The figure that was on slide 11 is from a paper from Nature Education Knowledge (citation on the slide). There are other review papers that go over Earth System Models.

Question 2: What do you compare the model to, to assess model bias? e.g. temperature, actual station data?

Answer 2: Climate models are compared to historical climate information, sometimes it's gridded observations, and sometimes it's from what are called reanalyses. It's a mix between a climate model and gridded observation, so they use observations where they have them to keep the model on track. Those are also useful for assessing bias. In general, it's estimates that are fundamentally based on station data.

Question 3: What about the white cells in the last slide (#14)?

Answer 3: Looking at model performance among metrics - a color array where brown=good, blue=bad. Those models just didn't produce that variable, or it wasn't assessed. We'd have to go back to the paper to double check. Some models don't produce all variables, and that's especially when you're - the Earth System models have more outputs than the climate models.

Question 4: Can we get citations for the references you mention?

Answer 4: Short version is on slides, but we can provide more extensive ones later.

Question 5: How do you translate suitability values to the general public?

Answer 5: (Assume related to habitat suitability modeling output). It's hard because in most cases the suitability values can't be interpreted as probabilities, which is what people often want. So a .5 doesn't necessarily mean there's a 50% probability the species is there. Each model has a different "optimal threshold" - a different cutoff for where the model would predict a species is absent vs. present. That's one reason often binary maps are used instead. A model can convert these continuous suitability values to a binary map, which might be easier to communicate. Another thing that we can do as modelers is assess what "calibration" - it essentially asks how close a .5 is to meaning that there's a 50% chance there's a species there. Or, in some cases, and for really common species, you see this more, a .2 might be a high enough value for the species to be there. It can be quite off from .5. This kind of communication is hard - in reality these suitability metrics also need to be communicated to managers of resources, of wildlife and habitat managers. Luckily, these are relatively common tools. Nevertheless, we don't want to assume people are interpreting these suitability values correctly. It's common to want to consider them a probability when they're not.

Question 6: Are there any web links to have evaporative water data?

Answer 6: Yes - there are 2 different "main" types of products relating to evapotranspiration. One is potential evapotranspiration - evaporative demand - that's a function of the climate and weather. So how much water does the system want to suck from the Earth. There's actual evaporative amount - the actual evapotranspiration - that's something that can be derived by remote sensing methods. It's also an output from climate models. It's typically used for the historical period. There's one product produced by Gabriel Sinai, who works with North Central Climate Center, SSEBop. That basically uses - it assumes that evaporation cools the Earth, which we know it does, and transpiration as well. The difference between land surface temperature and air surface temperature will be less if there's a lot of evaporation going on. When you have a dry place, i.e. there's no water to evaporate, we know those surfaces heat up. THat's why a desert floor can be very hot - there's no water to evaporate. It's a great question and lies at the interface of remote sensing/climate.

There's also a recorded ARSET webinar on soil moisture and evapotranspiration!

Question 7: Who is the author of the Africa maps with different predictions of a species distribution area in slide 33?

Answer 7: It's a paper by Araujo New a 2007 paper from a journal called *Trends in Ecology and Evolution*.
https://www.researchgate.net/publication/285843815_Ensemble_forecasting_of_species_distributions

Question 8: Where are the links to the assignment this week?

Answer 8: Thee URL for the assignment can be found in the Chat window and on the training webpage, Training Webpage **URL:** https://arset.gsfc.nasa.gov/land/webinars/scenario-based-ecoforecasting-17

Question 9: Are those climate analysis tools available worldwide?

Answer 9: Unsure which tools this question refers to

Question 10: Would you recommend to run MACA for BIAS correction with a data set like PRISM or GRIDMET for a specific watershed?

Answer 10: The MACA is a climate downscaling method and dataset that's produced by a group that also produces the GRIDMET data. MACA is bias-corrected to GRIDMET, and there's another version bias corrected to another dataset LIVNAH that's an updated version. Don't recommend that any ecologist attempt to do the data correction themselves. That's a complex - bias correction is a really complex, and is best left to climate scientists and climate downscalers. These products are becoming more widely available. MACA (Multivariate Constructed Analogs) and is available mostly for contiguous US.

Question 11: How about for CC impacts on water yields? Would the Delta method be appropriate?

Answer 11: It depends on what time scale you're interested in, in terms of water yields. If you're interested in average water yields over a 30 year period, it might be appropriate. If you're interested in variability of water yields from year to year, the delta method might underestimate that variability. The best you could do is get the same amount of variability with a shifted average, would be my guess. I'll say that with a caveat since my specialty isn't modeling water yields.

Question 12: Where we can find more examples of application of your methodology and /or more information about that.

Answer 12: First, I'm quick to say, this isn't a method that I came up with. It's - I was an ecologist that had the good fortune to collaborate with climate scientists. What we call the model space method is widely used in hydrology. It's essentially taken as a given in that field, but hasn't been often applied to ecological studies. When I got interested in assessing climate change impacts, I read a lot of the ecological literature and didn't see some of the lessons I was learning from the climate scientists there. That was the driver for writing the paper that

summarized that paper, and I would point you to that manuscript. A manuscript that came from *Global Change Biology.*

Question 13: Could you explain a little more about downscaling method? Doesn't downscaling increase bias and is there any tool available to do downscaling ?

Answer 13: I don't think we have time to get into all the different statistical downscaling methods. There are quite a variety of methods that - some of them are based on disaggregation and some are based on the MACA example we talked about earlier that's based on an analog approach. It looks at the cross cells and the pattern at a local scale and how it matches the pattern on a broad scale. Downscaling - no downscaling in general doesn't increase bias, per say, but it also doesn't provide added value. It doesn't necessarily improve the climate change signal, it just brings it to a smaller spatial scale. That's true for statistical downscaling - dynamical downscaling can really provide additional information. Is there any tool available? Not really. I'd really recommend sticking with products that are out there and produced by climate scientists. There are a lot of assumptions that go into different downscaling methods and a lot of active research going on in terms of developing and improving downscaling methods. For example, there are more complex version of the delta method, and so on. If you're interested in developing downscaling methods, it's an active area of research. As an ecologist, it's not so hard to apply the delta method. But I wouldn't recommend producing statistically downscaled efforts without expert collaboration.

Question 14: which Remote sensing data is free available for climate studies.

Answer 14: [Answer provided later] Defer to RS experts. We can't look *forward* with satellite data. We can use RS information for present and recent past, but don't' have RS data for the future. We can get similar variables and use them for things like checking reliability of climate model output.

Question 15: is there a maximum value of the delta (in the Delta downscaling) that tells us that the model can not be used?

Answer 15: Don't think so - honestly, there's been, if anything, models have underestimated rather than overestimated the amount of change we've seen so far. I don't think any absolute cutoff is really the right way to think about it. We want instead to be looking at whether the models really capture the key processes that are in a model. E.G. in the Southwestern US monsoons are really important to understanding warm season precipitation. Some models capture the monsoon season well - ideally we want to be assessing the physically processing levels.

Question 16: When we want to use ecological modelling, is it better use weather station data or the GCM data ?

Answer 16: It depends on the scale of your question. Firstly, what you're doing. If you have a local study area that's near a weather station, by all means use that weather station data instead of historical, gridded climate data. Whether to use weather station data or GCM data - in general, you want to understand the process and study the process first with observations. Whether that's from a climate station or gridded and then look in the model-space method to see whether the GCM historical simulation gives reasonable results for the area and system you're looking at.