Questions from
U.S. EPA Webcast:
Regional Climate Scenarios and Projections of Sea Level Rise
January 29, 2013

Questions for Joel Scheraga (EPA)

1. ***You say the scenarios can be used by all federal agencies, but the third bullet says "EPA and DOI." I'm looking for confirmation that other agencies can use these (e.g., DoD).***

   Thanks for that great question. The unequivocal answer is yes. In the slides and introductory comments I made, I focused on EPA and DOI simply because the participants in this pilot webcast are from EPA and DOI. And as I mentioned, depending upon your feedback that we'll get at the end of this Webcast, the USGCRP may host similar webcasts for other federal agencies.

   Having said that the regional climate scenarios and sea level scenarios that we've talked about today are already available to all federal departments and agencies including our colleagues at DOD. This is important not just for their own work, but because it also enhances our ability as a federal family to work together and to coordinate our efforts across federal agencies as we work together in particular places.

Questions for Anne Waple and Ken Kunkel (NOAA)

1. ***The reports documenting the regional climate scenarios are very technical. It is very difficult to discern from the documentation for any one particular region what your projections are for future climate change. Could you tell us, in plain English, what we should be planning for? As we do our work, how can we easily identify the range of scenarios we should use in our work?***

   Anne Waple: I think the first thing to note is that in the use of *scenarios*, obviously what we're trying to do is to provide a range and not to give you too narrow of a future to plan against – the narrower the range, the less likely it is to be close to reality! So these are sort of illustrative scenarios in some sense, they're not the highest or the lowest possible future changes, but a plausible range. The most useful range will depend on your decision criteria or tolerance for risk. Part of our next set of goals is to better understand these inputs, for different circumstances, and then to help provide information that takes into account its value for particular planning horizons and vulnerabilities.

   However, in terms of using THIS information and giving you sort of a more usable suite of products around the scenarios that we have chosen—I think we might be looking for your ideas in terms of how to make that usable.

For example, you have all the static set of maps and graphics for the A2 scenario and for the B1 scenario. Other than what's there, how would you like the information boiled down? Tables of ranges? A one-page summary of the major key findings? We're absolutely looking for feedback, so please e-mail with some ideas about how to provide this information in a way that you can take and import that into your decision processes—that would be very useful. Ken?

Ken Kunkel: Yes. Well, I don't know that I have any other ideas other than putting together these reports. But they're already very lengthy and we've made choices. The kind of information to present, you know, we've kind of made what we thought was a reasonable choice, you know, there's obviously data underlying all of these. And it's maybe possible to expand the information based on your feedback.

2. ***For adaptation purposes, I noted that the temperature scenarios through 2050 do not vary as significantly as the periods after 2050. Perhaps it would make sense for us to use that date in evaluating our immediate vulnerabilities for adaptation planning purposes.***

The particular planning horizon you use should depend first and foremost on the level of vulnerability and risk you face and at what timescale. It is true, however, that we have more confidence in the next few decades of climate projections because we know the greenhouse gas emissions of the past have more influence in the next few decades than the emissions of the future (there is lag in the system). Also, the emissions scenarios we have used depart from one another most significantly after 2050 because of the reasonable assumption that the societal and technological changes necessary to depart from our current emissions trajectory will take considerable time to develop and implement. However, even in the next few decades, there could be fluctuations that deviate significantly from the trend—for a few years or a decade or more. Then beyond about 2050, the specific future emission scenario differences becomes more important, and of course we are very uncertain about the socioeconomic, technological, and political realities that will alter the emissions trajectories globally. Still, we have chosen two emission scenarios that take into account changing socioeconomic pathways and so we still feel as though this is a plausible and useful future range even into the latter part of the century.

Questions for Anne Waple (NOAA)

1. ***What would "participatory scenario planning look like? Who might be involved? What scale?***

That's a great question. So I think we are, first of all, open to suggestions. Secondly, we actually have a small internal meeting on Thursday here at the GCRP office where we're beginning to get into what comes next for the scenario process, and that is both looking at what we would do to enhance the current set of scenarios (updating and improving), and where we want to take the efforts in broad terms,

But the participatory process would certainly involve understanding the multiple layers of decision making at multiple scales. We would be looking to engage different sets of decision-makers in ways that help us incorporate vulnerability, timescale, a value chain for impacts, and so on. So in answer to the question, we don't have a specific plan just yet but we are very much

interested in working on that and seeing where it can go and what it would take, to really invest in that and make it useful

2. ***Is there a "talking points" document about explaining to the public / stakeholders the difference between a scenario and a forecast? This would be helpful for land management agencies using this data.***

   Also a very good suggestion. If you go to the website (scenarios.globalchange.gov), there are actually frequently asked questions on there. And certainly, you're welcome to use these slides where we have explanation about that.

   If that is something that would be broadly useful, then I think we can put together a one-page fact sheet or something that explains the scenario process a little bit more helpfully for people who are not familiar with it. So if that's something that several people want to or you think it would be useful to distribute, let us know. We can put this together.

3. ***You mentioned that some scenarios were based on narrative, rather than data. Can you talk more about what was used and the process for making it a scenario?***

   A scenario is something that describes a plausible future and this can be literally a description or it can involve actual temperature ranges (and other parameters) based on our physical understanding, mathematical models, and certain assumptions. They are 'what if' explorations where we nonetheless feel as though they are based on a reasonable set of possible futures. What's most useful to you depends on the way in which you're using scenarios in your planning processes. Actually in this case, these are really a combination of narrative and data, but the future components are very much based on specific data from model output.

4. ***What are participatory scenarios?***

   Participatory scenarios involve the incorporation of decision makers and decision processes in the development of scenarios that then take into account not only the expected climate changes but also local priorities or values, or the impact of specific development choices or unique vulnerabilities. For example, in Western North Carolina, where I live, one of the unique vulnerabilities is that we have only two interstates in and out of the region and both of them go through mountain landscapes. During very wet conditions or situations with a lot of freeze-thaw, the chances of landslides are much higher, closing these major routes. In order to implement useful adaptation plans, it becomes clearer, through involving DOT, trucking companies and fuel delivery people, local governments (etc.), that we need to know both the very specific vulnerabilities of the transportation system AND it helps us identify whether heavy, prolonged precipitation is more important, or whether it is the lack of freeze days that are more important than the number of days over 90F…or any number of other parameters we might not be aware of. These are the kinds of outcomes we hope to get at a regional and national scale through supporting a participatory process, kick-started through the NCA.

Questions for Ken Kunkel (NOAA)

1. ***How can we access the actual scenario data? How much effort will it take? Is it readily usable? That is, is it user friendly? If not, what steps do we have to take to actually use the data?***

   Ken Kunkel: Well, at the moment, as Anne showed and Anne may want to add to this too, we're able to get the figures separately. We're able to do that fairly quickly. We also are planning, as Anne pointed out too, to add, you know, data to the sites. Again, with probably feedback from you and other users about what are the highest priorities. You know, we're thinking immediately that that's maybe one of the things we can probably do more quickly is to make map layers available for all the maps that we have in these reports. And that hopefully would help those who would like to overlay the information on their own analysis.

   That's sort of, I guess, my first reaction. I think that beyond what other level of detail in terms of data availability is provided would depend a lot on feedback, you know. We have our own ideas, but we don't know if those would be the most optimum types of information to provide.

   Anne Waple: In essence what we're trying to do, I think, is to, at some point, make all of this fully reproducible. And we know that that takes the underlying data, the access to the models individually as well as in an ensemble, the description of what was done to them, the algorithms that were actually used, and then the derivative information behind the maps. That's not all easy to do in terms of a short amount of time.

   So where would be the most useful information for you to plug in is going to be really helpful for us to just prioritize how we step through that progress. And that will actually also help us for the National Climate Assessment in general, because this was a very useful exercise for us in getting all of the information for the whole National Climate Assessment to become a little bit more transparent and traceable. And I think, you know, if we can get this right and understand the first level of priority, in terms of making data useable and accessible, then it will help us in all kinds of other things too.

2. ***The development of the kinds of data shown in the scenarios relies upon a lot more than the emissions scenarios—global models and either regional models or downscaling approaches. These are hugely consequential choices, about which there is much confusion. Can you touch upon how you navigated these choices? The scenarios team has clearly made choices at each level.***

   Yes. Well, first of all, I probably should just state that I did have an advisory panel of really tough climate modelers that helped me early in the process. And that was invaluable. Beyond that, you know, there is a lot out there, a lot of choices to be made. We tried to stick with some, I would say, out in the middle of road choices and NARCCAP is good example.

   There's actually quite a few regional climate model stimulations out there. But this was an organized project, all using the same – some basic or similar kinds of experimental conditions to

run these scenarios or to perform the simulation. And, you know, these are all top end modeling groups. The similarity of the runs meant that we could combine them without any issues about, you know, combining apples and oranges. And the periods of simulations were long enough that we could – we could use them in a similar way to the way we are using the global model data.

So I think we just took some common sense approaches to this, along with the advice from the top-end modeling experts to guide us in those choices.

3. ***Will the data (attribute tables for the shape files) be placed on the website for download? Specifically, temperature, precipitation, % humidity in MM5 format?***

Ken Kunkel: I'm not sure what that MM5 meant, but in general, yes, I think our goal barring some alternative feedback would be that all of the maps that we have in the report, we would be moving towards getting the shape files, the map layers that went in to producing those maps out there. So that would include the actual, you know, data, I think the raster files that are used along with the map overlays and so on.

So the plan would be, that would probably be the first thing we work on, and those would be available off the website, directly off the website.

Anne, do you have anything to add to that or counteract that?

Anne Waple: No. I think the only thing I would say is that when we look at the formats that we'll put information online, we would probably want to stick with the most widely used format. And then encourage people to customize beyond that and maybe we can create some more collaborative kind of spaces where if you can create the formats that are most usable for you, maybe you can also upload them to the site or something.

So I think, you know, from a central perspective, we just want to make sure that we understand what's broadly useful. We'll focus mostly on that because we'll also have to focus on updating the scenarios and putting new information up there. But I think we're open to whatever is most broadly useful, yes.

4. ***How are the large metropolitan heat island effects differentiated or pulled out of the temperature readings over time? In Phoenix, say, there would be no way to compare old agriculture field-dominated temperatures to the current concrete/asphalt-dominated temperatures.***

For the annual and seasonal temperature time series, NCDC has undertaken a large effort over the last few years to develop objective techniques to detect inhomogeneities in station temperature records and estimate adjustments to correct the impacts of such inhomogeneities. Such inhomogeneities include changes in instrumentation, changes in time of observation, and changes in station site characteristics, which could include urban heat island effects. This new data set is being released in 2013 and was the basis for our analysis. Several papers have been

published in scientific journals on this effort. A recent analysis of possible residual urban heat island effects on a large subset of these stations was performed and indicates that any remaining artifacts are likely small compared to the observed trends. An evaluation of the effects of the adjustments on urban heat island effects can be found in the soon-to-be published paper:

Hausfather Z., M.J. Menne, C.N. Williams, T. Masters, R. Broberg, and D. Jones, 2012: Quantifying the effect of urbanization on U.S. Historical Climatology Network Temperature Records. J. Geophys. Res., accepted.

Some additional work is needed to verify whether the magnitude of the urban heat island effect is also small when using the full set of stations and this is being undertaken.

For the temperature extreme metric time series, no adjustments were made because the magnitude of such effects during the infrequent extreme events has not been quantified. We minimized any such effects by averaging in such a way that large metropolitan areas are weighted in direct proportion to their areal coverage, but we recognize that the possible effects needs to be investigated further.

5. ***How can you have high uncertainty for precipitation in the southwest but high confidence for drying? Is it because of certainty in increases in temperature?***

   This difference arises principally because in one case I was talking about region-average quantities and in the other about areas within the region. My statements about confidence in the precipitation projections only apply to the southern portions of the southwest region; in this portion of the southwest there is considerable model spread in the magnitude of the change but most models indicate statistically significant decreases. So in this part of the region, we can make some confident statements about the direction of change, although the magnitude of the decreases is uncertain. However, the models do not agree on the direction of the changes in the northern part of the region. When I showed regional-averaged values of precipitation, combining the far southern regions of confident direction of changes with the northern regions of high uncertainty, the net result is that the regional averages are also uncertain regarding both direction and magnitude of changes.

6. ***When the model shows the ranges, what is the confidence interval between the upper and lower bounds of a given model projection?***

   I am not sure to which products this question pertains. If it refers to the scatter plots of individual model values, the plots show the mean values for each individual model. Altogether, we showed 15 different models. There is no formal confidence interval associated with these values as displayed. If the question refers to the two tables that show NARCCAP derived variables, the +/- numbers are 1 standard deviation values; thus the interval would nominally represent the mid 68% of the distribution.

Questions for Adam Parris (NOAA)

1. ***The NOAA sea level rise scenarios are global scenarios. How useful are they for work we are doing at the local level? Can we simply use these global projections, or must we make adjustments to them for our local conditions?***

   Well, I thank you for that question. We absolutely anticipate that folks adjust the global scenarios to suit local applications based on factors like vertical land movement and the outlook for the changing frequency and magnitude of extremes and ocean dynamics.

   However, one of the strengths of the scenario planning approach is the emphasis on the use of multiple scenarios. By doing so, you are considering your sensitivity across a range of conditions and, hopefully, making a more robust decision. One challenge is the tendency to compound uncertainty by integrating complex information from the global scale down to the local scale. It's absolutely important to integrate regional and local information, but it's equally important to consider a range of scenarios and not try to perfect any one of these scenarios.

2. ***Isn't the Low Scenario less than the current rate of SLR? The rate of SLR would have to decrease to hit that change?***

   Since 1992, we have observed a higher rate of global mean sea level rise using satellites. Specifically global mean sea level, according to the satellites, has been rising at a rate of 3.2 millimeters per year, as opposed to the 1.7 millimeter per year rate that has been observed globally through a compilation of tide gauges over the past 100 years.

   It is important to note that the global trend has varied considerably over an annual or even decadal timeframe. While global mean sea level has risen 8 inches over the past century, there were periods of time (15 to 20 year periods) where the rate was greater or less than 1.7 millimeters per year. This variability in global mean sea level rise may be due to climate patterns and/or variability in oceanographic circulation patterns from one ocean basin to the next.

   For these reasons, we felt that the satellite record of 20 years is not sufficient to determine a global trend, compared to 100-year dataset compiled from tide gages.

   Despite these limitations, we acknowledge in the report that both the lowest scenario and the intermediate low scenario are optimistic scenarios of future change, where they should only be considered where you have high tolerance for risk or where you are implementing decisions that you would implement quickly and that would only last for shorter periods of time and/or decisions where you have great flexibility to change your course of action.

   For example, for a beach nourishment project only meant to last five years, you might not consider the highest end scenario. It's also important to emphasize that the scenarios diverge around mid century, when the uncertainty about the rate and magnitude for global mean sea level rise dramatically increases. However, we do anticipate surprises.

3. ***What is the outyear estimate for when sea level will slow or stop and what is the end point rise in sea level?***

   We do not currently have an "outyear" estimate for when sea level will stop. The year 2100 has been a common endpoint in time for most projections and scenarios. However, recent studies in Nature have projected global sea level rise to the year 2300. See:

   http://www.nature.com/nclimate/journal/v2/n12/full/nclimate1584.html

4. ***Are there sea level rise projections for western Alaska? Also are there any maps that cover Alaska. I'm trying to understand the scope of the existing maps...***

   The maps in my presentation showed historic rates of relative sea level change wherever there are tide gages with 60 years or more of data. For projections of sea level rise in western Alaska, I recommend reviewing the Alaska Technical Input report submitted to the National Climate Assessment Development and Advisory Committee or the Alaska Regional Chapter of the draft National Climate Assessment.