

Reply to comments by Houston and Dean

We first extend our appreciation to our reviewers for their time and careful consideration of this report and methodology. Two issues that impact the calculation of the range of future sea level rise projections are the primary focus of the review comments. They are 1) how the confidence interval or range of projections for each component is treated mathematically as elements are combined in the methodology and 2) the assessment of local effects and how these are used in combination with the IPCC projections. The Panel has considered these comments and a synthesis of our discussions are provided below. The additional comments were more editorial in nature and will be considered in our revised draft in March.

1) The Panel discussed possible inclusion of 'quadrature' in assessing limits or ranges of estimates in our November meeting and is revisiting our proposed methodology based on the reviewers' comments. Because of the expression of range of estimates in the Table II.7.7 of Annex II: Climate System Scenario Tables is not a confidence interval, we have asked for additional review from statistics at NC State on our methodology and will not have their input until later this month. At that time we plan to update our calculations and will communicate with the reviewers on the outcome.

2) The reviewers note that the length of record for the gauge at Duck is not consistent with the time period used to establish a global SLR of 1.7 mm/yr and conclude that therefore the computed local effect at Duck is in error. Further, they suggest an alternative computation which would result in a conclusion that the local effect can be explained by the local VLM (vertical land motion) only.

The Panel recognizes the issues with respect to length of record of the tide gauges and the time period of the record relative to assessment of global sea level rise and in the November meeting considered using different rates for different gages. The primary tide gauge that has spurred this discussion is the Duck gauge. The time frame of operation of this gauge and the Oregon Inlet gauge are the shortest in North Carolina, spanning the late 1970s to present time frame (data through the end of 2013 were employed for the report). The panel spent considerable time discussing the issue of the different time periods of measurement for each of the gauges including an analysis offered by Tom Jarrett that could simulate the extension of the time series at Duck in order to be more consistent with the time frame for the use of 1.7 mm/yr. As a result of this discussion the Panel recommended that the time series issue should be dealt with as a special project outside the work of the Panel.

In response to the reviewers' comments we offer the following discussion. The time frame of operation of the Duck gauge coincides with a measured increase in the rates of sea level rise along the mid-Atlantic region (consistent with the reviewers' analysis). The question at hand is whether this measured increase reflects a global increase or is local. In addition, if local, will the effect persist for the 30 year response period requested by the CRC or is it other (i.e., cyclic or not persisting). In our draft, the Panel made the assumption that the local effect was separate from the global and would persist into the future. This assumption is clearly stated and the numbers reflect that approach. The Panel felt that it was responsible to acknowledge the possibility that local effects including oceanographic factors could

persist and to bring this information to the attention those making management decisions. After discussion in the January meeting, the Panel decided to keep this analysis in the report.

Because it is an assumption and we recognize it as such, we can compute and present the alternative formulation (considering the IPCC projections in combination with the VLM numbers) in order to communicate the magnitude of the difference in the projections by making this assumption. Using VLM directly eliminates the step of assuming a global sea level rise rate in the proposed methodology. Using the updated 2013 VLM values as computed by Zervas essentially reduces the local effects at Duck and Oregon Inlet 1-2 inches in the 30 year projection since these gauges have the shorter temporal records and are located north of Cape Hatteras where the increase in the mid-Atlantic rates has been observed. Projections for the Beaufort gauge remain the same and Wilmington and Southport differ by less than 1 inch. (see table below). Note, the magnitude of the high and the low of the local effect and the difference may change when procedures for error analysis are finalized.

Station	Local Effects			VLM Effects			Difference		
	Relative Sea Level Rise by 2045, inches			Relative Sea Level Rise by 2045, inches			Relative Sea Level Rise by 2045, inches		
	Mean	High	Low	Mean	High	Low	Mean	High	Low
Duck	3.4	4.2	2.6	1.8	2.2	1.3	-1.6	-2.0	-1.3
Oregon Inlet Marina	2.3	3.7	0.9	1.0	1.8	0.2	-1.3	-1.9	-0.7
Beaufort	1.2	1.4	1.0	1.2	1.4	1.0	0.0	0.0	0.0
Wilmington	0.4	0.6	0.2	0.5	0.7	0.2	0.1	0.1	0.0
Southport	0.4	0.6	0.1	0.6	0.8	0.4	0.2	0.2	0.3

The issue of the impact of the length of record and time period of the record of the tide gauges on the computations (including VLM) is important as the state considers how to use the information and our recommendation for further analysis will likely remain in the report.