Supplementary Materials: How Well Do AR5 Sea Surface-Height Model Projections Match Observational Rates of Sea-Level Rise at the Regional Scale?

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Data Deposit and Software Source Code

Supplementary materials in the form of a PDF file contains a range of graphical outputs at each site including integrated tide-gauge and satellite altimetry products as well as integrated tide-gauge and AR5 projection-model outputs for RCP2.6, 4.5 and 8.5 experiments. In addition, a Microsoft OneDrive account has been established to provide readers access to the following products upon request:

- input data files (*.csv format for tide gauges; netCDF format for AR5 projection-model ensemble outputs);
- summary analysis output products for each site (Excel spreadsheet and *.csv formats);
- figures generated in the paper (*.jpeg format to resolution 1800 dpi) including data and R scripting code developed to generate them.

Readers are referred to Section 2 for additional advice on publicly available data sources and open source analytical software used for this study.

S1. Introduction

This supplementary Information provides the following summary graphical outputs from the analysis of data for each of the sites considered in this study (refer Figure 1, Table 1 of manuscript for more specific details regarding data sources):

- <u>Figure SX.1</u>: Integrating estimated "relative" mean sea level tide gauge record with AR5 sea surface height projection modelling (RCP2.6). Projection model ensemble products have been normalized to the tide gauge record using the procedure advised in section 2.2 of the manuscript. The top panel in each figure integrates the "raw" projection outputs with the annual tide gauge time series. The middle panel depicts the "relative" mean sea level for both data sets due to external radiative forcing only. The bottom panel represents a zoomed in view of both records for the period of common coverage. Further details of analyses are described in Data and Methods section of the manuscript (section 2.2).
- <u>Figure SX.2</u>: Integrating estimated "relative" mean sea level tide gauge record with AR5 sea surface height projection modelling (RCP4.5). Same panel descriptions as discussed for Figure SX.1 above.
- <u>Figure SX.3</u>: Integrating estimated "relative" mean sea level tide gauge record with AR5 sea surface height projection modelling (RCP8.5). Same panel descriptions as discussed for Figure SX.1 above.
- <u>Figure SX.4</u>: Integration of tide gauge record and Ssalto/Duacs satellite altimetry products over period of common coverage. The top panel in each figure provides the complete time series of both sets of data with the start of the annualized altimetry time series normalized to the tide gauge record. The bottom panel represents a zoomed in view of both records for the period of common coverage. The tide gauge record is a "relative" mean sea level time series (i.e., uncorrected for vertical land motion). Further details are described in section 2.2 of the manuscript.

The nomenclature "X" in each of the abovementioned corresponds to the respective station ID (refer Figure 1, Table 1 of manuscript for details).



Figure S1.1. Integrating estimated "relative" mean sea level tide gauge record with AR5 sea surface height projection modelling ensemble outputs (RCP2.6) at Honolulu (USA).



Figure S1.2. Integrating estimated "relative" mean sea level tide gauge record with AR5 sea surface height projection modelling ensemble outputs (RCP4.5) at Honolulu (USA).



Figure S1.3. Integrating estimated "relative" mean sea level tide gauge record with AR5 sea surface height projection modelling ensemble outputs (RCP4.5) at Honolulu (USA).



Figure S1.4. Integration of tide gauge record and Ssalto/Duacs satellite altimetry products at Honolulu (USA) over period of common coverage.



Figure S2.1. Integrating estimated "relative" mean sea level tide gauge record with AR5 sea surface height projection modelling ensemble outputs (RCP2.6) at Prince Rupert (CANADA).



Figure S2.2. Integrating estimated "relative" mean sea level tide gauge record with AR5 sea surface height projection modelling ensemble outputs (RCP4.5) at Prince Rupert (CANADA).



Figure S2.3. Integrating estimated "relative" mean sea level tide gauge record with AR5 sea surface height projection modelling ensemble outputs (RCP4.5) at Prince Rupert (CANADA).



Figure S2.4. Integration of tide gauge record and Ssalto/Duacs satellite altimetry products at Prince Rupert (CANADA) over the period of common coverage.



Figure S3.1. Integrating estimated "relative" mean sea level tide gauge record with AR5 sea surface height projection modelling ensemble outputs (RCP2.6) at Seattle (USA).



Figure S3.2. Integrating estimated "relative" mean sea level tide gauge record with AR5 sea surface height projection modelling ensemble outputs (RCP4.5) at Seattle (USA).



Figure S3.3. Integrating estimated "relative" mean sea level tide gauge record with AR5 sea surface height projection modelling ensemble outputs (RCP4.5) at Seattle (USA).



Figure S3.4. Integration of tide gauge record and Ssalto/Duacs satellite altimetry products at Seattle (USA) over the period of common coverage.



Figure S4.1. Integrating estimated "relative" mean sea level tide gauge record with AR5 sea surface height projection modelling ensemble outputs (RCP2.6) at San Francisco (USA).



Figure S4.2. Integrating estimated "relative" mean sea level tide gauge record with AR5 sea surface height projection modelling ensemble outputs (RCP4.5) at San Francisco (USA).



Figure S4.3. Integrating estimated "relative" mean sea level tide gauge record with AR5 sea surface height projection modelling ensemble outputs (RCP8.5) at San Francisco (USA).



Figure S4.4. Integration of tide gauge record and Ssalto/Duacs satellite altimetry products at San Francisco (USA) over the period of common coverage.



Figure S5.1. Integrating estimated "relative" mean sea level tide gauge record with AR5 sea surface height projection modelling ensemble outputs (RCP2.6) at Key West (USA).



Figure S5.2. Integrating estimated "relative" mean sea level tide gauge record with AR5 sea surface height projection modelling ensemble outputs (RCP4.5) at Key West (USA).



Figure S5.3. Integrating estimated "relative" mean sea level tide gauge record with AR5 sea surface height projection modelling ensemble outputs (RCP8.5) at Key West (USA).



Figure S5.4. Integration of tide gauge record and Ssalto/Duacs satellite altimetry products at Key West (USA) over the period of common coverage.



Figure S6.1. Integrating estimated "relative" mean sea level tide gauge record with AR5 sea surface height projection modelling ensemble outputs (RCP2.6) at Balboa (PANAMA).



Figure S6.2. Integrating estimated "relative" mean sea level tide gauge record with AR5 sea surface height projection modelling ensemble outputs (RCP4.5) at Balboa (PANAMA).



Figure S6.3. Integrating estimated "relative" mean sea level tide gauge record with AR5 sea surface height projection modelling ensemble outputs (RCP8.5) at Balboa (PANAMA).



Figure S6.4. Integration of tide gauge record and Ssalto/Duacs satellite altimetry products at Balboa (PANAMA) over the period of common coverage.



Figure S7.1. Integrating estimated "relative" mean sea level tide gauge record with AR5 sea surface height projection modelling ensemble outputs (RCP2.6) at New York (USA).



Figure S7.2. Integrating estimated "relative" mean sea level tide gauge record with AR5 sea surface height projection modelling ensemble outputs (RCP4.5) at New York (USA).



Figure S7.3. Integrating estimated "relative" mean sea level tide gauge record with AR5 sea surface height projection modelling ensemble outputs (RCP8.5) at New York (USA).



Figure S7.4. Integration of tide gauge record and Ssalto/Duacs satellite altimetry products at New York (USA) over the period of common coverage.



Figure S8.1. Integrating estimated "relative" mean sea level tide gauge record with AR5 sea surface height projection modelling ensemble outputs (RCP2.6) at Buenos Aires (ARGENTINA).



Figure S8.2. Integrating estimated "relative" mean sea level tide gauge record with AR5 sea surface height projection modelling ensemble outputs (RCP4.5) at Buenos Aires (ARGENTINA).



Figure S8.3. Integrating estimated "relative" mean sea level tide gauge record with AR5 sea surface height projection modelling ensemble outputs (RCP8.5) at Buenos Aires (ARGENTINA).



Figure S8.4. Integration of tide gauge record and Ssalto/Duacs satellite altimetry products at Buenos Aires (ARGENTINA) over the period of common coverage.



Figure S9.1. Integrating estimated "relative" mean sea level tide gauge record with AR5 sea surface height projection modelling ensemble outputs (RCP2.6) at Brest (FRANCE).



Figure S9.2. Integrating estimated "relative" mean sea level tide gauge record with AR5 sea surface height projection modelling ensemble outputs (RCP4.5) at Brest (FRANCE).



Figure S9.3. Integrating estimated "relative" mean sea level tide gauge record with AR5 sea surface height projection modelling ensemble outputs (RCP8.5) at Brest (FRANCE).


Figure S9.4. Integration of tide gauge record and Ssalto/Duacs satellite altimetry products at Brest (FRANCE) over the period of common coverage.



Figure S10.1. Integrating estimated "relative" mean sea level tide gauge record with AR5 sea surface height projection modelling ensemble outputs (RCP2.6) at North Shields (UK).



Figure S10.2. Integrating estimated "relative" mean sea level tide gauge record with AR5 sea surface height projection modelling ensemble outputs (RCP4.5) at North Shields (UK).



Figure S10.3. Integrating estimated "relative" mean sea level tide gauge record with AR5 sea surface height projection modelling ensemble outputs (RCP8.5) at North Shields (UK).



Figure S10.4. Integration of tide gauge record and Ssalto/Duacs satellite altimetry products at North Shields (UK) over the period of common coverage.



Figure S11.1. Integrating estimated "relative" mean sea level tide gauge record with AR5 sea surface height projection modelling ensemble outputs (RCP2.6) at Karachi (PAKISTAN).



Figure S11.2. Integrating estimated "relative" mean sea level tide gauge record with AR5 sea surface height projection modelling ensemble outputs (RCP4.5) at Karachi (PAKISTAN).



Figure S11.3. Integrating estimated "relative" mean sea level tide gauge record with AR5 sea surface height projection modelling ensemble outputs (RCP8.5) at Karachi (PAKISTAN).



Figure S11.4. Integration of tide gauge record and Ssalto/Duacs satellite altimetry products at Karachi (PAKISTAN) over the period of common coverage.



Figure S12.1. Integrating estimated "relative" mean sea level tide gauge record with AR5 sea surface height projection modelling ensemble outputs (RCP2.6) at Mumbai (INDIA).



Figure S12.2. Integrating estimated "relative" mean sea level tide gauge record with AR5 sea surface height projection modelling ensemble outputs (RCP4.5) at Mumbai (INDIA).



Figure S12.3. Integrating estimated "relative" mean sea level tide gauge record with AR5 sea surface height projection modelling ensemble outputs (RCP8.5) at Mumbai (INDIA).



Figure S12.4. Integration of tide gauge record and Ssalto/Duacs satellite altimetry products at Mumbai (INDIA) over the period of common coverage.



Figure S13.1. Integrating estimated "relative" mean sea level tide gauge record with AR5 sea surface height projection modelling ensemble outputs (RCP2.6) at Ko Taphao Noi (THAILAND).



Figure S13.2. Integrating estimated "relative" mean sea level tide gauge record with AR5 sea surface height projection modelling ensemble outputs (RCP4.5) at Ko Taphao Noi (THAILAND).



Figure S13.3. Integrating estimated "relative" mean sea level tide gauge record with AR5 sea surface height projection modelling ensemble outputs (RCP8.5) at Ko Taphao Noi (THAILAND).



Figure S13.4. Integration of tide gauge record and Ssalto/Duacs satellite altimetry products at Ko Taphao Noi (THAILAND) over the period of common coverage.



Figure S14.1. Integrating estimated "relative" mean sea level tide gauge record with AR5 sea surface height projection modelling ensemble outputs (RCP2.6) at Fremantle (AUSTRALIA).



Figure S14.2. Integrating estimated "relative" mean sea level tide gauge record with AR5 sea surface height projection modelling ensemble outputs (RCP4.5) at Fremantle (AUSTRALIA).



Figure S14.3. Integrating estimated "relative" mean sea level tide gauge record with AR5 sea surface height projection modelling ensemble outputs (RCP8.5) at Fremantle (AUSTRALIA).



Figure S14.4. Integration of tide gauge record and Ssalto/Duacs satellite altimetry products at Fremantle (AUSTRALIA) over the period of common coverage.



Figure S15.1. Integrating estimated "relative" mean sea level tide gauge record with AR5 sea surface height projection modelling ensemble outputs (RCP2.6) at Hosojima (JAPAN).



Figure S15.2. Integrating estimated "relative" mean sea level tide gauge record with AR5 sea surface height projection modelling ensemble outputs (RCP4.5) at Hosojima (JAPAN).



Figure S15.3. Integrating estimated "relative" mean sea level tide gauge record with AR5 sea surface height projection modelling ensemble outputs (RCP8.5) at Hosojima (JAPAN).



Figure S15.4. Integration of tide gauge record and Ssalto/Duacs satellite altimetry products at Hosojima (JAPAN) over the period of common coverage.



Figure S16.1. Integrating estimated "relative" mean sea level tide gauge record with AR5 sea surface height projection modelling ensemble outputs (RCP2.6) at Aburatsubo (JAPAN). Note the errant model in the top panel was removed from the analysis for this station.



Figure S16.2. Integrating estimated "relative" mean sea level tide gauge record with AR5 sea surface height projection modelling ensemble outputs (RCP4.5) at Aburatsubo (JAPAN).



Figure S16.3. Integrating estimated "relative" mean sea level tide gauge record with AR5 sea surface height projection modelling ensemble outputs (RCP8.5) at Aburatsubo (JAPAN).



Figure S16.4. Integration of tide gauge record and Ssalto/Duacs satellite altimetry products at Aburatsubo (JAPAN) over the period of common coverage.



Figure S17.1. Integrating estimated "relative" mean sea level tide gauge record with AR5 sea surface height projection modelling ensemble outputs (RCP2.6) at Sydney (AUSTRALIA).



Figure S17.2. Integrating estimated "relative" mean sea level tide gauge record with AR5 sea surface height projection modelling ensemble outputs (RCP4.5) at Sydney (AUSTRALIA).



Figure S17.3. Integrating estimated "relative" mean sea level tide gauge record with AR5 sea surface height projection modelling ensemble outputs (RCP8.5) at Sydney (AUSTRALIA).



Figure S17.4. Integration of tide gauge record and Ssalto/Duacs satellite altimetry products at Sydney (AUSTRALIA) over the period of common coverage.



Figure S18.1. Integrating estimated "relative" mean sea level tide gauge record with AR5 sea surface height projection modelling ensemble outputs (RCP2.6) at Dunedin (NEW ZEALAND).



Figure S18.2. Integrating estimated "relative" mean sea level tide gauge record with AR5 sea surface height projection modelling ensemble outputs (RCP4.5) at Dunedin (NEW ZEALAND).



Figure S18.3. Integrating estimated "relative" mean sea level tide gauge record with AR5 sea surface height projection modelling ensemble outputs (RCP8.5) at Dunedin (NEW ZEALAND).


Figure S18.4. Integration of tide gauge record and Ssalto/Duacs satellite altimetry products at Dunedin (NEW ZEALAND) over the period of common coverage.



Figure S19.1. Integrating estimated "relative" mean sea level tide gauge record with AR5 sea surface height projection modelling ensemble outputs (RCP2.6) at Auckland (NEW ZEALAND).



Figure S19.2. Integrating estimated "relative" mean sea level tide gauge record with AR5 sea surface height projection modelling ensemble outputs (RCP4.5) at Auckland (NEW ZEALAND).



Figure S19.3. Integrating estimated "relative" mean sea level tide gauge record with AR5 sea surface height projection modelling ensemble outputs (RCP8.5) at Auckland (NEW ZEALAND).



Figure S19.4. Integration of tide gauge record and Ssalto/Duacs satellite altimetry products at Auckland (NEW ZEALAND) over the period of common coverage.