Rising Water Forecast

Use observations and model results to forecast coastal change.

HS-ESS3-5 "Analyze data and the results from global climate models to make an evidence-based forecast of the current rate of global or regional climate change and associated future impacts to Earth systems."

NAME _____ DATE _____

1 READ AND MARK

Read it twice

YOUR JOB Underline the observed data and circle the model results in the table. Number the sentences in the passage that help you turn those numbers into a rate and predict an impact.

A Higher Starting Point

1 At a harbor, a higher starting sea level lets ordinary high tides reach places they once missed. Satellites track global mean sea level, a planetwide average rather than a reading at one beach. The table gives rounded, illustrative values that resemble the observed rise and two possible model outcomes. All rises use 1993 as zero.

ILLUSTRATIVE GLOBAL MEAN SEA-LEVEL RISE SINCE 1993

Year	Observed rise (mm)	Modeled rise (mm): lower / higher emissions
1993	0	Not projected
2003	30	Not projected
2023	100	Not projected
2053	Not yet observed	195 / 245

2 To estimate a recent rate, subtract two observed rises and divide by the years between them. This gives a period average, not a claim that sea level changes equally every year. Ocean water expands as it warms, and melting land ice adds water. These processes connect a measured trend to forecasts of future coastal change.

3 The two model results represent lower and higher future greenhouse gas emissions, not exact predictions. Compare each 2053 result with the 2023 observation to estimate additional rise. Higher seas can push salt water into coastal groundwater and make tidal flooding more frequent. A city's outcome also depends on its shoreline and whether its land is sinking or rising.

2 ANSWER WITH EVIDENCE

Use the passage

1. What is the average yearly rate of sea-level rise from 2003 to 2023 in this dataset? Show how you calculated it.

2. How much additional rise does each model result forecast from 2023 to 2053?

3. Under higher emissions, what average yearly rate does the model imply from 2023 to 2053? Compare it with the observed rate from 2003 to 2023.

4. Which model result suggests a greater risk to coastal groundwater by 2053? Use a number from the table and a process from the passage to explain.

3 YOUR TURN

Your own words

Forecast sea-level rise since 1993 for the year 2043 under both emissions paths. Assume a steady rate between the 2023 observation and each 2053 model result, show your calculations, compare those rates with the recent observed rate, and describe one plausible coastal impact in four or five sentences.

Rising Water Forecast

PART 1 · READ AND MARK

Underline the observed data and circle the model results in the table. Number the sentences in the passage that help you turn those numbers into a rate and predict an impact. Accept any marking that follows this job and points at the right text.

PART 2 · ANSWERS

#	QUESTION	ANSWER
1	What is the average yearly rate of sea-level rise from 2003 to 2023 in this dataset? Show how you calculated it.	**(100 − 30) mm ÷ (2023 − 2003) years = 3.5 mm per year.**
2	How much additional rise does each model result forecast from 2023 to 2053?	**Lower emissions: 195 − 100 = 95 mm. Higher emissions: 245 − 100 = 145 mm.**
3	Under higher emissions, what average yearly rate does the model imply from 2023 to 2053? Compare it with the observed rate from 2003 to 2023.	**145 mm ÷ 30 years ≈ 4.8 mm per year, faster than the observed average of 3.5 mm per year.**
4	Which model result suggests a greater risk to coastal groundwater by 2053? Use a number from the table and a process from the passage to explain.	**The higher-emissions result, 245 mm of rise since 1993, suggests greater risk because higher seas can push salt water into coastal groundwater.**

PART 3 · YOUR TURN (SAMPLE ANSWER)

Under lower emissions, the forecast rate is (195 − 100) ÷ 30 ≈ 3.2 mm per year, giving a 2043 rise of about 100 + (20 × 3.2) = 164 mm since 1993. Under higher emissions, the rate is (245 − 100) ÷ 30 ≈ 4.8 mm per year, giving about 100 + (20 × 4.8) = 196 mm in 2043. The lower rate is slightly below the recent observed average of 3.5 mm per year, while the higher rate is above it. Either path could increase tidal flooding, but the higher path suggests greater risk.

Accept small differences in 2043 forecasts caused by rounding, including approximately 163 mm and 197 mm when students calculate before rounding. Students should treat the figures as illustrative estimates, not exact predictions for a particular city.