Module 02 – Climate Science

Assignment – 02

Total points : 10

1. Satellite data shows that Greenland and Antarctica are losing ice mass rapidly. Greenland loses ice at 280 Gt/year, and Antarctica at 150 Gt/year. Each gigaton of ice contributes 0.0028 mm to global sea level rise. However, measurements have an uncertainty of ±5% due to natural variability and satellite errors.

a. Calculate the sea level rise contribution from Greenland and Antarctica separately. (0.5 pt)
b. Compute the total sea level rise contribution per year. (0.5 pt)
c. Calculate the uncertainty range (±%) in sea level rise due to ice sheet loss. (0.5 pt)
d. Briefly interpret the impact of this uncertainty. (0.5 pt)

2. Given 10 years of global temperature anomaly data:

[−0.1,0.02,0.3,0.5,0.7,0.9,1.1,1.25,1.4,1.6]

a. Plot the temperature anomalies vs. time. (0.5 pt)
b. Fit a linear trend and extract the slope and intercept. (1 pt)
c. Interpret the trend: Is warming accelerating? (0.5 pt)

3. 5 million annual deaths linked to temperature extremes, 4 million from cold and 1 million from heat. A separate study finds: Every 1°C warming → heat deaths rise by 10%, cold deaths fall by 5%

a. Estimate new heat and cold-related deaths for a +2°C temperature rise. (0.5 pt)
b. Determine the net change in deaths. (1 pt)
c. Which is a greater risk. Heat or cold, justify in one paragraph. (0.5 pt)

4. Climate scientists use global climate models (GCMs) to predict future temperature changes. A researcher wants to assess the accuracy of a particular climate model by comparing its predicted global temperature anomalies (°C) to the observed values from 2000 to 2010.

The data is as follows:

Year	Observed Temperature Anomaly (°C)	Predicted Temperature Anomaly (°C)
2000	0.45	0.48
2001	0.47	0.50
2002	0.52	0.55
2003	0.50	0.53
2004	0.49	0.51
2005	0.54	0.58
2006	0.58	0.62
2007	0.60	0.63
2008	0.55	0.58
2009	0.57	0.60
2010	0.61	0.64

a. Calculate the RMSE between the model's predictions and observed values. (1 pt)
b. Interpret the RMSE value—does this model provide an accurate prediction of global temperature anomalies? (1 pt)

5. Survey the scientific literature to identify a climate-related research topic that is actively debated among scientists. Summarize the key argument from both sides of the debate and critically evaluate the evidence supporting each perspective. Based on your analysis, state which side you align with and justify your position using scientific findings. 3 short paragraphs (1 for one side, 1 for the other and third for the justification/critical evaluation). Cite your references. Only consider references from R1 journals. (2 pts)