

What is the 95% confidence interval for global average cloud fraction?

An illustration of the Monte Carlo (or bootstrap) method

1. a) Write down the estimates of the fraction of Earth covered by all clouds developed by each group. The particular order of groups does not matter.

Group 1	Group 2	Group 3	Group 4	Group 5

- b) Calculate mean cloud fraction over the entire globe by averaging the values from each group.
- c) The mean global cloud fraction value that you calculated has some degree of uncertainty. In science, uncertainty is often quantified in terms of the probability that the true value occurs within a specified range around the calculated value (e.g., 95% confidence that the true value is between X and Y , where $X < \text{calculated value} < Y$). How could we quantify the uncertainty range for mean global cloud fraction?
2. a) Assuming that the cloud fraction for each view of the Earth seen by a geostationary satellite is representative of the whole globe, the values in the above table represent a distribution of possible measurements of global cloud fraction. The average of five randomly selected values from the above table could be a different *realization* of mean global cloud fraction than the one we calculated. How could you use a large set of random realizations to provide information on the uncertainty range of the calculated mean global cloud fraction?
- b) Download and open the Excel file for the global cloud fraction activity from the course website. Enter the five values from the above table into the specified row. Check that the mean is the same as the one calculated above.
- c) Roll a set of five dice (color does not matter) and match the numbers to the cloud fraction values in the table above. Reroll any dice that come up as “six”. Enter the matching cloud fraction values into the five specified columns (the order does not matter), and the average will be automatically calculated. Repeat this process 80 times. Check the mean value of the 80 randomly selected cloud fraction averages. Is it close to the average of the five values in the table?
- d) Check the ratio of the standard deviation of the five values in the table divided by the standard deviation of the 80 randomly selected cloud fraction averages. Is the square of the ratio close to 5?
- e) Sort the 80 randomly selected cloud fraction averages from smallest to largest. Find the 3rd value and the 78th value. The range between the 3rd and 78th value is the 95 percent confidence interval for the calculated mean global cloud fraction. How do I know it is the 95 percent confidence interval? What values would span the 90 percent confidence interval?