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Project Description

The program I wrote in python carries out a numerical simulation of the cratering process on a planetary surface until the surface has reached saturation equilibrium. The program first generates a random (x,y) coordinate that represents a crater's center. The random (x,y) coordinates have a range from 0 to 500 so that they lie within the 500km square test area. Existing crater center coordinates are stored in two arrays, one holding the x values, and one holding the y values. The newly generated coordinate is then checked with existing coordinates(within the "in_radius" function) to determine if an existing crater's center lies within a 25 km radius of the new crater. If there *is* a crater center that exists within the radius of the new crater, the old crater is "destroyed"; in other words, the crater-counter in the program does not increment by one. This process continues until equilibrium is reached. The program checks whether or not equilibrium has been reached every time the simulation time doubles. For example, the program first checks if saturation equilibrium has been reached at 2000 years, then 4000 years, 8000 years, 16000 years, etc. (Note: The program generates coordinates for a crater once every 1000 years). In order to determine if saturation equilibrium has been reached, the program calls a function that takes in the current crater count, previous crater count (when simulation time was ½ current time), current year count, and previous year count. With these values, the ratio of craters to simulation time for previous time and current time are calculated. The function then checks if the ratio of craters to time has changed by more than 5%. If so, the simulation continues, if the ratio of craters to time has changed by < 5%, saturation equilibrium has been reached! Once saturation equilibrium has been reached, the program stops producing random crater coordinates and outputs the following information: time to saturation, total number of craters, number of craters as a function of time, table of craters vs time, plots of craters on test area.