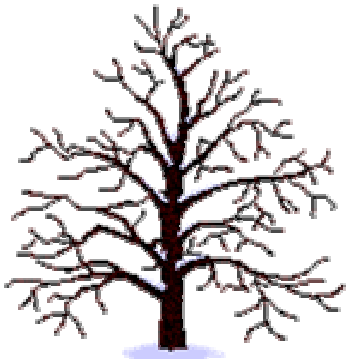
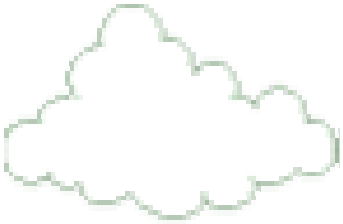
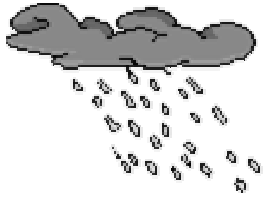


"Climate is what we expect…

weather is what we get."





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A very simple climatology…

In pairs, roll a dice 100 times and record the results on the worksheet.
Now answer the questions on the sheet.

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Climate vs. weather

- If you throw the dice another 100 times, can you predict what the climate will be?

- Can you predict what the weather will be on the next throw?

- If the sides of the dice were labelled 11-16 instead of 1 – 6, what would the climate be?

- Could you predict the weather (i.e. the next number you throw) with any more certainty than you could with a normal dice?

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- How is climate predicted?
- Why must a model be run for a long time?
- Why are so many models needed?

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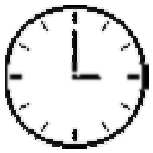
How long must the model be run for?

Set up the Excel program as described in the worksheet.
Answer the questions.



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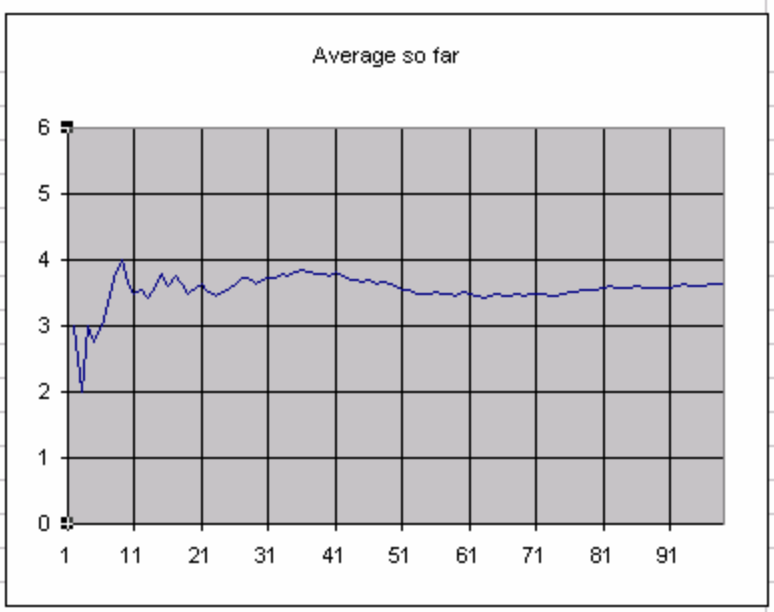
Sample results

Microsoft Excel - dice exp

File Edit View Insert Format Tools Chart Window Help

Value Axis =

	A	B	C
1	Random number	Corresponding number of the dice	Average so far
2			
3	0.374	3	3
4	0.067	1	2
5	0.778	5	3
6	0.197	2	2.75
7	0.631	4	3
8	0.664	5	3.333333
9	0.944	6	3.714286
10	0.943	6	4
11	0.098	1	3.666667
12	0.188	2	3.5
13	0.623	4	3.545455
14	0.246	2	3.416667
15	0.968	6	3.615385
16	0.871	6	3.785714
17	0.157	1	3.6



As the number of rolls of the dice increases so the mean (climate) tends towards 3.5 as predicted by logic.

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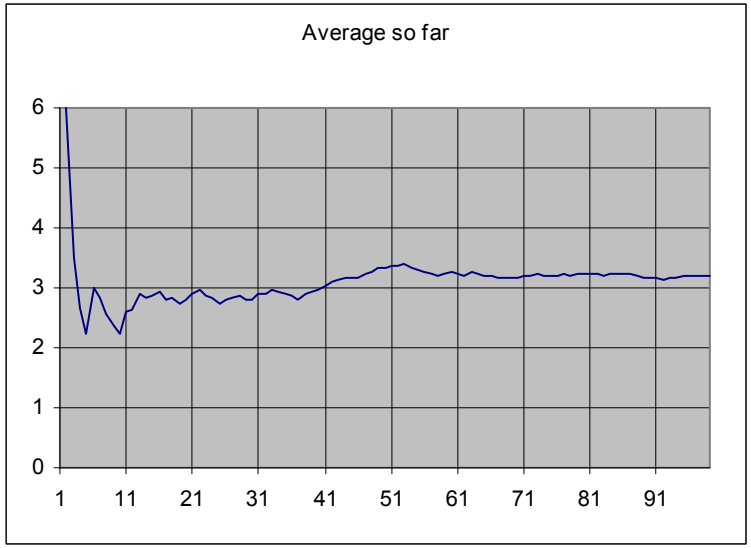

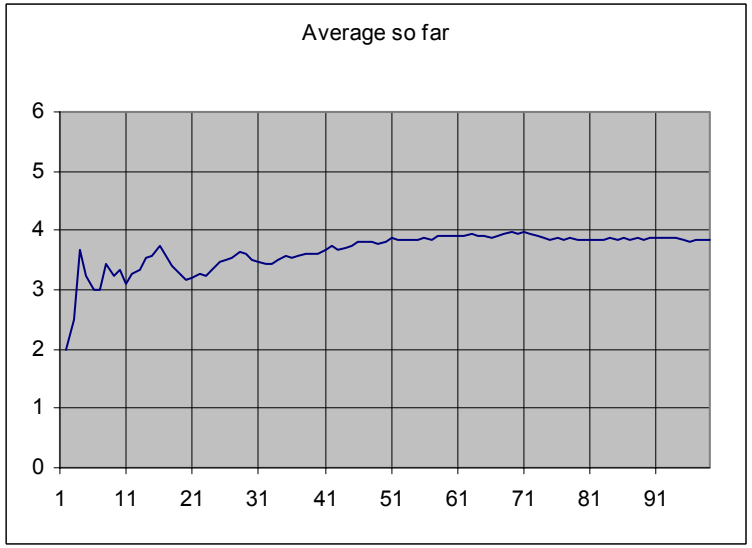

These graphs show results from the same Excel program but with different random numbers.

They show that 100 rolls of the die are not sufficient to reliably obtain the same climate, even with the same initial conditions.

Even with this simple model over 6000 trials are needed for the mean (climate) to consistently achieve 3.5 (1 d.p.)

The Meteorological Office run their climate model for the equivalent of 2000 years in order to produce a climate!

That is 35 million timesteps each of 30 minutes!

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Why are so many models needed?

The reason is because the atmosphere is a ‘chaotic’ system on some time scales, and therefore very small changes to initial conditions *could* make very big changes overall.

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