Compare the weather

Introduction

Being able to interpret data from a large data set such as in a spreadsheet table and to choose appropriate methods to display and analyse this data is an important functional skill and is useful across the school curriculum. Conventional spreadsheet software often offers a bewildering selection of display features many of which could be at best inappropriate for displaying data effectively. TI-Nspire offers a good range of clear display options that can help students to make decisions about appropriate forms of display.

This activity gives students a large table of weather data facts and figures chosen from places around the world that display very different weather patterns. They are asked to consider the data and to discuss and make comments and notes about what they notice. They can then go on to use the facilities of TI-Nspire to display the data to illustrate their findings. They can also analyse the data using a variety of statistical calculations.

The activity

1. Discussion points

The activity could begin with some class discussion about weather around the world.
What figures do you think might be on record?
Why would you want to know about the climate?

- What would you like your holiday or school trip weather to be like? How does this vary with the time of year? Are some months in some places best avoided?
- Who else might want to know about the weather and why? For example, which locations might be most suitable for solar energy; where is home insulation important; where and when would de-icing measures for roads be needed, etc?

Students could then be asked to consider some data and to discuss and make comments and notes about what they notice. For example:

- What do you notice about the monthly rainfall in the places shown in the table in the tns file?
- Which places have very different monthly rainfall?
- How could you display this information so that you can see these differences at a glance?
- What other information could you find from the table that would help you compare rainfall over the year? (Further details in the Teachers notes later)

Sources of data for discussion

- There is a five page spreadsheet with weather data from 20 different world locations (source of the information: Hutchinson World Weather guide. Helicon publishing Ltd). The file contains
  - mm of rain: average number of millimetres of rain falling per month
  - sunshine hours: the average number of hours of sunshine in each month of the year
  - rainy days: the average number of days per month when rain fell
  - min temp: the average daily minimum temperature
  - max temp: the average daily maximum temperature
- There is also a prepared tns file containing the first page of the spreadsheet data on average number of millimetres of rain falling per month. Further pages could be copied and pasted into new tns files.
- Further details of the places used in these files are shown opposite.

Place	Country	Latitude (nearest degree)
Antofagasta	Chile	**23 deg South**
Auckland	New Zealand	**37 deg S**
Bangkok	Thailand	**14 deg North**
Beijing	China	**40 deg N**
Bergen	Norway	**60 deg N**
Darwin	Australia	**12 deg S**
Death Valley	USA	**36 deg N**
Innsbruck	Austria	**47 deg N**
Irkutsk	Russia	**52 deg N**
Islamabad	Pakistan	**34 deg N**
Las Vegas	USA	**36 deg N**
London	England	**51 deg N**
Moscow	Russia	**56 deg N**
Mumbai	India	**19 deg N**
Oban	Scotland	**56 deg N**
San Francisco	USA	**38 deg N**
Seville	Spain	**37 deg N**
Tokyo	Japan	**36 deg N**
Ulanbator	Mongolia	**48 deg N**
Urumqi	China	**44 deg N**

- Sites in the UK can be compared using the LGFL weather station site http://weather.lgfl.org.uk/ There is more information about what this shows in the activity 'Hurricane Force'. The Table view of the LGFL site (shown below) gives all the currently available live readings. This site also has historical data. The number of readings and the lack of great variation in the UK data on this site makes comparisons more difficult to see quickly.

Weather Monitoring System

Station	Time	Temp Out (°C)	Bar (hPa)	Rain Rate (mm/hr)	Day Rain (mm)	Wind Dir (°)	Avg Wind (m/s)	Out Hum (%)	Solar Rad. (W/m²)	UV Index ()
Ascot, Berkshire	13:23	18.1	1025	0.0	0.0	288	1	65	128	1.0
Ashford, Kent	13:24	18.1	1023	0.0	0.2	331	4	66	352	3.2
Aylesbury, Buckinghamshire	13:23	17.4	1028	0.0	0.0	30	1	66	374	2.6
Bedfont, W London	13:24	18.6	1025	0.0	0.0	17	2	60	348	3.7
Belmont, S London	13:23	18.3	1024	0.0	0.0	46	2	63	160	2.0
Bow, London	13:24	18.7	1024	0.0	0.0	106	5	59	239	2.4
Brent, London	13:24	19.5	1025	0.0	0.0	71	3	56	622	3.8
Brill, Buckinghamshire	13:23	15.8	1026	0.0	0.0	42	3	75	304	2.7
Caernarfon, Gwynedd	13:23	15.5	1030	0.0	0.0	11	1	67	891	4.6
Cambridge, Cambridgeshire	13:23	18.6	1024	0.0	0.0	52	0	55	274	
Camden, London	13:23	18.8	1024	0.0	0.0	92	3	58	313	4.0
Carshalton, S London	13:24	17.9	1020	0.0	0.0	20	2	57	236	2.6
Catford, SE London	13:23	18.3	1021	0.0	0.0	304	2	63	111	1.8
Chesham, Buckinghamshire	13:23	16.4	1025	0.0	0.0	332	4	73	287	2.3
Chippenham, Wiltshire	13:23	16.5	1026	0.0	0.0	131	1	66	323	2.1
Christchurch, Dorset	13:24	21.7	1025	0.0	0.0	83	1	54	722	4.5
Clapton, E London	13:23	18.2	1024	0.0	0.0	325	4	60	309	4.0
Colindale, NW London	13:23	20.9	1024	0.0	0.0	325	2	55	313	2.6
Corby, Northamptonshire	13:24	15.3	1095	0.0	0.0	32	4	71	146	2.0
Dagenham, E London	13:23	19.1	1024	0.0	0.0	342	3	54	341	2.1

- The Meteorological Office also has sets of data http://www.metoffice.gov.uk/weather/

2. Using TI-Nspire

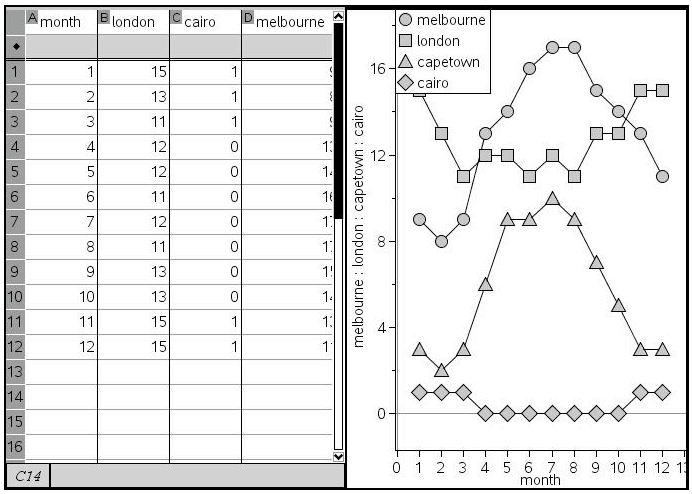
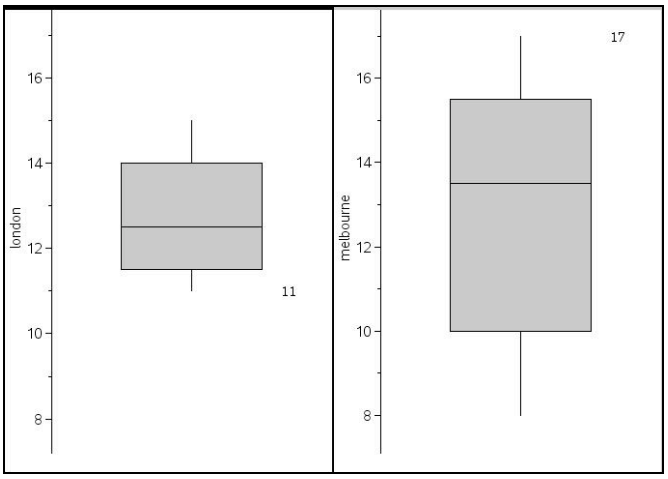
Given the prepared tns file containing the rain data, students could start by considering this first. Then for later comparisons they or the teacher could prepare further files by copy and pasting data from the other pages of the Excel spreadsheet. Students could be asked to:

- Write about what they think the data shows in a notes page.
- Choose which methods of display or statistical calculations best illustrate the point they are trying to make and do this in a 'data and statistics' page. There are some notes to help later and also more detailed instructions for producing different charts in the introduction to this booklet.

3. Examples

These are just a few examples of the sort of display that students could use. Many are possible and there are other examples in the STEM activities Introduction booklet and in the activity 'Reaction times'. Ideally students will try out a variety and discuss which ones work well and which are not so clear. Teachers can then decide whether to share these examples with their students and at what stage to do this. This might be:

- after students have had some opportunity to experiment for themselves with different forms of display or;
- teachers may prefer to show them an example first and then let students choose which cities and data would produce interesting looking results.

Both 'Quick graph' on the 'Lists and Spreadsheet' menu or the default graph on inserting a 'Data and Statistics' page allow multiple entries for variables on the y axis. Select 'add variable' to do this. Note that 'connect data points' has been selected. This chart shows the number of rainy days in different months of the year in four world cities. The graph legend shows which symbols represent which places. This type of chart can show the monthly rainfall pattern.	
This time a 'box plot' has been used to compare the monthly rainfall in two cities. • What does this show? (See booklet introduction) • What information does this give that the chart above doesn't show? • What information is shown in the first example that cannot be seen here?	

Statistical calculations

The main aim of this activity is to encourage students to think about effective ways of displaying data but calculations could also be used for comparison. (Further details are in the introduction to this booklet and in the activity 'Reaction times'.) Data could be read off from the boxplot, but in this example the mean annual rainfall has been calculated by inserting an extra row at the foot of the table and using 'mean' from the catalogue.

	A month	B anto	C auck	D bang	E beij	F berg	G darw	H deat	I inns	J
◆										
1	1	0	79	8	4	143	386	3	54	
2	2	0	94	20	5	142	312	0	49	
3	3	0	81	36	8	109	254	3	41	
4	4	0	97	58	17	139	97	3	52	
5	5	0	127	198	35	83	15	5	73	
6	6	3	137	160	78	126	3	3	110	
7	7	5	145	160	243	142	0	8	134	
8	8	3	117	175	141	168	3	8	108	
9	9	0	102	305	58	228	3	5	81	
10	10	3	102	206	16	235	51	0	67	
11	11	0	89	66	11	211	119	3	53	
12	12	0	79	5	3	204	239	0	46	
13		1.16667	104.083	116.417	51.5833	160.833	123.5	3.41667	72.3333	

4. Additional information — Weather data

All the data is in a 5-page Microsoft Excel spreadsheet 'Weather data'

Data from individual pages, columns or rows can be copied and pasted into a TI-Nspire file or individual items of data could be entered manually. This is what the five pages look like.

Millimetres of rain falling on average in each month of the year

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U
1	month	Anto	Auck	Bang	Beij	Berg	Darw	Deat	Inns	Irku	Isla	LasV	Lond	Mosc	Mumb	Oban	SanF	Sevi	Toky	Ulan	Urum
2	1	0	79	8	4	143	386	3	54	13	64	18	54	39	3	146	119	66	48	0	15
3	2	0	94	20	5	142	312	0	49	10	64	13	40	38	3	109	97	61	74	0	8
4	3	0	81	36	8	109	254	3	41	8	81	8	37	36	3	83	79	90	107	3	13
5	4	0	97	58	17	139	97	3	52	15	42	8	37	37	0	90	38	57	135	5	38
6	5	0	127	198	35	83	15	5	73	33	23	5	46	53	18	72	18	41	147	10	28
7	6	3	137	160	78	126	3	3	110	56	55	5	45	58	485	87	3	8	165	28	38
8	7	5	145	160	243	142	0	8	134	79	233	13	57	88	617	120	0	1	142	76	18
9	8	3	117	175	141	168	3	8	108	71	258	13	59	71	340	116	0	5	152	51	25
10	9	0	102	305	58	228	13	5	81	43	85	8	49	58	264	141	8	19	234	23	15
11	10	3	102	206	16	235	51	0	67	18	21	8	57	45	64	169	25	70	208	5	43
12	11	0	89	66	11	211	119	3	53	15	12	5	64	47	13	146	64	67	97	5	41
13	12	0	79	5	3	204	239	0	46	15	23	10	48	54	3	172	112	79	56	3	10
14																					

Average number of hours of sunshine per day for each month of the year

month	Anto	Auck	Bang	Beij	Berg	Darw	Deat	Inns	Irku	Isla	LasV	Lond	Mosc	Mumb	Oban	SanF	Sevi	Toky	Ulan	Urum
1	11	7	9	7	1	6		2	3	7	8	1	1	9	1	5	6	6	3	6
2	10	7	8	7	2	6		4	5	8	9	2	3	10	2	7	6	6	4	5
3	8	6	9	8	3	7		5	7	8	10	4	4	9	3	8	6	6	5	6
4	4	5	8	8	5	8		5	7	10	11	5	5	10	5	10	8	7	6	7
5	6	4	8	9	6	9		6	8	10	12	6	8	10	7	11	9	6	8	10
6	6	4	6	9	6	10		6	8	9	14	7	9	5	6	11	11	5	7	9
7	6	4	5	7	6	10		7	8	8	12	6	9	2	4	10	12	6	7	9
8	6	5	5	7	6	10		6	7	9	12	6	8	3	4	9	11	7	7	9
9	6	5	5	8	3	10		6	6	10	12	5	6	5	4	9	9	5	6	9
10	6	6	6	8	2	10		5	5	9	10	3	3	8	2	8	7	4	5	7
11	7	7	8	6	1	8		3	3	8	9	2	1	9	1	7	6	5	3	5
12	9	7	9	6	0	7		2	2	7	10	1	0	9	1	6	5	5	2	5

Average number of rainy days in each month of the year

month	Anto	Auck	Bang	Beij	Berg	Darw	Deat	Inns	Irku	Isla	LasV	Lond	Mosc	Mumb	Oban	SanF	Sevi	Toky	Ulan	Urum
1	0	10	1	3	20	20	1	13	3	7	2	15	18	0.2	20	11	8	5	1	17
2	0	10	1	3	17	18	1	13	3	6	2	13	15	0.2	17	11	6	6	1	14
3	0	11	3	3	16	17	2	11	2	7	2	11	15	0.1	15	10	9	10	2	14
4	0.1	14	3	4	19	6	1	14	4	6	1	12	13	0.1	17	6	7	10	2	9
5	0.1	19	9	6	15	1	0.5	15	8	4	1	12	13	1	16	4	6	10	4	5
6	0.2	19	10	8	17	1	0.1	19	7	7	1	11	12	14	16	2	1	12	5	11
7	0.5	21	13	13	20	0	0.3	19	9	13	2	12	15	21	20	0	0	10	10	5
8	0.4	19	13	11	20	0	0.7	17	11	10	2	11	14	19	19	0	0	9	8	4
9	0.5	17	15	7	21	2	0.3	14	8	5	1	13	13	13	19	2	2	12	3	4
10	0.2	16	14	3	23	5	1	12	6	2	1	13	15	3	21	4	6	11	2	10
11	0.3	15	5	3	21	10	1	12	4	1	1	15	15	1	20	7	7	7	2	14
12	0	12	1	2	22	15	2	13	4	3	2	15	23	0.1	22	10	8	5	1	18

Average daily minimum temperature (in °C) for each month of the year

month	Anto	Auck	Bang	Beij	Berg	Darw	Deat	Inns	Irku	Isla	LasV	Lond	Mosc	Mumb	Oban	SanF	Sevi	Toky	Ulan	Urum
1	17	16	20	-10	-1	25	3	-7	-26	2	-2	2	-16	19	2	7	6	-2	-32	-22
2	17	16	22	-8	-1	25	7	-5	-25	6	1	2	-14	19	1	8	7	-1	-29	-19
3	16	15	24	-1	0	25	11	0	-17	10	4	3	-8	22	3	9	9	2	-22	-11
4	14	13	25	7	3	24	16	4	-7	15	7	6	1	24	4	9	11	8	-8	2
5	13	11	25	13	7	23	21	8	1	21	11	8	8	27	7	11	13	12	-2	8
6	11	9	24	18	10	21	26	11	7	25	16	12	11	26	9	11	17	17	7	12
7	11	8	24	21	12	19	31	13	10	25	20	14	13	25	11	12	20	21	11	14
8	11	8	24	20	12	21	29	12	9	24	19	13	12	24	11	12	20	22	8	13
9	12	9	24	14	10	23	23	10	2	21	14	11	7	24	9	13	18	19	2	8
10	13	11	24	6	6	25	15	5	-6	15	8	8	3	24	7	12	14	13	-8	-1
11	14	12	22	-2	3	26	8	0	-17	9	2	5	-3	23	4	11	10	6	-20	-11
12	16	14	20	-8	1	26	4	-4	-24	3	-1	4	-10	21	3	8	7	1	-28	-13

Average daily maximum temperature (in °C) for each month of the year

month	Anto	Auck	Bang	Beij	Berg	Darw	Deat	Inns	Irku	Isla	LasV	Lond	Mosc	Mumb	Oban	SanF	Sevi	Toky	Ulan	Urum
1	24	23	32	1	3	32	19	1	-16	16	16	6	-9	28	6	13	15	8	-19	-11
2	24	23	33	4	3	32	22	4	-12	19	19	7	-6	28	7	15	17	9	-13	-8
3	28	22	34	11	6	33	27	11	-4	24	22	10	0	30	9	16	20	12	-4	-1
4	21	19	35	21	9	33	32	16	6	31	27	13	10	32	11	17	24	17	7	16
5	19	17	34	27	14	33	37	20	13	37	32	17	19	33	14	17	27	22	13	22
6	18	14	33	31	16	31	43	24	20	40	37	20	21	32	16	19	32	24	21	26
7	17	13	32	31	19	31	47	25	21	36	39	22	23	29	17	18	36	28	22	28
8	17	14	32	30	19	32	46	24	20	34	39	21	22	29	17	18	36	30	21	27
9	18	16	32	26	15	33	41	21	14	34	35	19	16	29	15	21	32	26	14	21
10	19	17	31	20	11	34	33	15	5	32	29	14	9	32	12	20	26	21	6	10
11	21	19	31	9	8	34	24	8	-7	28	22	10	2	32	9	17	20	16	-6	-1
12	22	21	31	3	5	33	19	2	-16	20	16	7	-5	31	7	14	16	11	-16	-8