Balloon Trajectory Forecast Exercise

This exercise was used with an 11-16 STEM club who were planning a balloon launch. It was used with a large, laminated map of the UK which they could mark their school and their calculated landing points on.

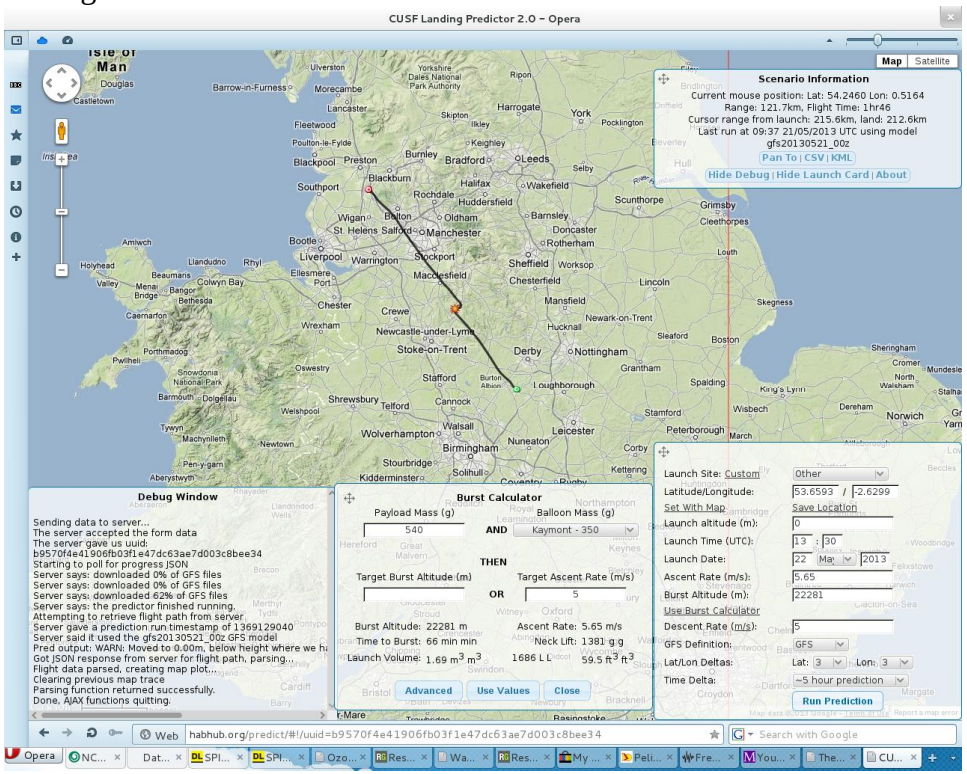
The students worked in pairs with a calculator. Each pair was given a table (below) and one of the sets of altitude/ wind speed data sets. Note that some of the sets are harder, and expect students to be able to convert e.g. SW winds into their S and W components.

The wind speed and direction data can be copied straight from the data set given onto the table. The time taken column will be the same for every group, e.g. 1000m % 5m/s for the first row.

The rest of the data needs to be calculated. For example, if the balloon takes 200s to rise through the first 1000m, where the wind speed is 2m/s from the North, then the balloon will travel 400m South in that time, which would be recorded as -400 in the penultimate column and 0 in the last.

The exercise is a useful application of maths, and can be used as an introduction to the fact that the wind speed changes with height and that where the balloon lands is important ï if it lands in the sea or too far away from the start point, then it wonôt be retrievable.

Real trajectories can also be calculated using websites such as habhub.



Balloon launch altitude: 0m
Balloon burst altitude: 30,000m
Balloon ascent/ descent rate: 5m/s

Altitude (m)	Wind speed	Wind direction	Time taken to rise through this section (height/ ascent rate)	distance travelled N/S (positive if to the north, negative if to the South)	distance travelled E/W (positive if to the east, negative if to the west)
0-1000					
1000-5000					
5000-7500					
7500-10,000					
10,000-20,000					
20,000-30,000					
30,000-20,000					
20,000-10,000					
10,000-7500					
7500-5000					
5000-1000					
1000-0					

TOTAL DISTANCE TRAVELLED:

The map scale is 1cm = 10km
So on the map your balloon will land

--------- cm left/ right of start point ------- up/ down from start

Altitude (m)	Wind speed m/s	Wind direction (direction the wind is blowing FROM)	Altitude (m)	Wind speed m/s	Wind direction (direction the wind is blowing FROM)

0-1000	5	South	0-1000	2	North
1000-5000	10	West	1000-5000	15	North
5000-7500	7	North	5000-7500	18	West
7500-10,000	25	West	7500-10,000	30	West
10,000-20,000	20	West	10,000-20,000	18	West
20,000-30,000	15	West	20,000-30,000	17	West

Altitude (m)	Wind speed m/s	Wind direction (direction the wind is blowing FROM)	Altitude (m)	Wind speed m/s	Wind direction (direction the wind is blowing FROM)
0-1000	10	East	0-1000	8	North
1000-5000	12	North	1000-5000	12	West
5000-7500	4	West	5000-7500	16	North
7500-10,000	20	North	7500-10,000	49	West
10,000-20,000	21	West	10,000-20,000	20	West
20,000-30,000	19	West	20,000-30,000	20	West

Altitude (m)	Wind speed m/s	Wind direction (direction the wind is blowing FROM)	Altitude (m)	Wind speed m/s	Wind direction (direction the wind is blowing FROM)
0-1000	12	West	0-1000	2	South
1000-5000	12	North	1000-5000	5	West
5000-7500	14	North	5000-7500	20	West
7500-10,000	24	West	7500-10,000	68	West
10,000-20,000	22	West	10,000-20,000	15	West
20,000-30,000	18	West	20,000-30,000	19	West

Altitude (m)	Wind speed m/s	Wind direction (direction the wind is blowing FROM)	Altitude (m)	Wind speed m/s	Wind direction (direction the wind is blowing FROM)
0-1000	1	West	0-1000	4	North
1000-5000	7	West	1000-5000	8	West
5000-7500	15	North	5000-7500	8	West
7500-10,000	30	North	7500-10,000	28	North
10,000-20,000	26	West	10,000-20,000	24	West
20,000-30,000	24	West	20,000-30,000	26	West

Altitude (m)	Wind speed m/s	Wind direction (direction the wind is blowing FROM)	Altitude (m)	Wind speed m/s	Wind direction (direction the wind is blowing FROM)
0-1000	2	East	0-1000	8	West
1000-5000	7	North	1000-5000	8	North
5000-7500	15	West	5000-7500	10	North
7500-10,000	23	West	7500-10,000	38	West
10,000-20,000	18	West	10,000-20,000	21	West
20,000-30,000	18	West	20,000-30,000	22	West

Altitude (m)	Wind speed m/s	Wind direction (direction the wind is blowing FROM)	Altitude (m)	Wind speed m/s	Wind direction (direction the wind is blowing FROM)
0-1000	6	North	0-1000	1	South
1000-5000	4	North	1000-5000	9	West
5000-7500	8	West	5000-7500	16	North
7500-10,000	42	North	7500-10,000	22	North
10,000-20,000	26	West	10,000-20,000	24	West
20,000-30,000	26	West	20,000-30,000	25	West

Altitude (m)	Wind speed m/s	Wind direction (direction the wind is blowing FROM)	Altitude (m)	Wind speed m/s	Wind direction (direction the wind is blowing FROM)
0-1000	7	West	0-1000	7	North
1000-5000	18	North	1000-5000	24	West
5000-7500	22	West	5000-7500	24	orth
7500-10,000	67	West	7500-10,000	44	West
10,000-20,000	18	West	10,000-20,000	14	West
20,000-30,000	16	West	20,000-30,000	20	West

Altitude (m)	Wind speed m/s	Wind direction (direction the wind is blowing FROM)	Altitude (m)	Wind speed m/s	Wind direction (direction the wind is blowing FROM)
0-1000	1	North	0-1000	2	South
1000-5000	5	NW	1000-5000	6	West
5000-7500	10	North	5000-7500	23	West
7500-10,000	48	North	7500-10,000	53	West
10,000-20,000	22	West	10,000-20,000	23	West
20,000-30,000	23	West	20,000-30,000	22	West

Altitude (m)	Wind speed m/s	Wind direction (direction the wind is blowing FROM)	Altitude (m)	Wind speed m/s	Wind direction (direction the wind is blowing FROM)
0-1000	8	NW	0-1000	6	SW
1000-5000	10	NW	1000-5000	10	NW
5000-7500	12	NW	5000-7500	12	NW
7500-10,000	65	West	7500-10,000	40	West
10,000-20,000	24	West	10,000-20,000	22	West
20,000-30,000	24	West	20,000-30,000	26	West