

Mobile phone coverage and the topography of North Clare

Introduction

One of the problems faced by us and many of our school friends in north Clare is the availability of good mobile phone coverage in the area. This really affected some during Covid while trying to do schoolwork from home and some of our friends have gone outside their houses to get phone connection.

When we looked at the COMREG coverage maps (<https://coveragemap.comreg.ie/map>) of north Clare we could see that some areas have very differing coverage while only being a kilometre apart. We were curious as to what could cause such variance in signal and this gave us the idea for the project.

Aims

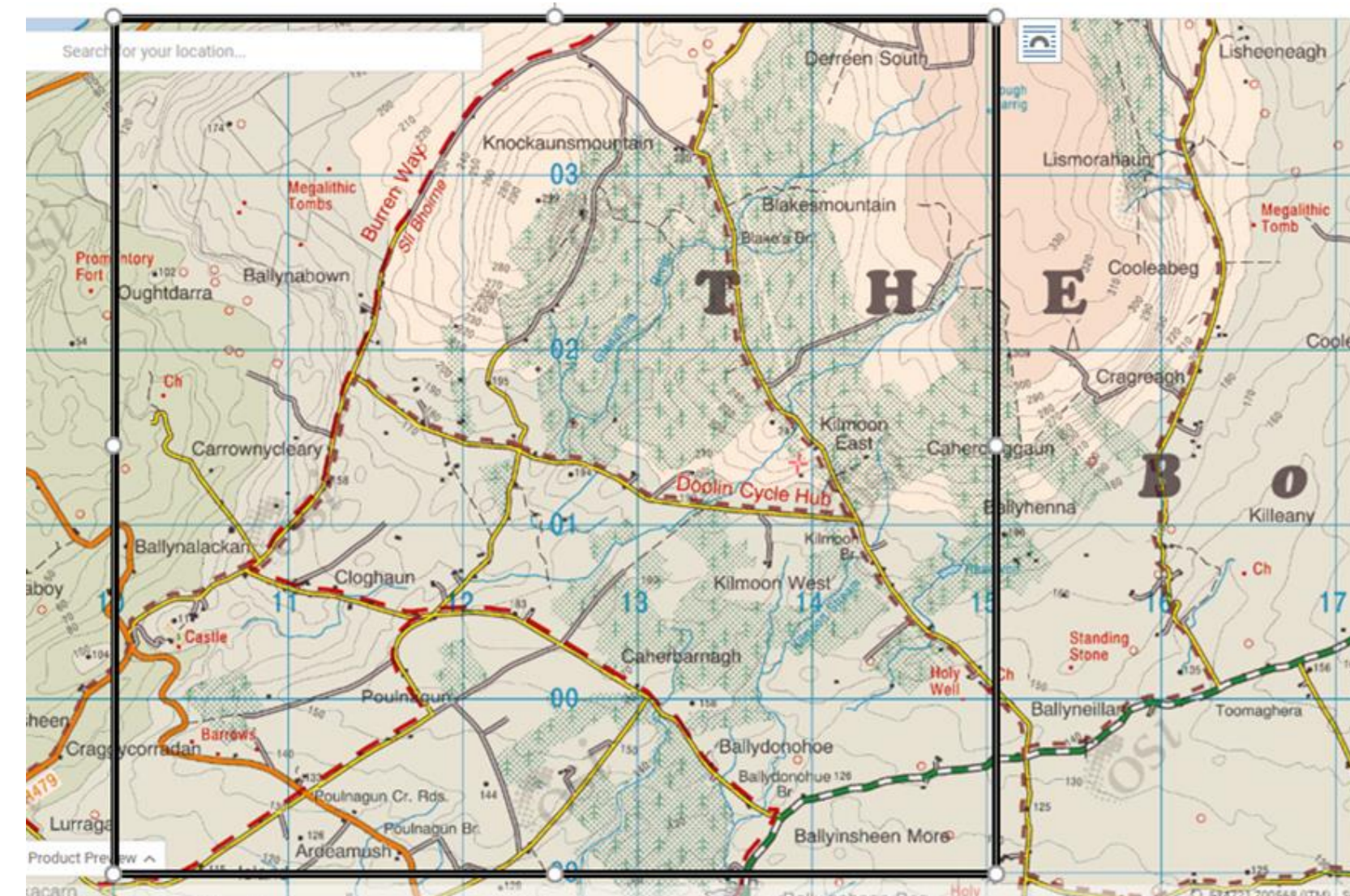
The aims of our project are:

- To map the mobile phone signal strength, upload and download speeds for Eir, Three and Vodafone in the North Clare area.
- To examine what effect topography has on signal strength, upload and download speeds for the different providers.
- To see if the data we collect is in line with coverage maps provided by COMREG.
- To see if further mast location could alleviate coverage blackspots.

Methods

We chose the 3 Primary network providers in Ireland, Three, Eir and Vodafone. We chose these three networks because all the other service providers are carried on one of these networks. For example, Tesco Mobile is carried on the Three network.

The locations that we took measurements at are based on the grid lines on the Ordnance Survey map of North Clare, starting on the R 99000 N line on the Irish National Grid. We took our measurements every 500m along the national grid lines and at the centre of each grid. The total area covered is 25 km². This is shown on the map below.



To collect our data, we are using 3 iPhone 7's each with a sim card for one of the networks named above. We have mounted these phones on a pole 2m high as seen in the photo below.

At each location we took readings on one phone at a time at the locations outlined above. We collected data four times over a 5 minute period. The method of collecting the data is given below. Firstly, we recorded the generation and the number of bars showing on the phone.

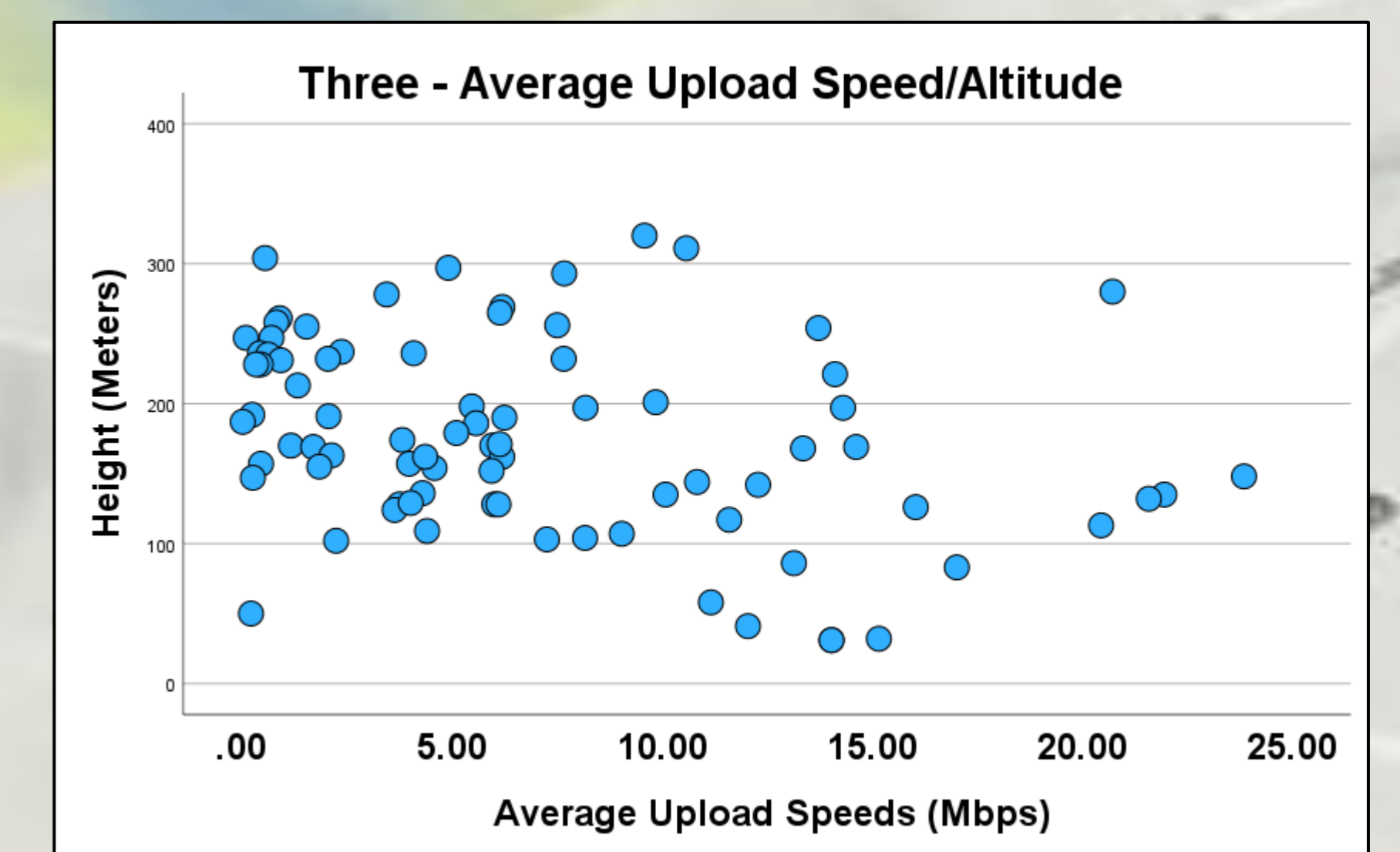
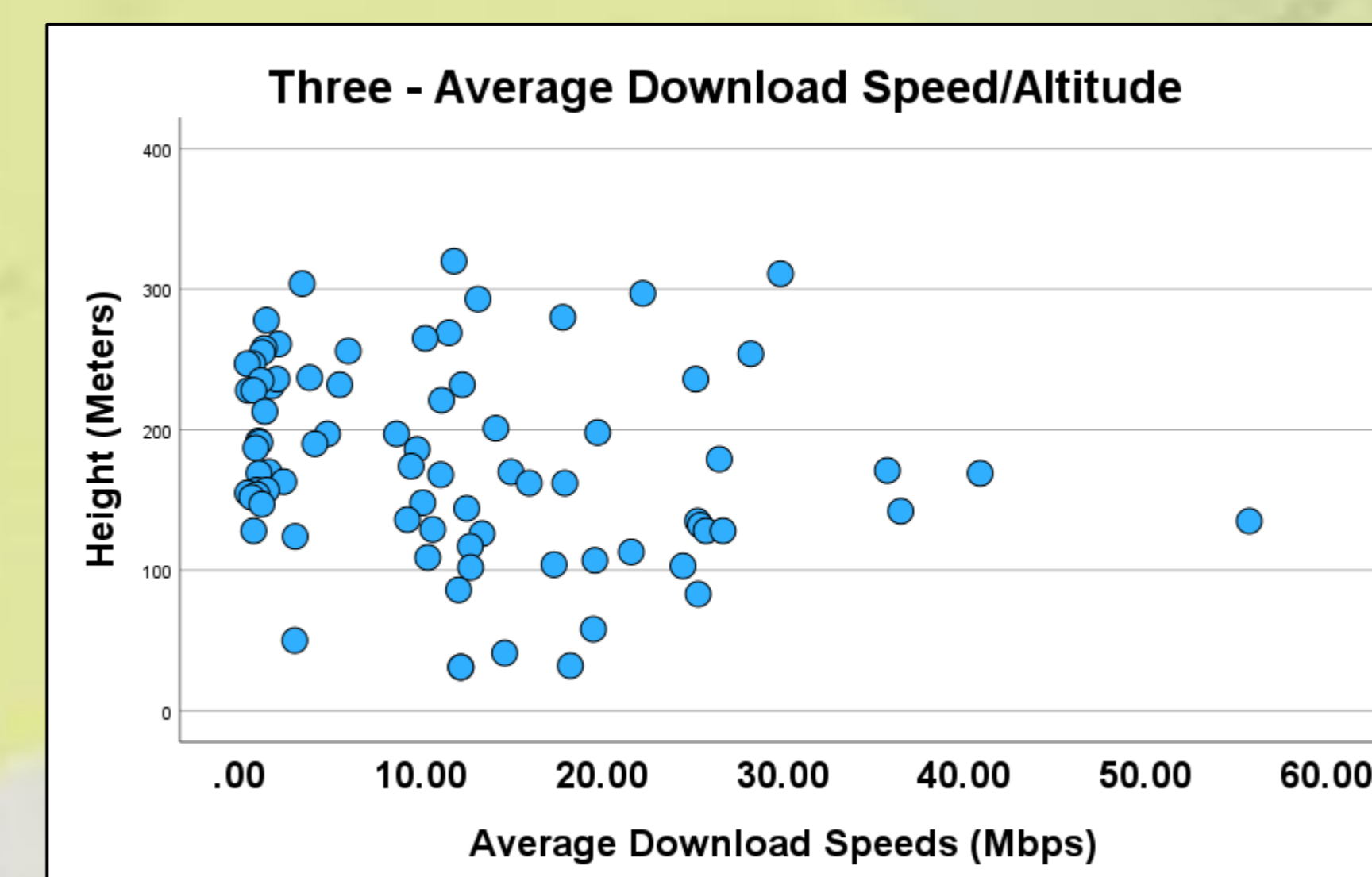
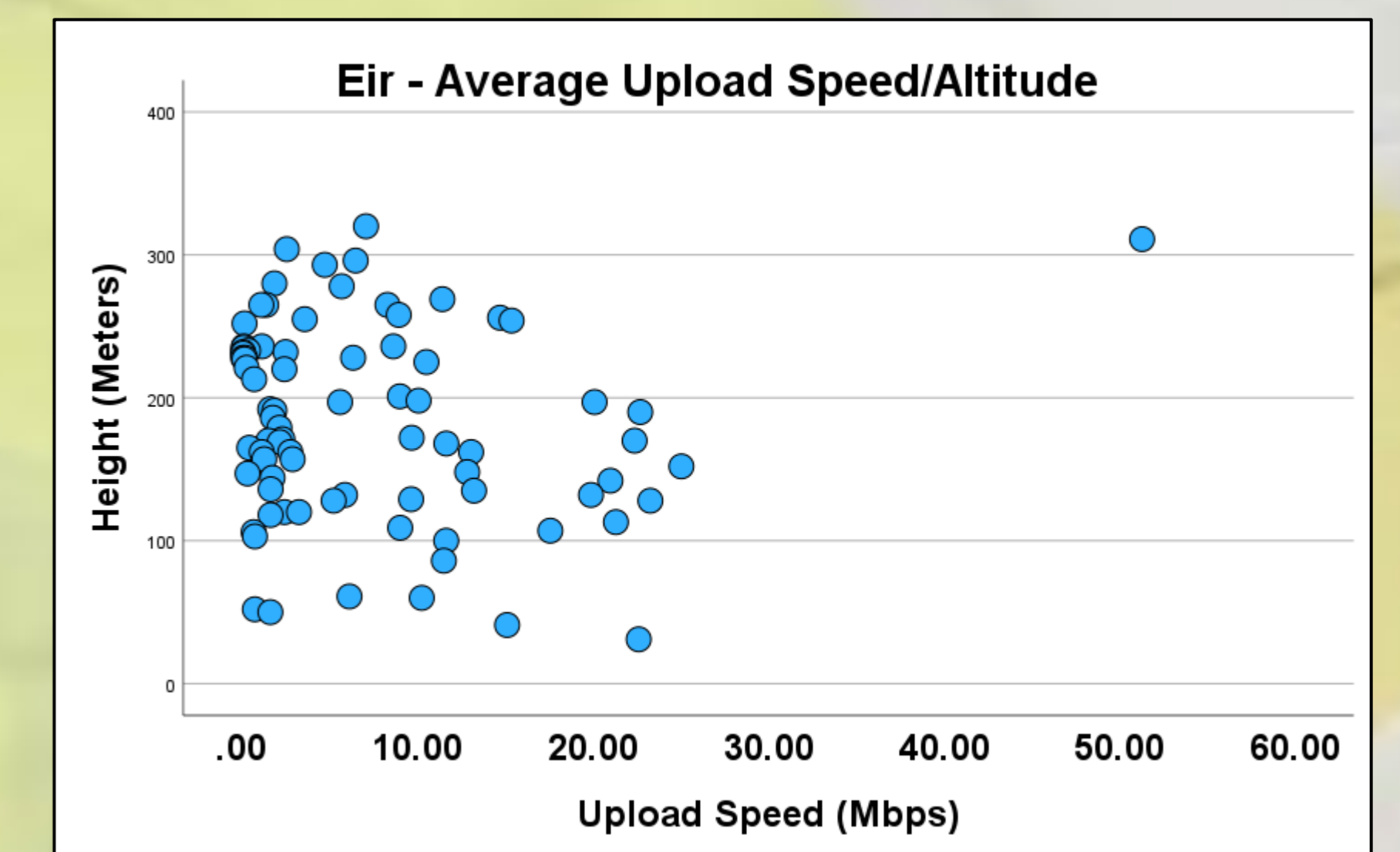
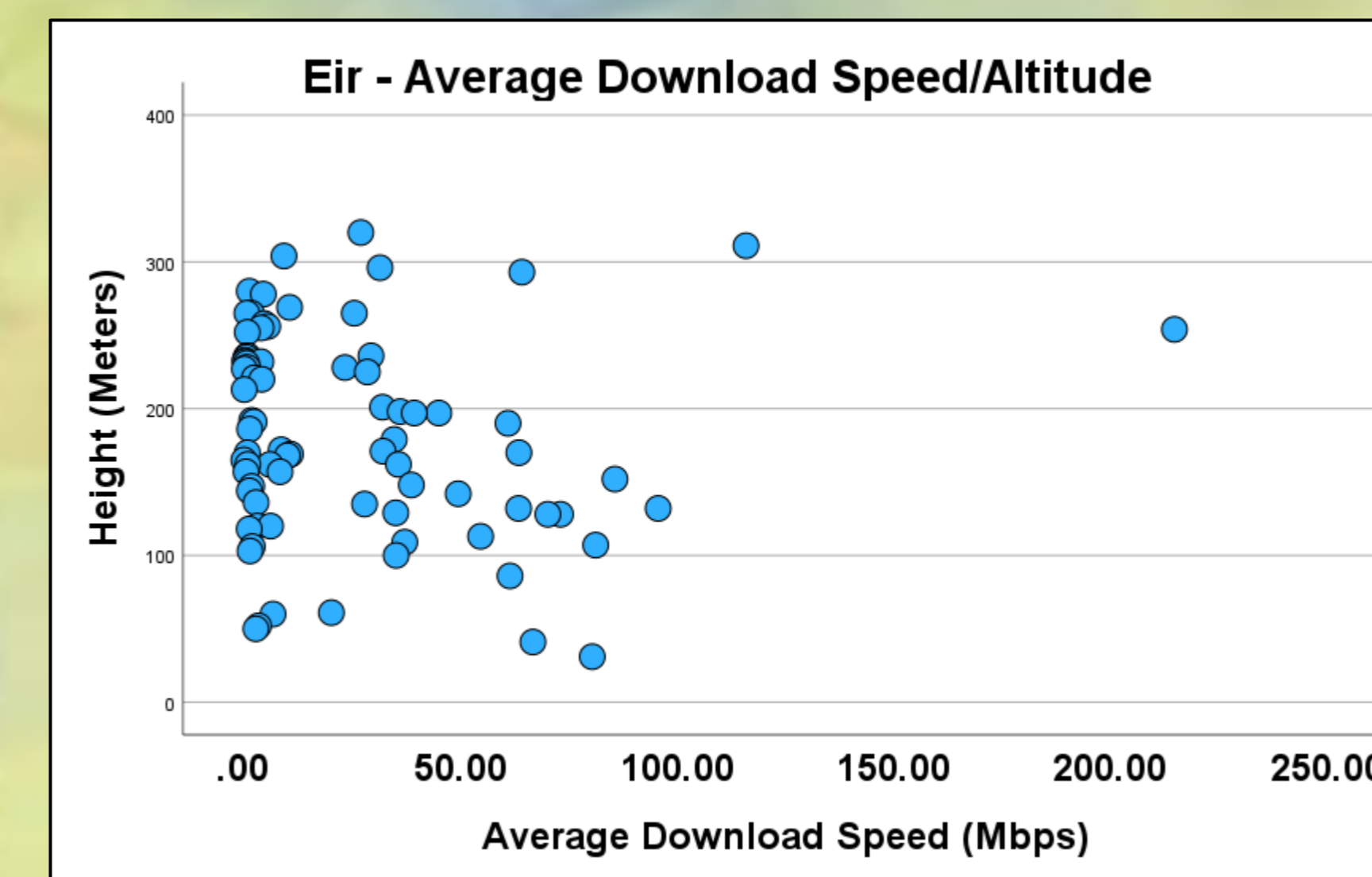
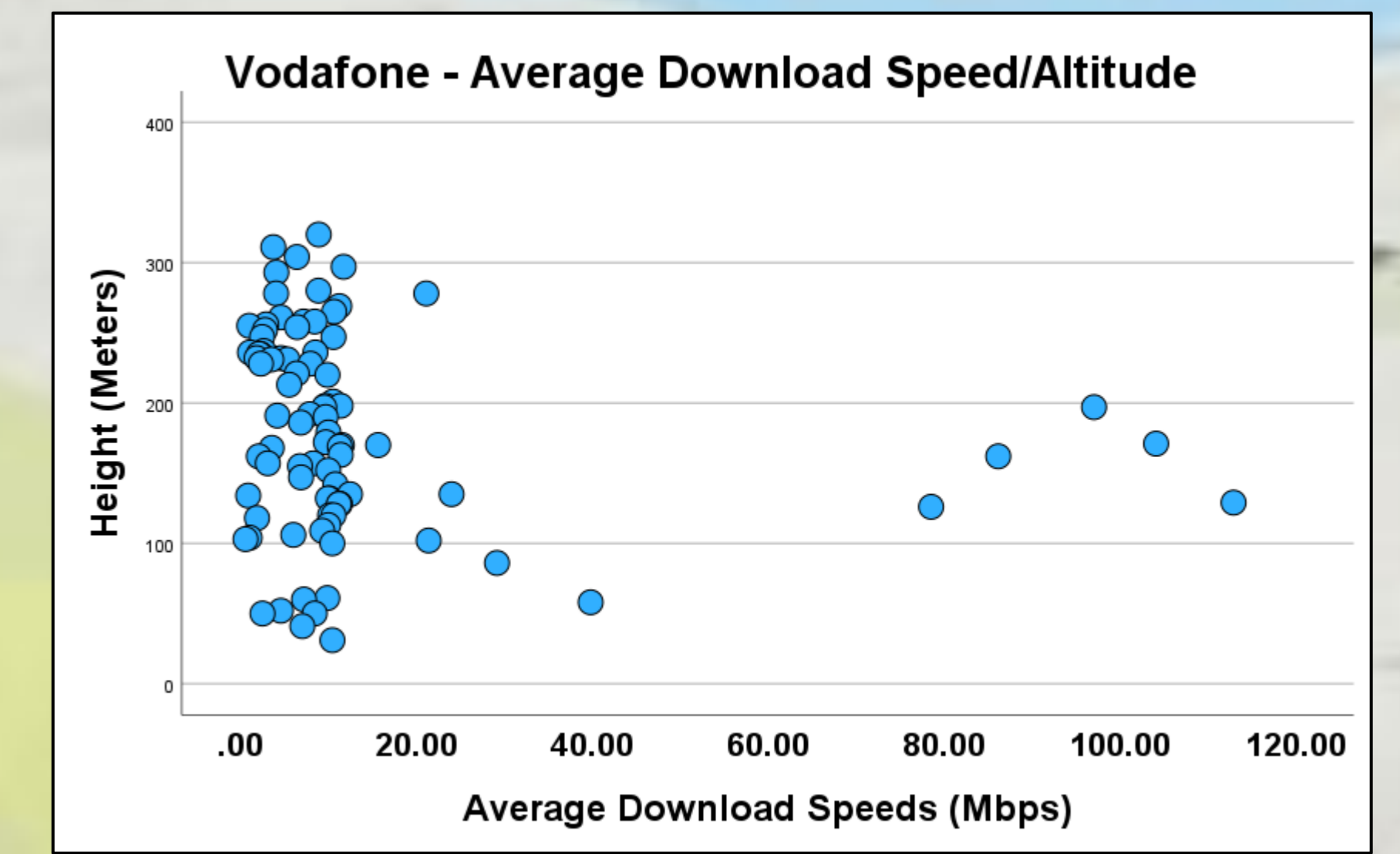
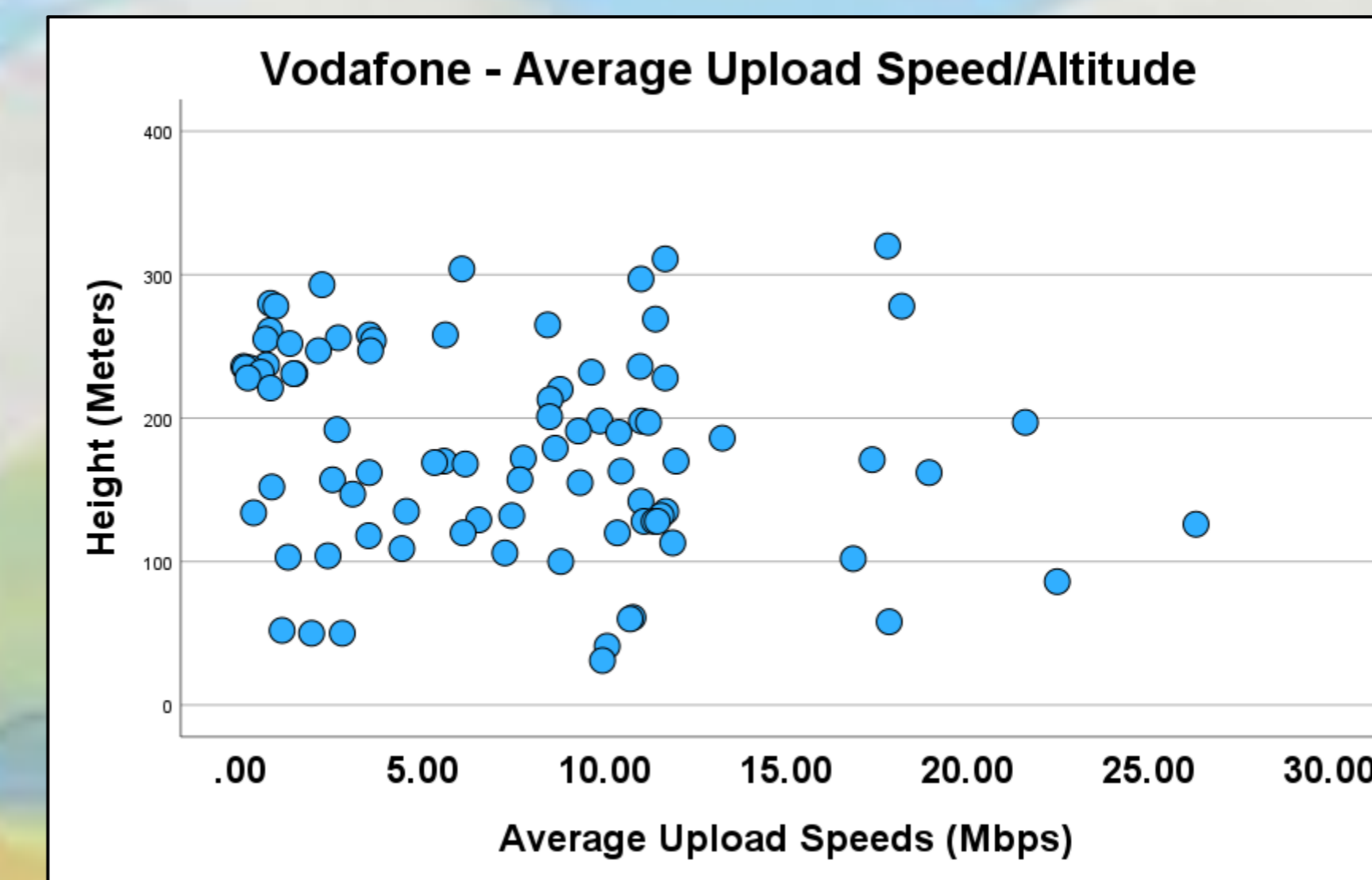
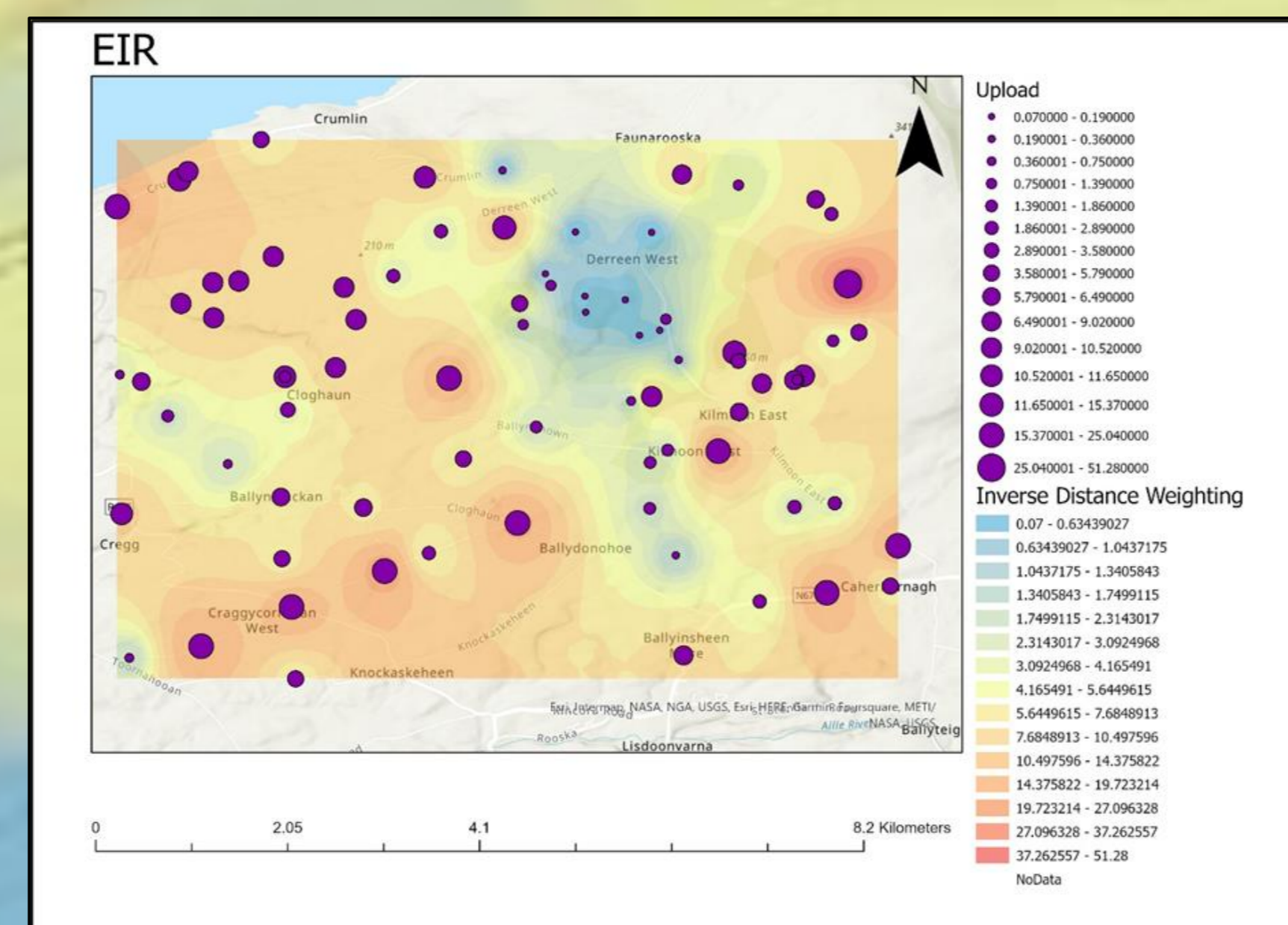
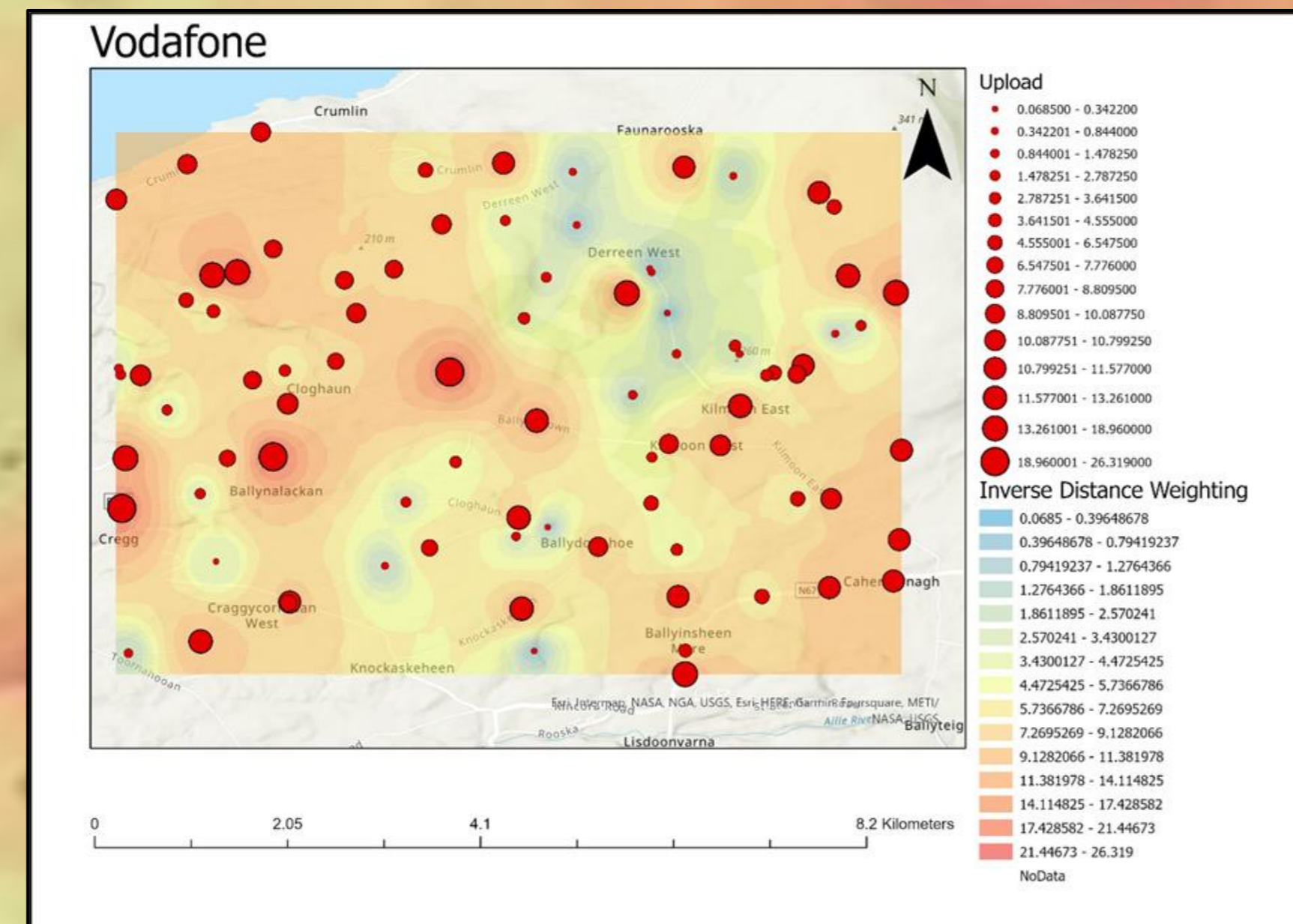
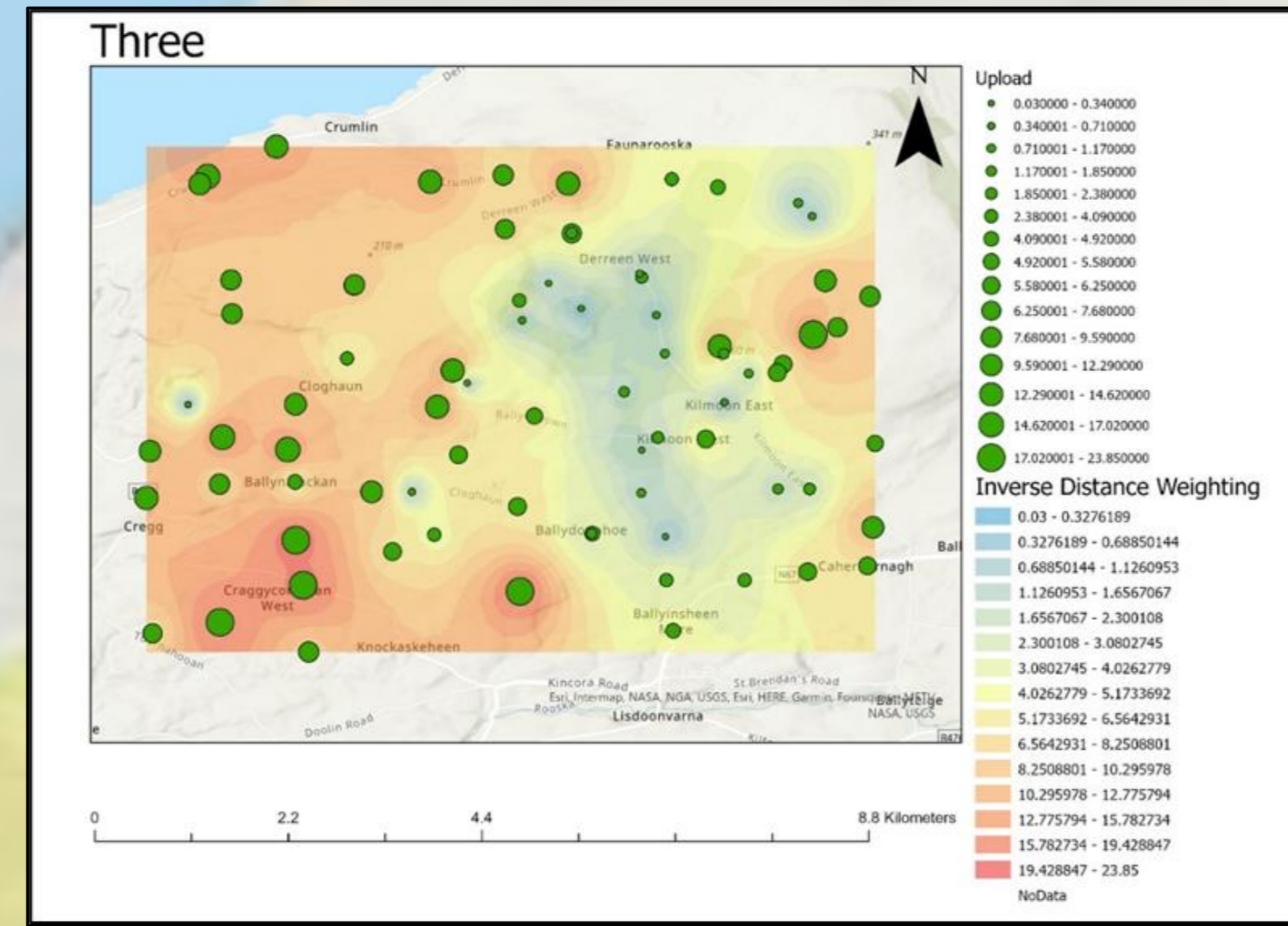
To get the upload and download speeds we used an app called Speedtest by Ookla. Once this was set up for a particular network we found it easy to use. It gives us a reading in Mbps. As well as recording the upload and download speeds it also provided us with data on responsiveness. We recorded our data on sheets. The phone also recorded the results of the upload and download speeds and other relevant data.

To make sure we were collecting data at our chosen locations we used an app called Irish grid. This gave us the location using the Irish national Grid as well as WGS84 latitude and longitude readings.

When all the data was collected, we mapped our results using ArcGIS. We used topographical maps of the research area and superimposed the signal strength, upload, and download speeds and other data onto these maps creating 3D maps.

Results

The maps are for average upload speeds from the three main networks. We also created scattergraphs between altitude and the upload and download speeds. Some of these are shown here.



Correlations

To see if there was statistically a relationship between altitude and upload and download speeds we ran correlations in SPSS. As we expected the correlations were weak or very weak. A sample of our correlations are given below.

Three		Height	Upload
Height	Pearson Correlation	1	-.317**
	Sig. (2-tailed)		.004
N		81	81

Vodafone		Height	Upload
Height	Pearson Correlation	1	-.195
	Sig. (2-tailed)		.070
N		87	87

Eir		Height	Download
Height	Pearson Correlation	1	-.100
	Sig. (2-tailed)		.373
N		81	81

Three		Height	Download
Height	Pearson Correlation	1	-.206
	Sig. (2-tailed)		.065
N		81	81

Conclusions

The first aim of our project was to map the mobile phone signal strength, upload and download speeds for Eir, Three and Vodafone in North Clare area and to examine what effect topography has on signal strength, upload and download speeds for different providers. From our results, we had found a great variety of signal strengths ranging from no coverage at all to very high signal strengths between the three networks throughout the different locations.

Our second aim was to examine the effects topography has on signal strength in our area (25 km² covered). The strength of a signal relies on the line of sight from tower it's directed to. We found that the signal strength from higher ground was not always better than on lower ground. This was borne out by our correlations being weak in relation to altitude and upload and download speeds. However if the location was in line of sight of a signal tower coverage was better whether on lower or higher ground. For example, there was good coverage on low ground along the coast as it was able to receive a signal from the Aran Islands.

Around Oughtara there are high cliffs, and even on the road down to the bottom of the valley you can get coverage because it is in the line of sight for Doonagore, Slieve Elva or the Aran Islands. However, in the bottom of the valley the coverage is very poor or non-existent.

Our third aim was to see if the data we collected was in line with the coverage maps provided by COMREG. Once we had measured all the signal strengths and copied them into an Excel file, we found the averages which we then used to create 2d and 3d maps. We agree that these maps create a very accurate and great visual which helped us come to conclusion that topography does have a significant effect on the mobile phone coverage in north Clare.

Our final aim was to see if further mast location could alleviate coverage blackspots. If you look at the upload and download maps you will see that near Ballinalacken there is very low download and upload speed, even though it is surrounded by high upload and download speeds. This is a low area called Oughtara. It is very low down. Down in the valley you have no line of sight with a transmitter so therefore poor or no coverage.

Remember in our research we looked at coverage in the open air two meters from the ground. Inside buildings it would have lower coverage. People down in the bottom of Oughtara say there is no coverage at all.