AS91011 The Ground Shook- Canterbury Earthquakes

Problem

Help people to understand the Canterbury earthquakes geographically and visually.

Introduction

The region of Canterbury experienced many earthquakes between 2010 and 2012 with some having devastating effects on people and the environment. Geologists recorded these earthquakes as well as the many aftershocks that have kept Canterbury on edge.

The Canterbury Earthquake Recovery Authority (CERA) was set up by the New Zealand Government and is an organisation that leads recovery work in the Canterbury region following the huge series of earthquakes since 2010. One of CERA's aims is to produce material that the wider population of NZ can understand about the effects and significance of the earthquakes. They also want this material to be available for other organisations to use to help inform people for example newspapers.

I am going to produce a media package that covers what CERA wants available to the public. It will visually and geographically help show people the effects of these earthquakes on people and the Canterbury environment.

My media package will include:

- A WebMap that shows the distribution of earthquakes during the 2010 and 2012 period in the Canterbury region and examples with information of major effects of the earthquakes.
- A report about the effects of the earthquakes on people and the built environment of the Canterbury Region, as shown on the WebMap.

Process summary

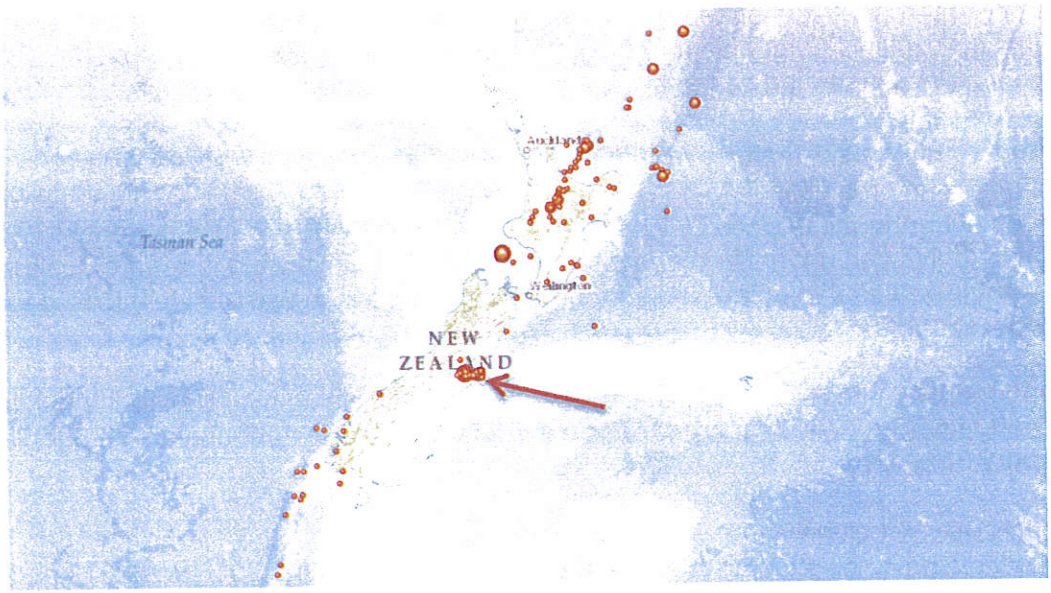
What follows is a process summary of the steps I under took to complete this media package for CERA.

1. Set up a profile on ArcGIS online.
2. Set the basemap to topographic which gave a relief background to my map.
3. Went to the Geonet website to access data for 2010-2011. I then selected earthquakes with a greater magnitude of 5 because these earthquakes are the ones that can have a dangerous effect on the environment, so are the ones that are best to look at. This means the distribution of earthquakes on my map will be much more significant.
4. Saved this as a CVS file which means it can be read online by ArcGIS.
5. Added this data I received to ArcGIS online by using the add data tool.
6. Changed the symbols of this data so that the bigger magnitude earthquakes had larger circles. This made it easier to identify bigger earthquakes from smaller ones.
7. Edited the data so that when each earthquake that is clicked relevant information pops up about it. I removed information that is not needed for example the latitude and longitude data.
8. Noted the pattern of the earthquakes and where the strongest earthquakes were clustered.
9. Created polygons to show where the red zone with the greatest damage is located. It would help to see if there was a relationship between the location of these zones and the location of major earthquakes and major damage, however there was a fault with the website where we gathered this information so my mapping could not be completed.
10. Researched where different effects of the earthquake were located for example the Christchurch Cathedral.
11. Created 'pop up' information boxes. This was to show where the effects occurred and also to see if there was a relationship between the location of the red zone and the location of specific effects such as liquefaction. Since the red zone could not all be made, this was hard to tell and isn't shown on my map.
12. Took screen captures of stages of my WebMap to include in my report which follows below.

Report

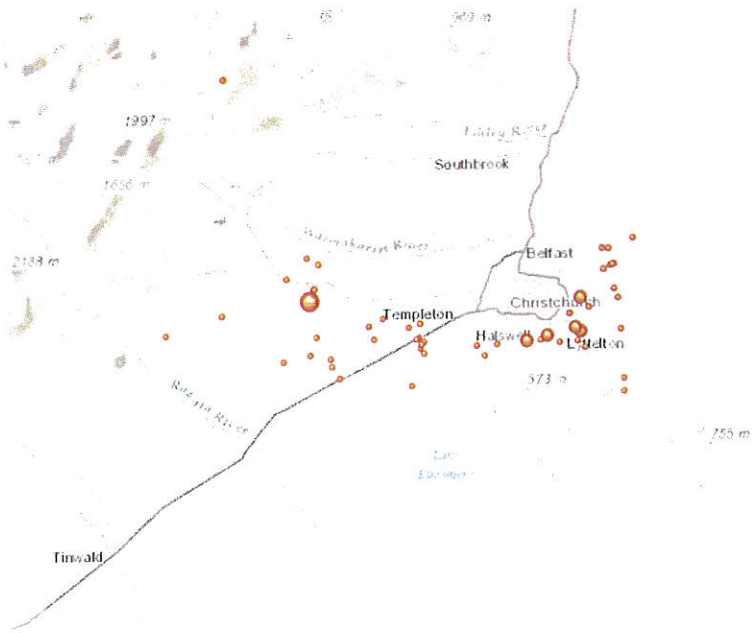
This is the report I have presented to CERA which gives an overview of the effects on people, land and the built environment of Christchurch due to the earthquakes and is shown by screen captures of the WebMap.

Shot 1- Location of Christchurch in New Zealand



Over many years Wellington was the city that was thought to have the highest risk of a major earthquake occurring in NZ. Because of this a lot of earthquake strengthening focus was put on to Wellington and not so much other cities for example Christchurch, meaning it was not prepared for the earthquakes it received as it was never looked at as the place to have a major quake.

Shot 2- The Location of the Earthquakes



This screen capture of my map is all of the earthquakes from 2010-2012 that occurred in Christchurch with a magnitude over 5. As you can see they form what looks like a line around Central Christchurch which relates back to the damage that will be shown in other screen shots. The largest magnitude earthquake was out to the west of Christchurch and is why there was not

a lot of severe damage because of the fact it was centred away from people and their built environments. However, the few larger dots that are hanging very close to Central Christchurch show why there was a lot of damage when these quakes struck because of the distance to people and built environments. The earthquakes over a magnitude of 5 are the ones that can have a dangerous effect on the environment, so are the ones that are best to look at meaning these points on the map are much more significant.

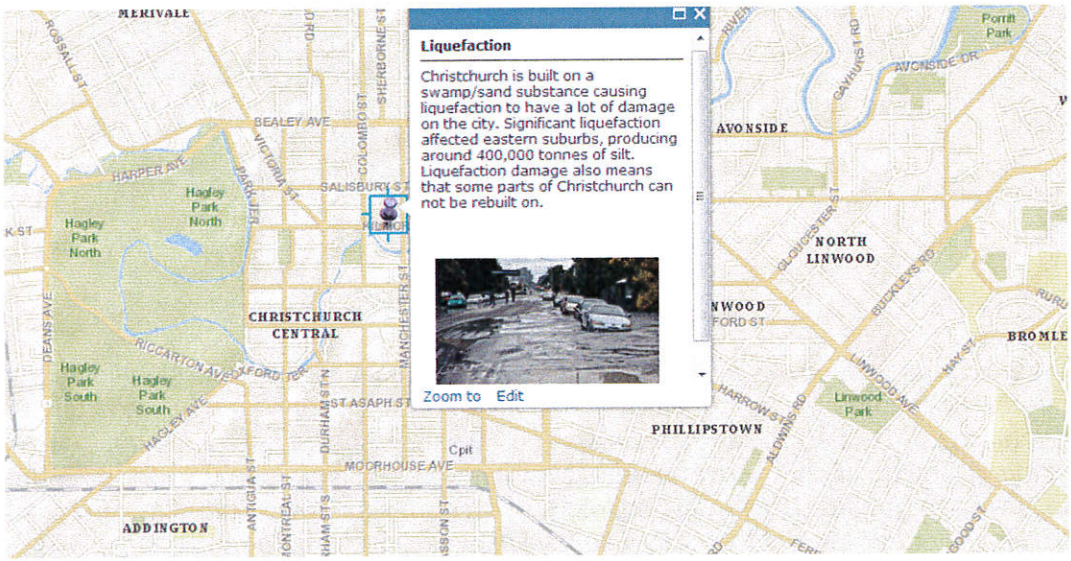
Shot 3- The Red Zones

Land is red zoned when it is unlikely in can be built on for a long time, there is significant and extensive area wide land damage, the success of engineering solutions may be uncertain and when any repair would be disruptive for land owners. This map shows one of the many sections of the red zone in Christchurch. I was unable to complete the red zone of my whole map because the website which we gathered this mapping information from was down during most of this project time. However I know that the CBD was basically all classified as red zone as well as some suburbs close to town. More of the red zone was mostly to the west of this section that is mapped. The red zone area changed over time due to the development of the city and the progress that has been made or what new danger discoveries have been made. It would have been good to get the whole red zone mapped onto my WebMap as it would help to show the relationship to the damage and the relationships to the earthquakes themselves.

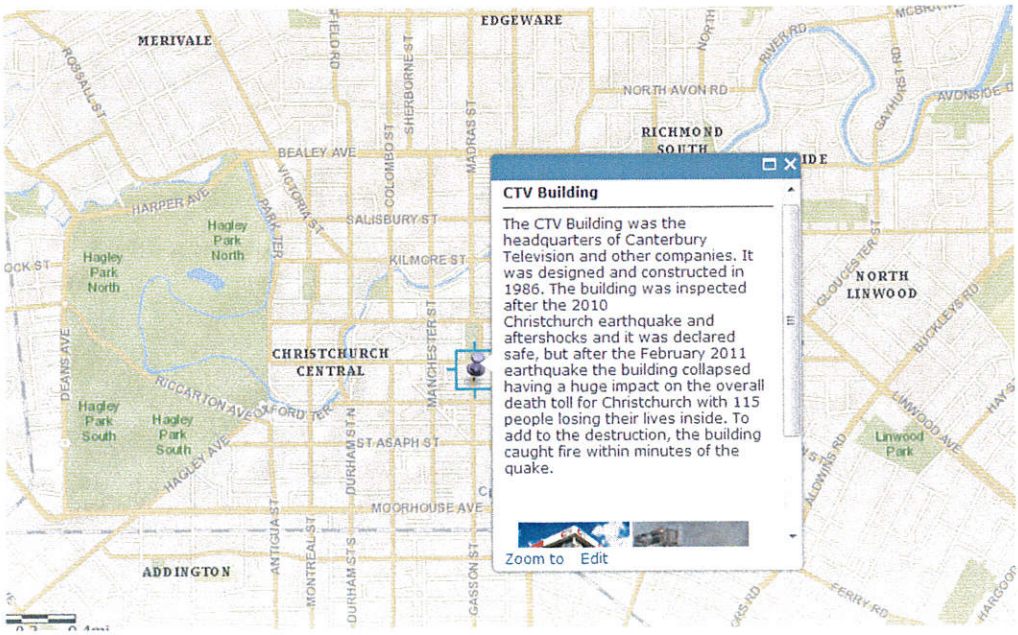
Shot 4- Pins of Damage

This is a photo with all of the pins that I have added to my map. As you can see they are all centred around or are very close to Central Christchurch. The ones that are a bit further away are up north slightly and this is because it was just put as a random example of road damage but this could have been anywhere closer to town, and the pin to the east is explaining the red zone but as we know this could have been centred right in the middle of town if I had been successful with the polygon drawing. We now have a better idea of the relationship between the damage that the city suffered from the very nearby earthquakes if we compare this screen shot to the second one, as it is all clustered in one as well as the significant earthquakes.

This is a few examples of some of the pins that I placed with areas that suffered significant damage in the built environment of Christchurch. This damage affected people in mainly negative ways as many people lost their homes due to damage and liquefaction or simply because the land is deemed unsafe to live and rebuild on. The damage is still being counted, and estimates are in the region of $20-$30 billion dollars. Many governments, organisations and individuals from New Zealand and from all over the world have helped out. However, there was an upside for some as employment in the construction industry increased by 4,500 (18 percent) in Canterbury over the year to September 2011.



This pin shows one of the many areas that suffered liquefaction in not only the city itself but other nearby suburbs in Christchurch. This is one of the major problems that the earthquake caused to the environment of Christchurch and became a real hassle for many people as it kept coming and was very hard to clear.



The CTV Building right in Central Christchurch became a major construction process and was one of the worst destructions on the built environment due to earthquakes and it suffered the highest loss of life as a building in Christchurch with 115 people losing their lives inside.

The second shot shows the pattern of the earthquakes. The effects were different in 2011 from 2010.

2010

This earthquake caused no loss of life and damage was not as severe as the later quakes. This could very well be linked to the fact that it was centred to the west of the main city (shown in shot 2) in a more remote area of Canterbury where not a lot of people live so therefore there was not a lot in the area that could be damaged. This earthquake did cause some initial structural damage to buildings and areas for example the Christchurch Cathedral was closed for inspections until 22 September when it was deemed safe to re-open. However, after the February 2011 earthquake a lot of damage was sustained which increased throughout more 2011 quakes. This is a pin that can be brought up on my WebMap.

Christchurch suffered damage to the city after this quake and everything that happened from this one lead onto worsening damage in the next (2011). Sewers were damaged, and water lines were broken. Power to up to 75 percent of the city was disrupted. Several cases of gastroenteritis were reported due to damage to buried pipes that may have allowed sewage to contaminate the residential water supply.

Many more heart attacks than usual were reported in the days following the quake. Usually the heart unit at Christchurch Hospital handles two to three heart attacks a day, but the rate had risen to eight to ten a day since the earthquake.

Many people still suffer from economic and social stress and even some larger physiological effects as a result of this very first earthquake. Many people have lived on edge with the reoccurring aftershocks from this initial quake.

The Canterbury earthquakes beginning in 2010 have had a major economic impact on the region itself and on New Zealand as a whole. The earthquakes rank as one of the most costly natural disasters for insurers worldwide since 1950. Treasury's assumption is that the rebuild will cost the equivalent of around 10 percent of Gross Domestic Product (GDP), which represents a 'very large shock' in relative terms.

2011

This was the earthquake that had the greatest amount of structural damage and loss of life, therefore the effects were much worse from this time.

Following this quake the Central City Red Zone was set up. This proves how much more destructive this earthquake was to extensive areas in Christchurch. The Red Zone did change over time due to the development of the city and the progress that has been made or what new danger discoveries have been found.

The pins on my WebMap that I have given examples from earlier show that the 2011 earthquake (one of the bigger dots in shot 2 right under the Central City) caused the majority of damage in Christchurch as it was centred very near town where people live therefore where there is built environment for example the AMI Stadium suffered structural damage from this quake but not from the 2010 one.

This earthquake had big problems for Christchurch as well as effects on people and the environment. The overall accommodation capacity of the Canterbury region has decreased since the earthquakes, particularly hotels and backpacker accommodation. International guest nights were down 32 percent in the Canterbury region in September 2011 (compared with September 2010) and domestic visitors down 23 percent. Canterbury's tourism businesses lost $230 million in 2011 because of earthquake destruction and overseas visitors shunning the city. This has a huge effect on the economy of Christchurch and New Zealand as well as the tourism factor in itself.

Conclusion

The main purpose of the WebMap that I made was to give CERA a way to help people in the wider community understand the effects of the Christchurch earthquakes to people and the built environment in an interactive way that gave visual information relating to locations. It is a way for people to easily understand and make connections between two things that are on my WebMap,

rather than the information just being written down. It is also a much more interesting way to explore Christchurch with helpful pictures so that people can get a real idea of the damage.