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Candidate session number

Candidate name

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School name

Examination session (May or November)

MAY

Year

2012

Diploma Programme subject in which this extended essay is registered: GEOGRAPHY

(For an extended essay in the area of languages, state the language and whether it is group 1 or group 2.)

Title of the extended essay: IMPLICATIONS OF THE FLOOD OF 2002 FOR THE CITIZENS OF GALLNEURIBCHEN, UPPER AUSTRIA

Candidate's declaration

This declaration must be signed by the candidate; otherwise a grade may not be issued.

The extended essay I am submitting is my own work (apart from guidance allowed by the International Baccalaureate).

I have acknowledged each use of the words, graphics or ideas of another person, whether written, oral or visual.

I am aware that the word limit for all extended essays is 4000 words and that examiners are not required to read beyond this limit.

This is the final version of my extended essay.

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Date: 27.2.2012

Supervisor's report and declaration

The supervisor must complete this report, sign the declaration and then give the final version of the extended essay, with this cover attached, to the Diploma Programme coordinator.

Name of supervisor (CAPITAL letters) _____

Please comment, as appropriate, on the candidate's performance, the context in which the candidate undertook the research for the extended essay, any difficulties encountered and how these were overcome (see page 13 of the extended essay guide). The concluding interview (viva voce) may provide useful information. These comments can help the examiner award a level for criterion K (holistic judgment). Do not comment on any adverse personal circumstances that may have affected the candidate. If the amount of time spent with the candidate was zero, you must explain this, in particular how it was then possible to authenticate the essay as the candidate's own work. You may attach an additional sheet if there is insufficient space here.

The teacher was informed about the topic of this Extended Essay well in time, however, the student did not consult the teacher for a long time afterwards and handed in a more or less final version of the paper at the end of January. Thus, the stages of planning the essay, gathering information and evaluating this information occurred unsupervised. The authenticity of the paper could be ~~proven~~ proven by a final viva voce which showed that the student created/wrote the paper herself, although the understanding of the subject is partly very shallow and there's no real insight into the topic.

This declaration must be signed by the supervisor; otherwise a grade may not be issued.

I have read the final version of the extended essay that will be submitted to the examiner.

To the best of my knowledge, the extended essay is the authentic work of the candidate.

I spent hours with the candidate discussing the progress of the extended essay.

Supervisor's signature: _____

Date: 27.2.2012

Assessment form (for examiner use only)

Candidate session number

Achievement level

Criteria	Examiner 1	maximum	Examiner 2	maximum	Examiner 3
A research question	1	2	1	2	
B introduction	1	2	1	2	
C investigation	2	4	2	4	
D knowledge and understanding	2	4	2	4	
E reasoned argument	1	4	1	4	
F analysis and evaluation	1	4	1	4	
G use of subject language	2	4	2	4	
H conclusion	1	2	1	2	
I formal presentation	2	4	2	4	
J abstract	0	2	0	2	
K holistic judgment	1	4	1	4	
Total out of 36	14		14		

Name of examiner 1: _____
(CAPITAL letters)

Examiner number: _____

Name of examiner 2: _____
(CAPITAL letters)

Examiner number: _____

Name of examiner 3: _____
(CAPITAL letters)

Examiner number: _____

IB Cardiff use only: B: ✓

IB Cardiff use only: A: 104465

Date: 17/5

Extended Essay

Geography HL

**“Implications of the flood of 2002 for the citizens of
Gallneukirchen, Upper Austria”**

Wordcount :3675

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Abstract

In this Extended Essay the research question concerns the implications of the flood of 2002 for the citizens of Gallneukirchen in Upper Austria. Floods all over Europe occur more frequently, that might be because of global warming. During August 2002 many parts of Austria were flooded. Also Gallneukirchen, a small town about 15 kilometres from Linz was affected by the heavy rainfall. The water level of the river Große Gusen rose and caused severe damages to buildings and fields. Also the tiny rivers which join the Große Gusen became dangerous. The fire brigade and the Austrian Army had to deal with the problematic situation. They had to evacuate people, pump out cellars, and build dams of sandbags. Fortunately no one came to death because of the flood in Gallneukirchen, in contrast to other surrounding communities. As a consequence various precautions were established, to avoid future flooding or severe damages.

Vogel

Elektrore not

Clear at all — —

Conclusion —

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Introduction

In this Extended Essay I am going to take a close look on the flood of August 2002. In particular I am going to examine to what extent the flood of 2002 of the Große Gusen influenced the citizens of Gallneukirchen, a small Upper Austrian town about 15 kilometres from Linz.

✓ Broad and Vague A-1 Apr

I have chosen this topic because this natural disaster was a very shocking incident in my life. I was only 8 years old when Gallneukirchen was flooded, but I can remember the ruined houses and bridges, flooded fields and roads. Since this event I am convinced that it is very important to deal with the prevention of floods and the avoidance of severe damages. It is widely maintained that floods with dangerous effects can only take place far away, for example in Bangladesh. But I have seen that floods can also destroy huge parts of Austria. The same experiences have made the people I have been questioning for getting my data. A remarkable fact is the helplessness of the affected people.

See signature

In this paper I will give an overview of the flood of August 2002 of the Große Gusen. I will show the possible causes of the flood, furthermore I will describe the effects of the flood on the inhabitants and the nature and I will deal with the preparedness of the community. Then I will present my collected data and the evaluation of the data.

Hypotheses

- 1.) Inhabitants of Gallneukirchen are more aware of the dangers of flooding, and take precautions to prevent damages.
- 2.) Politicians and local authorities help the inhabitants living in houses next to the Große Gusen in case of flooding
- 3.) Because of global warming there is increasing precipitation, which causes floods. ??
- 4.) People take measurements to avoid severe flood- damages .

Far too many and are of .
far impossible to demonstrate

Main Body

Gallneukirchen is a small town 300 metres above sea level (in Austria it is considered a city, but seen worldwide it is only a small town) in Upper Austria, one of the 9 federal states of Austria. It is located in the northern part of Upper Austria in the Mühlviertel, which is a small province. Gallneukirchen has about 6000 inhabitants, but the number of people living there is increasing. It has an area of about 5.15 km². Gallneukirchen is surrounded by four hills, the Gallusberg in the west, the Punzenberg in the north, the Tumbachberg in the east and the Linzerberg in the south. Gallneukirchen is divided into three parts.

The Große Gusen which is about 30 km long flows through Gallneukirchen. It starts in the Bohemian Massive and flows south east until it reaches the Danube at Mauthausen. From the Bohemian Massive to Mauthausen, the Große Gusen flows through deep valleys and wide basins. At Gallneukirchen there is a basin, which is called "Gallneukirchner Becken". The Gallneukirchner Becken consists of two other towns, which are relatively small in size: Engerwitzdorf and Alberndorf. In the Bohemian Massive two minor rivers, the Rohrbach and the Grasbach, join the Große Gusen, then in Gallneukirchen the Lissi, Mirellenbach, Schladerbach and the Schweinbach join the Große Gusen as well. This can be seen on map 4: .

7
(1.13)

Map of Austria

Map 1:



Source:www.zonu.com

This map shows Austria and its 9 federal states. Upper Austria is located in the north and it is coloured green. The capital city of Upper Austria is Linz and about 15 kilometres away from Linz Gallneukirchen can be found.

Map of Gallneukirchen and the Große Gusen

Map 2:

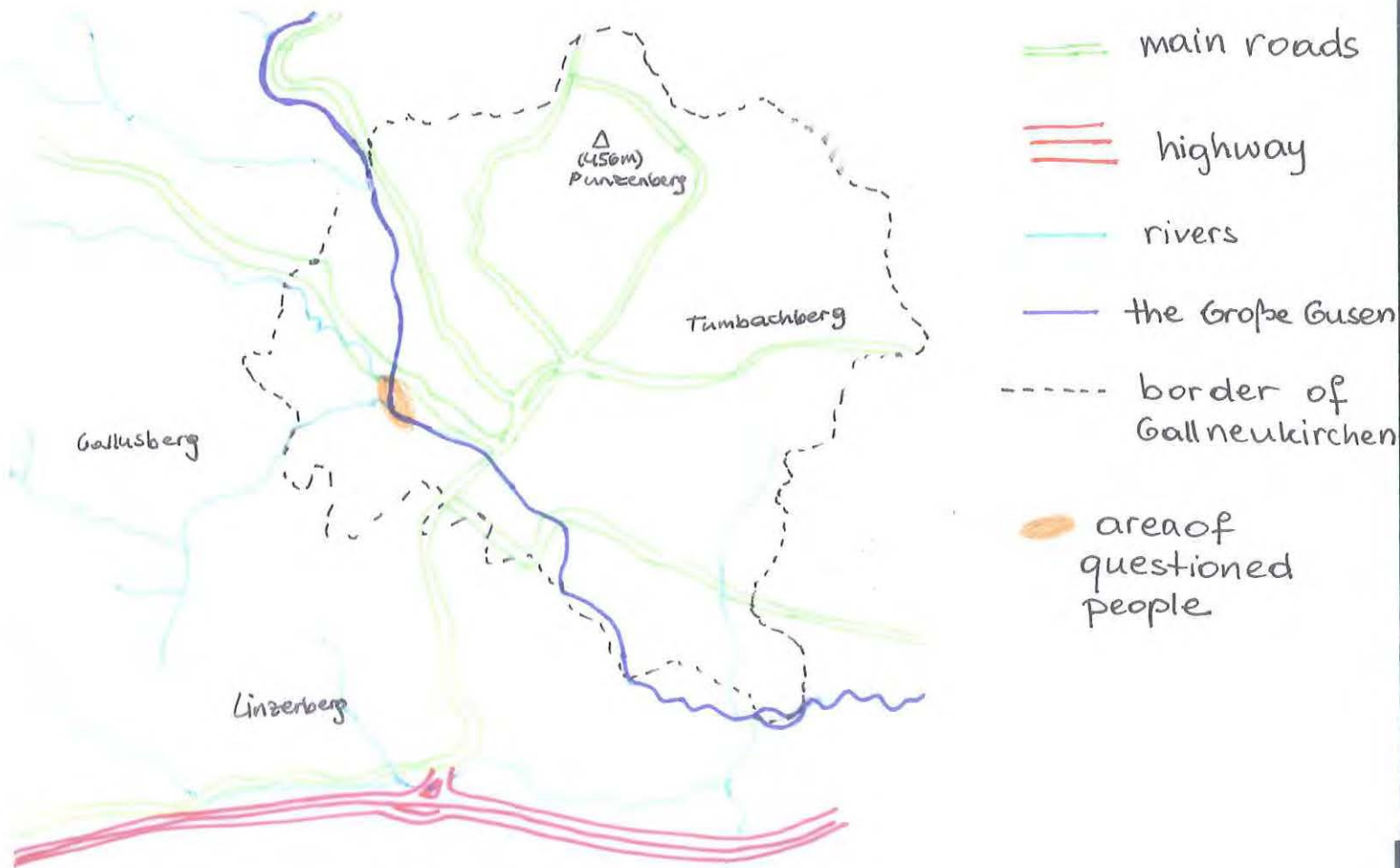


Source:www.wikipedia.org

This map shows Gallneukirchen. It also shows the Große Gusen. Down to the west you can see Linz.

Map of Gallneukirchen and the flooded area, where I distributed my questionnaires

Map 3:



See w.

Source: City Hall of Gallneukirchen, selfdrawn

From this map the four hills, Punzenberg, Tumbachberg, Linzerberg and the Gallusberg can be seen. Also the Große Gusen is indicated. Also the area of the questioned people is indicated.

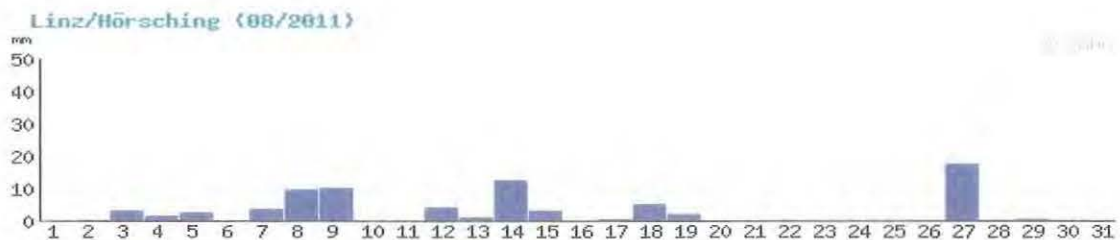
The flood of 2002

In summer 2002 the water of the Große Gusen rose so much, that the whole basin of Gallneukirchen was flooded. This flooding was due to precipitation. It was a 100-year flood, not only in Gallneukirchen but also in every part of Austria. Also other European countries were affected. Many people died and millions of houses and buildings were destroyed. Unfortunately there were two floods, one from the 6th to the 9th of August 2002 the other occurred from the 11th to the 15th of August 2002. For Gallneukirchen the first flood was more damaging to houses and buildings, because the heavy rainfalls came rather unexpectedly. Before the flooding, Gallneukirchen experienced a very hot and dry summer with average temperatures rising from 24°C to 31°C. That is why, the high water of the Große Gusen was so damaging. The soil was dry and was unable to soak up so much water. Nearly in every region in Austria it rained 30 mm per m² within 48 hours, but in the north of Austria, which means in the Mühlviertel, it rained far more than 60 mm per m² during these 48 hours. This graph shows the precipitation of August in 2011 in Linz. The amounts of water are rising from 0 mm per m² to 13 mm per m² per day (I only looked at the data from the 6th to the 9th of August 2011 and the 11th to the 15th of August 2011). It can be said, that the rainfall of 2002 was in some areas twice as high and in some areas even six times as high as the rainfall of 2011.

Graph showing precipitation in Linz of August 2011

Graph 1:

best scale?



www.zamg.ac.at

Methodology

For getting my data I used several methods. I made 30 questionnaires, which people living next to the Große Gusen had to fill out, moreover, I went to the City Hall and asked for information about the flood in Gallneukirchen, and I took notes, while they told me their stories. Then I went to the fire department of Gallneukirchen and asked them what they did during the flood and how they were saving houses from being flooded.

The 30 questionnaires, contained 5 questions each, and the inhabitants, which are living next to the Große Gusen had to answer them. It was on purpose that I created open questions, because I wanted to get as much information as possible.

The politicians and the employees of the city hall explained that after the flood of 2002 a flood protection was created. I was given some information about it, which was very useful for me, because I did not know anything about this topic. Also a fire-fighter of the fire department gave me data which I used to examine the flood. The data included the numbers of sandbags which were used. He also told me that 21 people had to be evacuated, because their houses were completely destroyed and it was not safe anymore to live in there. The walls of the houses could not carry the weight of the first floor (and second floor) and the roof.

I also used a book, which had maps of the basin of Gallneukirchen, which showed the flooded area. I also used it for explaining the average width a river needs during a flood, based on the Große Gusen.

For evaluating the cause of the flood I used two small articles ,one published by the Max-Planck Institute of Hamburg and another from the UNO.

First I will evaluate my questionnaires then I will examine the data of the fire department and of the flood protection.

Evidence of flooding

B. Context is described in a very superficial way.

Evaluation of questionnaires

From my questionnaire I got very similar answers which I want to evaluate.

28 people stated in their answer to question 1 that their property was destroyed, that is about 93.3 % . So 93.3% of the houses were damaged or destroyed, it is obvious that the Große Gusen really had much power, which should not be underrated. 63.3% said that their cellars were flooded, the remaining stated that the ground floor was flooded. 1 person wrote that the water in the kitchen was about 10 centimetres high. As I compared my results, with the places where the asked people lived, I noticed that the citizens of Gallneukirchen with the flooded cellars are all on one side of the Große Gusen. The others are on the other side. Every interviewed person answered to question 1a.) the same. All were calling the fire brigade to get help.

Also the answers of question 2 were the same. 30 of 30 people stated that the fire fighters pumped out the water very effectively, that is 100%. 100% of the victims were satisfied with the work of the fire department.

The answers to question 3 differ from each other. 7 people, that is 23, 3% said that such a flood would never ever will happen again and that they did not care about the change of the water levels of the tiny river. But the others stated that, they have underestimated the power of precipitation, and that it does not take long, that a small river develops into really dangerous body of water. Furthermore some wrote that they were not expecting the weather to rain, because it had been such a dry and hot summer before the flood.

76.6 % , that are 23 people, wrote down that the flood protection programme was introduced right after the flood. It measures the water level every day, and if the water level is too high, the fire-fighters come and protect the houses and gardens with sandbags. Therefore houses can be protected before the event will even take place. The members of that programme also build dams. Consequently the water cannot reach housing or buildings that easily. ✓

The last question was answered with 25 people saying "No" that is 83% of those who were asked and 5 people saying "Yes". The majority of those interviewed stated that they do not want to give up their home, due to a flood. That indicates that the citizens of Gallneukirchen haven a relatively "close relationship" with their river. The remaining 5 people stated that they enjoy their life, near the Große Gusen but if a 100-year flood will reoccur they would rather try to find another place to live.

graphs would be more helpful!

Data from the fire department

The information that I got from the fire department was also very interesting. In August 2002 the fire-fighters worked very closely together with the Austrian army. The fire fighters of Austria could not do everything for the citizens of Austria so they asked the Austrian Army to help them. The fire-fighter whom I talked to, gave me details about Austria [] and about Gallneukirchen.

Table showing data from Austria and from Gallneukirchen

Table 1:

	Austria	Gallneukirchen
People rescued by helicopters	740	0
People evacuated	12650	21
Programme : " Essen auf Rädern"	Yes (daily for about 1500 people)	No
Appartments for free to people which had lost their homes	16	0
Sleeping bags	650	0
Pullovers	800	4

Source: Fire department of Gallneukirchen

It can be seen from the table that in Gallneukirchen 21 people had to be evacuated. They had to move out of their houses, because it would have been too dangerous, to stay inside the houses. I calculated the percentage and 21 people of 12650 are 0.17 %. Moreover 4 Pullovers, which is 3.2 %, were handed out from the Austrian army to citizens of Gallneukirchen.

Flood protection in Gallneukirchen

The rain of August 2002 caused that the water levels of small rivers which join the Große Gusen to rise so much that the surrounding area there was flooded. The danger of a high water by tributaries is often underestimated. The danger that water penetrates into cellars and buildings is given by the rising of the ground-water level. These measures were taken after the flood of 2002.

- **permanent occupation of the municipality**
In case of a flood everybody of the city hall and other public institutions have to work. That means that solutions to upcoming problems (for example: flood) can be found easier.
- **fire departments are available and have to be on stand-by**
The fire department always has to be aware of possible alarms.
- **quicker evacuation programmes were introduced**
The fire department or the Austrian Army can react quicker in case of a flood.
- **erection of dams for flood-endangered buildings or areas**
In case of a flood dams will be build, to save buildings and housing areas.
- **the population takes up self-protective measures**
They will dig a ditch into the soil around their house.
- **safeguarding and cleaning-up operation**
After the flood everything will be cleaned up properly, in order that future floods cannot destroy that much.

endeb?

The flood protection of Gallneukirchen consists of these six rules, if they are obeyed, floods in the future will not have such disastrous effects on the people and on the surrounding area of Gallneukirchen.

Source: City Hall of Gallneukirchen

The space which a river needs during flooding

“For the smallest area, which a river needs, the average width of the Große Gusen and the rivers which join the Große Gusen were estimated. The large width of the Große Gusen in Gallneukirchen is due to the buildings and housing. One can say that buildings destroy the natural habitat of a river. So the Große Gusen cannot flow naturally. For creating this table (see table 2:) the 8 metres of the Große Gusen from the public pool to the end of Gallneukirchen are estimated. But they include the natural changes and the changes due to buildings and houses. And for the safety distance the width was doubled on every river bank. This value is between the suggested values (ranking from 3 times as large to 7 times as large on one river bank) of the safety distance at extreme flooding.”

source: Definition und Sicherung des Raumbedarfs von Fließgewässern, Sarah Höfler

Table 2:

Bodies of water	Average width of the body of water	Min.safety distance from every shore/riverside
Mirellenbach	2.5 m	5m
Lissi	2.5m	5m
Schladerbach	1m	2m
Schweinbach	3m	6m
Große Gusen from Riedegg to the public pool	6m	12m
Große Gusen from the public pool to the end of Gallneukirchen	8m	16m

then we need safety distance!

Source: Definition und Sicherung des Raumbedarfs von Fließgewässern, Sarah Höfler

Pool 1 km.

From this table 2: one can see that the width (of the Große Gusen from the public pool to the end of Gallneukirchen) is 8 metres wide and the safety distance is 16 metres on every river bank, so the safety distance is all in all 32 metres wide. You can see the rivers on map 4:

Map of Gallneukirchen and the most important rivers.

map 4:



Scientists state that a reason for the increasing danger of floods is the global warming

Article of Max- Planck Institute for Meteorology

The director of the Max Planck Institute of Meteorology Hartmut Graßl says that rainfall is increasing in all continents. The climate of the Mediterranean countries is getting dryer but the climate of middle Europe wetter.

The reason for the stronger rainfalls is the property of the air to store more steam at higher temperatures. Clouds arise in the atmosphere between minus ten and plus ten degrees. At a temperature of a degree centigrade, air can take about ten per cent more steam than at zero degree. "If warmer air masses are raised, then the arising clouds contain more liquid water or ice", explains Graßl. "And more water falls out of them per time unit. " This rather leads to inundations.

Source:www.orf.science.at

Article of the UNO

Another cause of the flood describes the article of the UNO

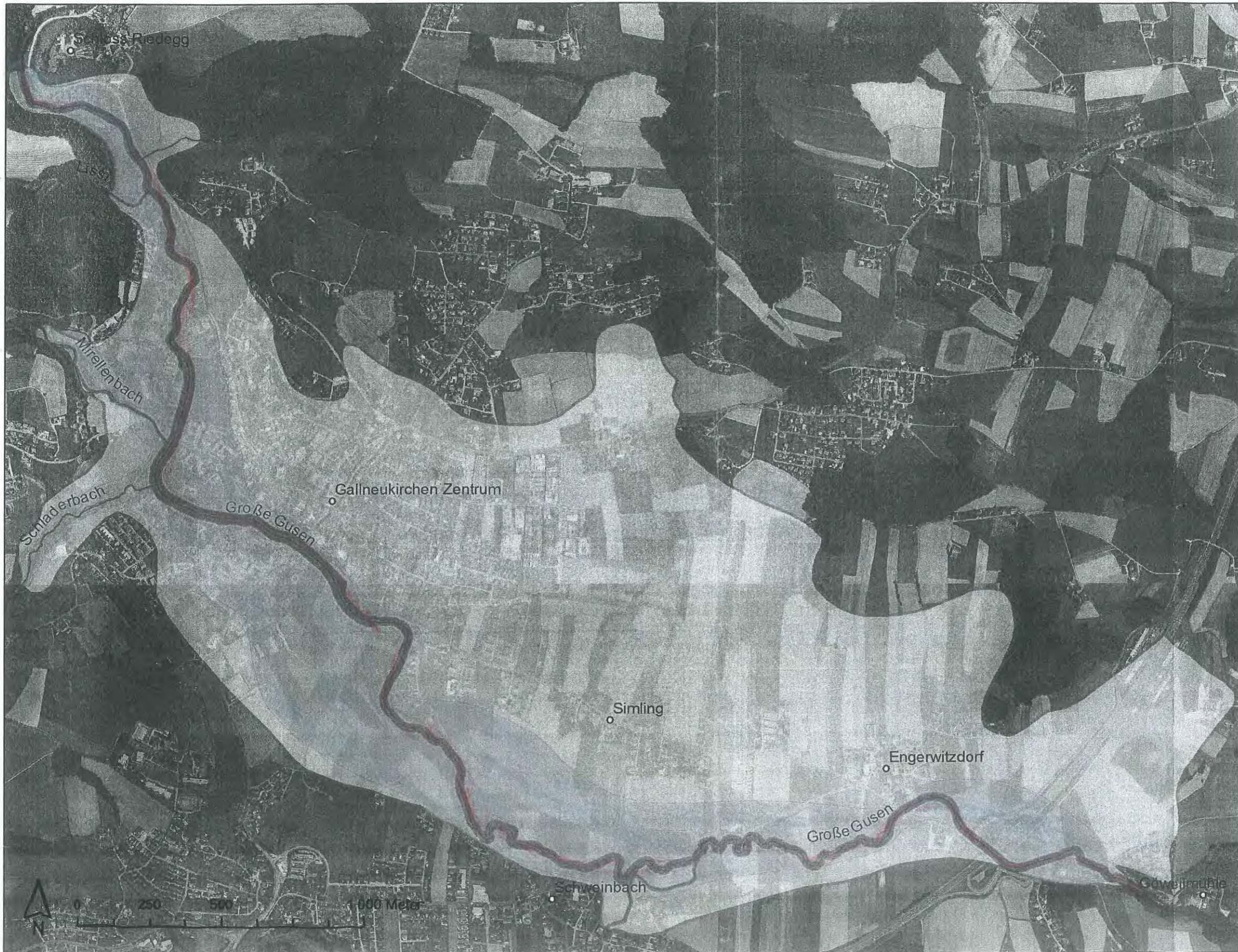
According to a report of the UN science advice for climate questions (IPCC) half of the glaciers will melt in Europe up to the year 2100. Therefore more and more rivers will flow over the shores. In addition the droughts will increase in Southern Europe.

Source:www.orf.science.at



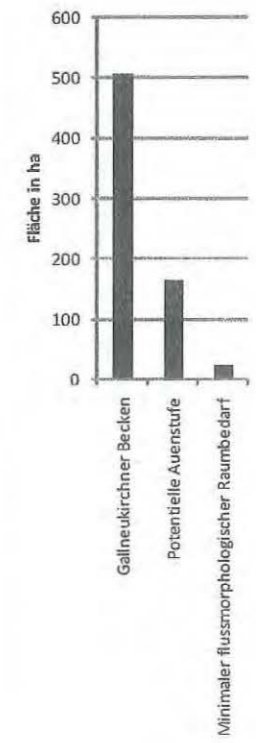
Überblick über die Große Gusen und ihren Raumbedarf im Gallneukirchner Becken

Karte 1



Legende

- Wichtige Orte *Important towns*
- Minimaler Flussmorpho- *smallest*
logischer Raumbedarf *space, the*
(fünffache Gewässer- *river needs,*
bettbreite) *(the width of the*
river bed → times 5.
- Potentielle Auenstufe
possible flood plain
- Gallneukirchner Becken
basin of Gallneukirchner



Diplomarbeit Sarah Höfler
Kartenerstellung: April 2010

Quellen: Stadtgem. Gallneukirchen,
Amt der OÖ. Landesregierung, DORIS,
BMLFUW: eHora und eBOD,
Pascher, 1996; Eitler et al., 2002;
Gumpinger, 2001

This map (map 5:) shows the basin of Gallneukirchen which is coloured white, the Große Gusen with the smallest space the river needs and it is coloured red, then the blue part is the possible flood plain.

The blue coloured area indicates that this area is always very wet even when it is not raining, but if it is raining this area is flooded very quickly. Moreover it can be seen from the map that the red area of the Große Gusen is larger than in other towns, for example at the "Göweilmühle" which is located in the east the red area is rather thin. The large red area in Gallneukirchen might be due to the buildings, which do not allow the Große Gusen to flow in a natural way. Now one can imagine which parts of Gallneukirchen were flooded in summer 2002 .Not only the water level of the Große Gusen rose, but also had the water levels of other rivers risen.

Actually the whole white area was flooded. Many roads were closed and you were not allowed to walk over wooden bridges. In 2002 the blue part was flooded completely, and as it is always wet and fertile there, even in summers, farmers often grow corn and wheat there. Unfortunately everything was damaged and the farmers had to deal with huge losses. The only areas where no cellar was pumped out and where nothing was damaged were on the four hills : Gallusberg, Punzenberg, Tumbachberg and the Linzerberg. The water ran down the streets in small rivers and flooded the centre of Gallneukirchen ,instead.

*Simple /
nature*

Conclusion

In this essay I have shown where in Upper Austria Gallneukirchen and the Große Gusen are located. I have also dealt with the importance of the small rivers, which join the Große Gusen. Furthermore I have summarised the information from the fire department about the damages and the measures which were taken. Moreover I have evaluated the questionnaires of the asked people and have presented my results. In addition I have examined the relation between global warming and the amounts of precipitation.

Concerning the hypothesis I have stated in this essay I have found out the following interesting information.

It is a fact that a great percentage (76.7 %) of the inhabitants of Gallneukirchen are now more aware of the danger of flooding than before 2002. They stated that before the flood they would not believe that the Große Gusen could become such a dangerous river. As a result they watch the water levels if it is raining 23 people (76.6%) wrote down that they feel secure and safe due to the flood protection programme which was introduced shortly after the flood. Nevertheless five people (17%) have considered moving away from the Große Gusen.

Secondly it is true that politicians help in case of flooding. Shortly after the flood the flood protection programme was introduced in Gallneukirchen. The water level is measured every day, if it is too high houses will be protected with sandbags. In addition dams were built. Members of the City Hall and of the fire department have to be on stand-by. Therefore they can react quicker in case of flooding.

Many experts warn the population about the effects of the global warming. One theory is that the precipitations increase because the air holds more water when the temperature rises. Consequently big rivers as well as small rivers flood more often. Moreover there are longer dry periods. So the ground is unable to soak up water. Due to that problem the damages caused by floods are getting more disastrous all over the world. Others claim that the melting glaciers are the cause of flooding.

Several measurements to prevent flood damages were taken. In 2002 the fire department gave people information about the flood. Unfortunately it was too late as the flood had already destroyed public buildings and houses, roads and bridges. Now as prevention the fire department of Gallneukirchen offers a workshop every year how to deal with flooded cellars, gardens and ground floors. So the most severe damages can be avoided. Another step to decrease the negative impacts of flooding is that politicians decided that new companies and houses are not allowed to be built that close to the river Große Gusen. The inhabitants of the houses next to the Große Gusen can protect their property by using sandbags and digging ditches. Moreover dams were built so the water will be held back when it rises.

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C - 2 only one data not
exp...

D - 2 distinct methodology way
~~the expected~~

E - 1 question is not answer

F - 1 analytical method?

G - 2 Suppliers in macro analysis

H - 1 not location in data.

BIBLIOGRAPHY

Map1: www.zonu.com

<http://www.zonu.com/detail/2011-06-28-13971/Estados-federados-de-Austria.html>

Map 2: www.wikipedia.org

http://upload.wikimedia.org/wikipedia/commons/1/1d/Gallneukirchen_Stadtgliederung.png

Map 3: City Hall of Gallneukirchen , selfdrawn

Map 4: City Hall of Gallneukirchen , selfdrawn

limited

5 Map: Definition und Sicherung des Raumbedarfs von Fließgewässern, Sarah Höfler

Graph1 : www.zamg.ac.at

http://www.zamg.ac.at/klima/klima_monat/niederschlagssummen/?jahr=2011&monat=08

Table 1: Fire department Gallneukirchen

Table 2 : Definition und Sicherung des Raumbedarfs von Fließgewässern, Sarah Höfler