

ESA SCHOOL PROJECT

“CLIMATE DETECTIVES 2020”

**SCIENTIFIC HIGH SCHOOL CARLO
CATTANEO**

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THE DISSOLUTION OF GLACIERS

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The impact of human activities on the environment around us has led to severe consequences and so-called global warming over time. Among the main consequences of global warming that affect our planet is the melting of glaciers. The impact that this event is having on the planet is very serious and also leads to an increase in the level of the oceans. According to the IPCC report, glaciers will lose more than a third of their mass on average and some mountain ranges will lose 80% of the ice by 2100 and other glaciers will disappear altogether. Future changes in the cryosphere on land will inevitably affect resources and their uses, such as hydroelectricity and agriculture, fires will increase significantly for the rest of the century, in the tundra and in the boreal regions. The international media now prefer to talk about the climatic emergency rather than, generally, global warming: the European Parliament on November 28 approved a resolution to declare the climatic and environmental emergency in Europe and in the rest of the world reiterating the urgency of adopting a strategy common to achieve carbon neutrality by 2050. A 55% reduction in greenhouse gas emissions must be targeted by 2030.

The cryosphere: why should we preserve it?

The cryosphere (40% of the planet is covered by ice and snow) performs several fundamental functions for our life: it represents a shield, a fresh water reserve and also acts as a global "thermostat". The ice melts although it is white due to the rise in global temperatures which in turn inevitably affects the temperature of the oceans which, unlike ice, tend to absorb solar radiation massively. This creates a vicious circle called Positive Feedback Loop:

1. the global average temperature increases;
2. consequently, the temperature of the oceans increases;
3. Arctic ice melts, due to the temperature of the oceans;
4. decreases the reflective surface to repel solar radiation;
5. the ocean absorbs a little more solar radiation;
6. return to step 1.

Reasons

The main factors to which the melting of glaciers can be attributed are: the increase in the concentration of greenhouse gases and deforestation or intensive farming. It is true that the greenhouse effect is a natural phenomenon but human activity has unfortunately increased the effect with consequences on the radioactive and thermal surface balance of the earth. In fact, the melting of glaciers is evidence that the terrestrial cooling system "is breaking".

Polar ice melting

The poles tend to undergo amplified what happens in the rest of the globe. The poles have warmed by over 4 ° C in this century: this has caused, in the last 10 years, an arctic ice loss of 278 cubic km of ice per year, while in Antarctica the loss has been 155 cubic km . The estimate on the rate of degrowth of Arctic ice is between 3.5 and 4.1% for each decade and the average age of the Arctic ice cap is always lower: only very few portions of glaciers exceed 5 years of life

On the other side of the globe, however, the surface occupied by Antarctic ice has not changed much. While Arctic ice floats on the sea, Antarctic ice rests on a continent (Antarctica). For this reason, Arctic ice is sensitive to the temperatures of the waters in which they float, and which tend to warm up more easily. Antarctic ice, on the other hand, is located above sea level, therefore less sensitive to variations.

However the level of the Earth's oceans grows at a rate 50% higher than the average recorded in 1993, and about 25% of the water arrives from the glaciers of Greenland which contributes to this alarming increase. Using the satellite data series, it was possible to establish that while twenty years ago the sea level grew at a rate of 2.2 millimeters per year, today the growth is of the order of 3.3 millimeters per year. that in about 30 or 40 years the glaciers will have disappeared.

Consequences of melting glaciers

The main consequences of melting glaciers are:

- Increase in the level of the oceans. The water level rises covering most of the continental areas which, in a few years, could be completely submerged
- Climate change. The balance of cyclonic and anticyclonic structures change and the weather conditions, as they say, "go crazy" (increase in extreme events)
- Food chain imbalance. The habitats of many marine and terrestrial species change by disrupting the natural cycle

HEAT WAVES



PROVENANCE

The heat wave is generated in the northern hemisphere by the descent of cold air from north to south; in the southernmost point an area of low pressure is generated which feeds the rise of hot air in the areas located east of it. In the high pressure area, currents tend to flow from the south-west along the westernmost edge located near the depression, from the south in the heart of the anticyclonic area, while the eastern end tends to be affected by northern influences.

FEATURES

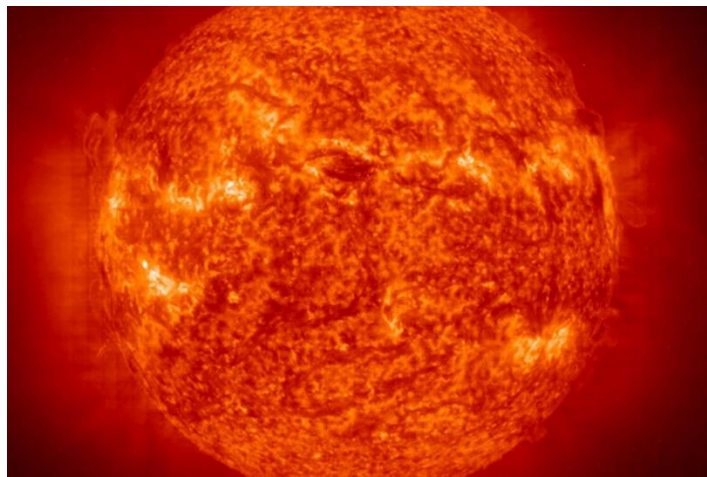
The term heat wave is defined differently in different countries. According to the World Meteorological Organization, the heat wave is characterized by a large heating of the air which raises temperatures, or is the cause of the arrival of abnormal hot air waves. According to the French meteorological service, with heat ode we can mean periods with maximum temperatures above 30 ° C. For US experts, three consecutive days with maximum temperatures above 32 ° C are

sufficient, while for the British meteorological service temperatures at least 4 ° C higher than the average for the period are sufficient. In the Netherlands, heat wave is considered to be a period characterized by a minimum temperature of not less than 25 ° C for at least five consecutive days and a maximum of at least 30 ° C for three consecutive days.

Europe can be affected by multiple heat waves over the same summer season, which can have a variable number of days of persistence depending on the areas examined.

In the countries north of the Alps, the average duration of a single heat wave is rarely longer than a week.

HEAT WAVES IN PIEDMONT



Also in Piedmont the historical analysis of the data, edited by Arpa Piemonte, highlights some changes in the meteorological variables, including temperature, rain and snow.

The temperatures have undergone an increase, especially in the maximum values, which reaches 2.3 ° C in the last 60 years and is in line with what has been highlighted by the literature for the Alpine area.

The trend of intense rainfall is more uncertain, but seems to be growing. The rainy days, considering the last 15 years or so, are decreasing almost all over the region, while the maximum length of

the dry periods increases. The annual rainfall, in the same period, has undergone changes, with an increase in some areas such as the Verbano and the lower Alessandrino and a decrease in others.

Comparing the two indicators, there is an increase in intense events where the annual rainfall has increased.

The amount of fresh snow has decreased overall over the past thirty years, even if individual particularly snowy seasons are highlighted in the same period.



PREVENTIONS

Temperatures are rising sharply and a heat wave of particular intensity. The Piedmont Region has developed a program to prevent damage to health due to summer heat waves: the information campaign aims to raise awareness of the main prevention measures to limit negative effects on health, while in the city of Turin carried out a monitoring aimed in particular at the population over the age of 75.

The effects of heat on health derive from the combination of some meteorological variables such as humidity, temperature, wind speed, consecutive days of heat.

Using this information and combining it with other health-related ones, the Forecast Systems and Environmental Epidemiology Department of Arpa Piemonte have developed a forecast forecast of the heat so that the population can adopt behaviors and precautions to prevent damage to health.

Heat waves occur when there are very high temperatures for several consecutive days, often associated with high humidity, strong solar radiation and absence of ventilation: climatic conditions that can pose a risk to the health of the population. The health risk levels set by the

Ministry are defined in relation to the climatic conditions of a specific city. Past experience has shown how an unexpected heat wave can lead to lethal outcomes and serious damage to the health of the population. In Italy at least eight thousand elderly people died as a direct cause of the heat wave of the summer of 2003: they were mainly lonely elderly people, over 75 years of age and with concomitant diseases.

Prevention of the negative effects of heat waves is possible: knowing in advance that the heat wave is about to arrive allows you to optimally target preventive interventions towards people at higher risk.

The Regional Directorate of the Health Department has sent a note to the health companies recommending the utmost attention.

TEMPERATURE CHANGE IN THE MAIN PIEDMONT AREAS

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Class:

Introduction

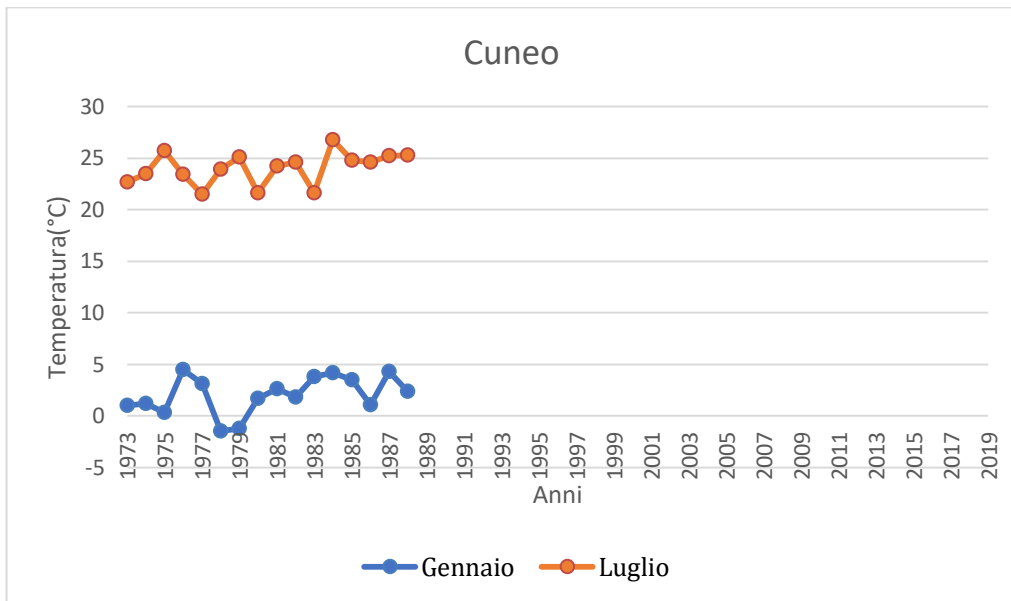
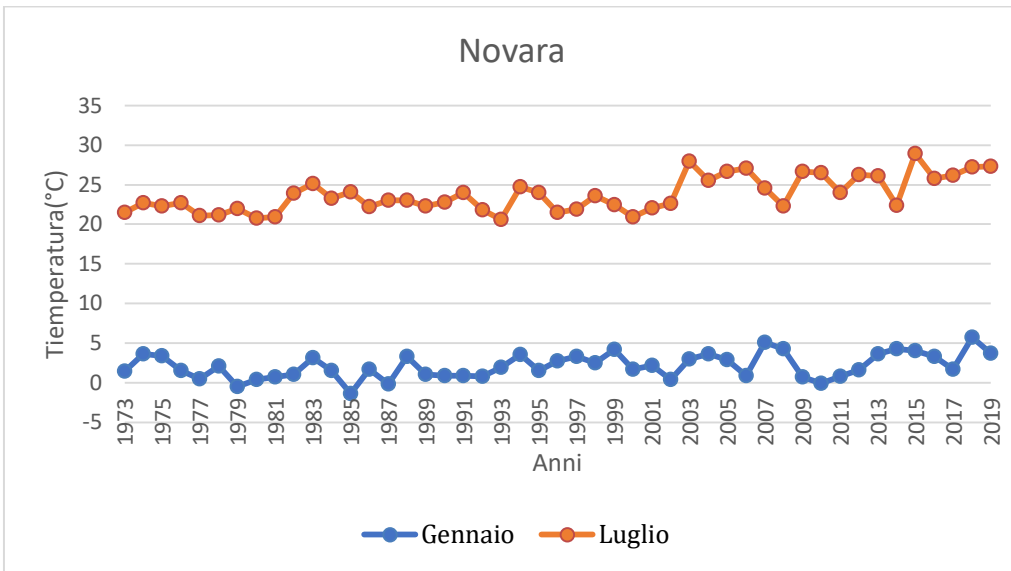
Global warming is a climatological phenomenon, characterized by a general increase in temperatures and which has started to affect our planet since the twentieth century and is still ongoing. Today, it is one of the greatest dangers that could "quickly" lead to the extinction of the human species, if it were not blocked, an action that should reduce greenhouse gas emissions into the atmosphere. This research aims to find and analyze data regarding the rise in temperature over time, most likely caused by the phenomenon of global warming, in the main Piedmont areas.

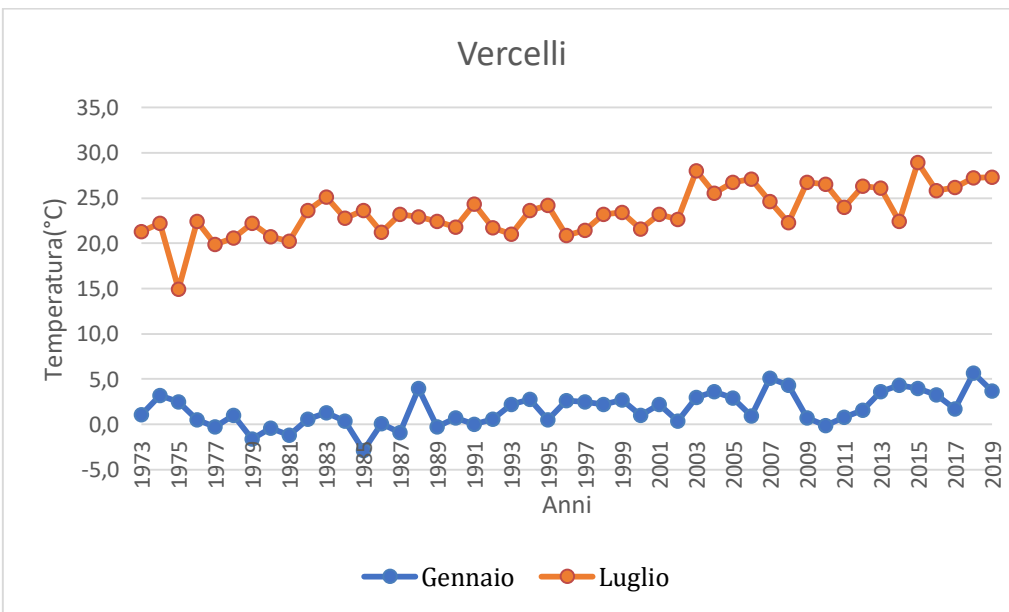
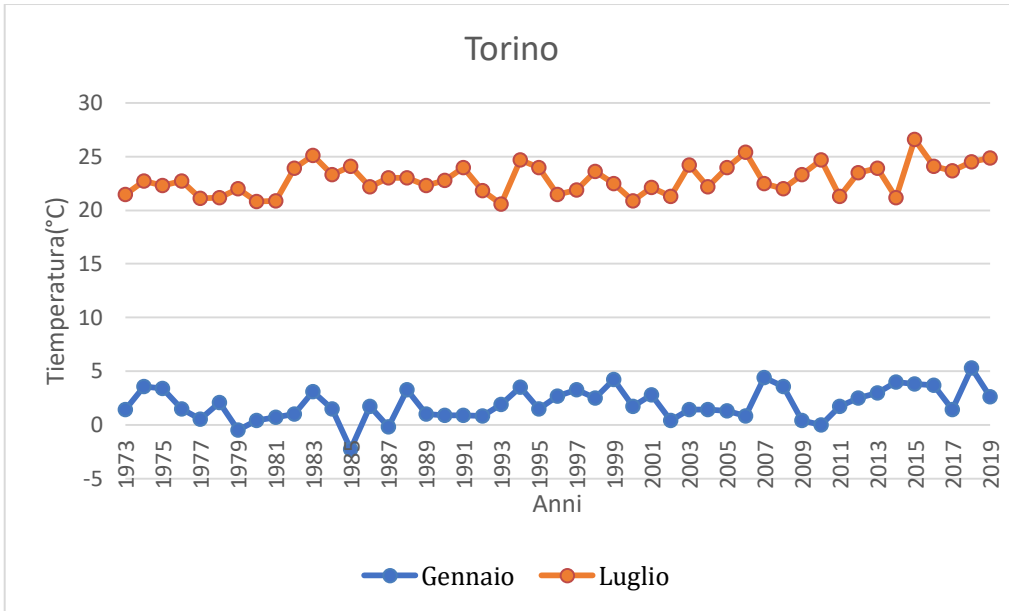
Data collection and analysis method

This research, in order to collect the data it needs, was mainly based on weather archives of rather well-known weather services. The main archive from which the data was taken, is that offered by the weather service of "ilmeteo.it": <https://www.ilmeteo.it/portale/archivio-meteo/Piemonte>. Given the immensity of the data in the aforementioned archive, and the lack of enough time to analyze the entire archive, it was decided to collect data regarding the change in temperatures of only two months, the hottest and coldest of the year: July and January, for all years where data were available (from 1973 to 2019).

The areas chosen for measuring the change in temperatures are 4 cities and they are also the only ones for which the archive keeps data: Cuneo, Novara, Turin, Vercelli. It should be noted that the data regarding Cuneo have only started to be stored since 2004. The data collection was organized using the Microsoft, Excel spreadsheet service, elaborating, again with this service, charts, to visually point out rising temperatures. Finally, to obtain a single data that can demonstrate the increase in temperatures in an approximate way, the difference between the average temperatures between 2000 and 2019 and between 1973 and 1999 was used.

Results





General Increase In Temperatures

Conclusions

The results of the research proved to be fully satisfactory from various points. First of all, looking at the data at a first glance, it can be seen that the phenomenon of global warming, which has been affecting our planet for a few decades, is a phenomenon that although not uniformly, is leading to a rather rapid rise in temperatures in the main areas Piedmont.

A second observation regarding the data concerns the fact that the general temperatures are increasing more steeply in the cities located in the Novara and Vercelli area, while compared to the cities mentioned above, the cities of Turin and Cuneo today retain temperatures generally lower (at least for the months of January and July).

It should also be noted that there is the possibility that the archive from which the data was taken is not somewhat reliable, both from the point of view of the conservation of truthful data, and from the fact that in the past the technologies that allowed the measurement of temperatures was not as sophisticated as what is available today, but also because it can be seen directly that the past data are of a lower number than what is available in recent years. From this, it can be concluded that the work done behind this research is not perfectly consistent with reality, but serves to give an approximate indication of the increase in temperatures in the main Piedmontese areas.

Cities	Mesi	1973-1999	2000-2019	Increase
Novara	January	1,68°C	2,67°C	+0,99°C
	July	22,57°C	25,36°C	+2,79°C
Cuneo	January	/	2,05°C	/
	July	/	24,03°C	/
Torino	January	1,64°C	2,31°C	+0,67°C
	July	22,57°C	23,32°C	+0,75°C
Vercelli	January	0,9°C	2,6°C	+1,7°C
	July	22°C	25,5°C	+3,5°C

The impacts of climate change

The impacts of climate change directly or indirectly affect the lives of the populations that inhabit our planet. Heat waves have caused thousands of deaths across Europe in the recent years, as well as the increase of mosquitoes in the northern parts of the planet, which promotes the spread of tropical diseases, such as malaria and dengue. Many animal species unable to adapt to the current changes are at risk of extinction: scientists say that we are experiencing the sixth mass extinction, this time caused by man and of even greater scope than the previous one, that had caused the disappearance of the dinosaurs. Changes in terrestrial and marine ecosystems due to ongoing warming will affect all production sectors, from primary to services. Just think of the decreases in yields on agricultural lands due to the increasingly frequent extreme events.

Flora

Industry studies tell us how plant species are particularly sensitive to climatic mutations: plants suffer from changes in average temperature, even when they are of minimal magnitude. Current warming produces both direct consequences in the plant world, with anticipation of blooms or variations in growth, or indirect, through, for example, the reduction of snow cover or soil moisture. High temperatures along with prolonged droughts can reduce the photosynthetic capacity of plants and their absorption of carbon dioxide. In addition to the risk of extinction of some plant species, the risk of fires, erosive phenomena, the movement of species to higher altitudes increases is greatly endangering our flora.

Fauna

Since 1500, the extinct animal species are 79 mammals, 145 birds and 36 amphibians. The causes are many: overfishing (hunting, fishing, illegal trade, etc.), pollution, habitat destruction in favour of infrastructures and new areas for agriculture. Climate change affects the processes of biodiversity loss, in fact many animals are at risk of extinction or became extinct due to the impossibility of adapting to a change as fast as the one taking place. Warmer temperatures also promote species migrations to other latitudes.

How to Help Preserve Biodiversity

Since the existence of human beings depends on these ecosystems, it is necessary to protect the biodiversity of the planet. You can help protect it by changing your personal habits, volunteering and supporting the adoption of rules that defend on a large-scale biological differentiation and coexistence of all living species. We need to reduce the consumption of food products, daily care, reading, leisure and entertainment, they require the use of energies that are taken away from biodiversity. Consumption or use of a resource in industrial production can affect the local ecosystem in a variety of ways, for example destroying natural habitat (to give space to crops), polluting the ecosystem (through oil spills) or impoverishing the territory (through deforestation to produce paper), compromising the biodiversity of an area. By reducing consumption, you can mitigate its negative effects on the environment. You should also use organic products and foods, as they do not require the use of pesticides. In addition, the use of pesticides kills insects, exterminating entire species over time. By differentiating trash, which could be dangerous and even lethal to animals and pollute water systems. Encourage the cultivation of native plant species over alien species, which are better suited to occupy the territory in which they originated and evolved. For example, if you live in a dry or warm climate, you won't have to continuously water your plants if they belong to native species. Supporting environmental organisations, which work globally to enforce environmental laws.