

# Meteorological measurements in the Arctic – basic package

## Guide with lesson plans

Download educational materials described in this guide from:

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## Meteorological measurements in the Arctic – basic package

### Guide with lesson plans

The „Meteorological measurements in the Arctic – basic” is designed for students 13-15 years old, so for those attending lower secondary schools or upper classes in primary schools.

<b>Title</b>	Meteorological measurements in the Arctic – basic
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<b>Students' age</b>	13-15 years
<b>Educational stage</b>	lower secondary school
<b>Subject</b>	Geography, Mathematics
<b>Overview of package content</b>	
<p>Meteorology is the interdisciplinary scientific study of the atmosphere and its phenomena. Knowledge on the weather (state of the atmosphere at a particular time) and the ability to predict future weather conditions (weather forecasting) is an important part of a person's life. It is not limited to helping with the selection of a daily wardrobe, but it is also of great importance in the economy of the country, particularly in agriculture and transport.</p> <p>There is a network of meteorological observatories around the world, where observations and atmospheric measurements are made. The data and statistics collected and the knowledge of the laws governing atmospheric processes are used to determine the most likely future weather conditions - weather forecasts.</p> <p>The proposed work package aims to familiarize students with meteorological measurements at meteorological site of Polish Polar Station Hornsund on Spitsbergen and to compare them to the current weather in the place of residence. Suggested meteorological databases are available online.</p> <p>The "Meteorological measurements in the Arctic" package is designed to educate students about the use of databases. It refers to the meteorological data that pupils use throughout school education - from simple observations in primary school to advanced statistical data analysis in the fourth educational stage. Meteorological data are also known to students in everyday life, so dealing with worksheets should not cause them much difficulties.</p>	

### Expected educational goals

#### The student knows:

- Definitions of: weather, climate;
- what devices are used to measure particular meteorological parameters;
- what is the weather forecast and where to find it?

#### The student understands:

- what are the differences of weather conditions in different parts of the world;
- impact of weather / climate on life and human activities

#### The student is able to:

- identify, interpret, and summarize meteorological data presented on selected websites;
- calculate basic meteorological parameters (e.g. air temperature amplitude; daily, monthly, annual average);
- draw basic graphs (e.g. air temperature, precipitation);
- assess changes in meteorological parameters compared to the previous month/year.

### Content of the package

1. "Meteorological measurements in the Arctic" – presentation – basic package;
2. ["Meteorological measurements in the Arctic" - short movie based on the presentation – basic package;](#)
3. "Meteorological measurements in the Arctic" - worksheet;
4. "Climatic differences" – worksheet;
5. "Monthly Bulletins" – worksheet;
6. "Cloudiness" – worksheet;
7. "Mathematical tasks" – worksheet;
8. "Mathematical tasks" – answer key;
9. "Meteorological measurements" – Guide with lesson plans.

### Additional materials

- <http://hornsund.igf.edu.pl/weather> - Meteorological Bulletins
- [http://www.yr.no/place/Norway/Svalbard/Hornsund/hour\\_by\\_hour.html](http://www.yr.no/place/Norway/Svalbard/Hornsund/hour_by_hour.html) - weather forecast for Hornsund Station in the Arctic
- <http://meteo.us.edu.pl/arctowski> - present weather conditions at Arctowski Station in Antarctica - in case if there is no connection to automatic station check:  
[https://www.yr.no/place/Antarctica/Other/Henryk\\_Arctowski\\_Polish\\_Antarctic\\_Station/](https://www.yr.no/place/Antarctica/Other/Henryk_Arctowski_Polish_Antarctic_Station/)
- <https://www.windytv.com/> - present weather conditions and weather forecast

## Lesson 1.

### Subject: Meteorological measurements in the Arctic

Lesson plan for "Meteorological measurements in the Arctic"

In order to conduct the lesson, it will be necessary to provide:

- a multimedia projector, computer, loudspeakers;
- worksheets printed out for each student „Meteorological measurements in the Arctic” (no. 3) and „Climatic differences” (no. 4);
- geographical atlas;

Approximately 1 week before the lesson, the teacher gives the students (selected) additional work to do. The work consists of gathering information from various sources about the Polish Polar Stations (located both in the Arctic and Antarctica):

- **The Stanisław Siedlecki Polish Polar Station in Hornsund** on Spitsbergen is located in the Arctic, far behind the Arctic Circle. The station is manager by the Institute of Geophysics Polish Academy of Sciences in Warsaw. It is a year-round operating station, where continuous measurements have been conducted since 1978.
- **Henryk Arctowski Polish Antarctic Station** is located in the South Shetland Islands archipelago on the King George Island. It is manager by the Institute of Biochemistry and Biophysics of the Polish Academy of Sciences in Warsaw. An important information for students is that the station is located in the Antarctic, but outside of Antarctica (continent).
- **Antoni Bolesław Dobrowolski Polar Station** is an inactive Polish polar research station located in the Antarctica continent. The station belongs to Poland since 1959 (formerly belonged to the Soviet Union). It is planned to install maintenance-free measuring scientific instruments there.

Expected educational goals of the lesson:

Same as of the educational package "Meteorological measurements in the Arctic - basic package"

Suggested forms of work:

- offering: a lecture, a talk;
- displaying: a presentation, a movie;
- activating: a discussion;
- practical: exercises based on worksheets.

### Lesson procedure:

1. Start of the lesson, organizational activities, attendance list check.
2. Introduction to the topic. The teacher writes down the coordinates of the points on the blackboard. Students are asked to find points on the map in the geographical atlas. They then try to guess what objects are located in designated locations:
  - **77°00'N 15°33'E** (The Stanisław Siedlecki Polish Polar Station in Hornsund)
  - **62°10'S 58°28'W** (Henryk Arctowski Polish Antarctic Station)
  - **66°16'S 100°45'E** (Antoni Bolesław Dobrowolski Polar Station)

Selected students present information about each station. Then the teacher asks questions to see if the students are able to differentiate the research stations.

- At which Polish research stations annual observations have been conducted?  
Answer: The Stanisław Siedlecki Polish Polar Station in Hornsund and Henryk Arctowski Polish Antarctic Station
  - Which stations are located in the Arctic and which in Antarctic?  
Answer: Hornsund station is an Arctic station, the other two are Antarctic.
  - It is often a mistake to say that the station Arctowski is located in Antarctica. How should you determine the location of this station?  
Answer: Arctowski Station is located in the Antarctic. It is located on the King George Island not on the continent of Antarctica.
3. Students watch [the movie "Meteorological measurements in the Arctic"](#) (no. 2). During the movie the teacher should check if the content presented is clear and legible to students, and should be aware of any difficulties and if necessary should provide additional explanations.
  4. After watching the movie, the teacher gives students a worksheet "Meteorological measurements in the Arctic" (no. 3). The students themselves fill in the tasks. During work, the teacher may display a presentation "Meteorological measurements in the Arctic" (no. 1) so that students can return to the content they have not been able to remember.
  5. Before the end of the lesson, students work on the "Climate Difference" worksheet (no. 4). Their task is to read the current values of air temperature at polar stations: Arctic and Antarctic and in their place of residence. Based on the collected data and the previously acquired knowledge, students draw conclusions about the differences.

## Lesson 2.

### Subject: How to interpret meteorological data?

#### Lesson plan for "Meteorological measurements in the Arctic – basic package"

In the package "Meteorological measurements in the Arctic" students get the access to professional meteorological databases - bulletins prepared by employees of the Institute of Geophysics Polish Academy of Sciences from meteorological measurements and observations conducted at the Polish Polar Station Hornsund on Spitsbergen.

There are exercises included to this lesson. From previous lesson "Meteorological measurements in the Arctic" students have the theoretical background on the location of the Hornsund station. This lesson is supposed to be conducted in the school computer lab, where students have access to database, and will be able to download the necessary bulletins, and complete exercises on their own or with little teacher guidance. In case of lack of access to computers / the Internet, the lesson can be conducted on the basis of the bulletins previously selected by the teacher, which should be printed in advance and distributed among students.

#### In order to conduct the lesson, it will be necessary to provide:

- computer with internet access for each student (or group of students); or else worksheets printed out for each student „Meteorological bulletin”;
- worksheet "Monthly bulletins" (no. 5) printed for each student.

#### Expected educational goals of the lesson:

Same as of the educational package "Meteorological measurements in the Arctic - basic package"

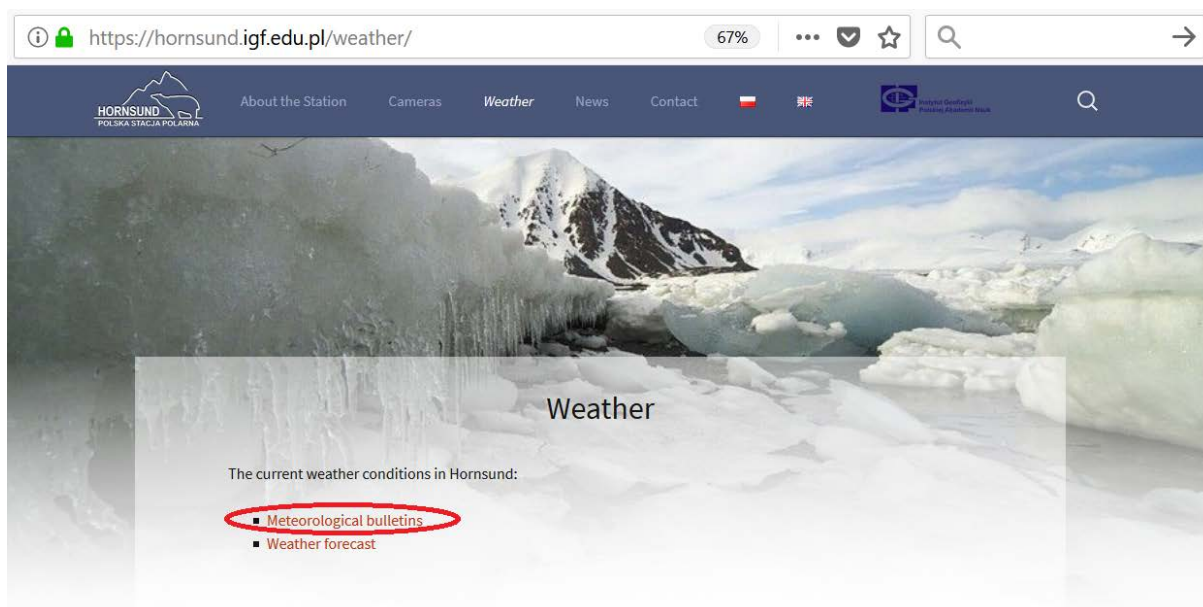
#### Suggested forms of work:

- practical: exercises based on worksheets.

#### Lesson procedure:







1. Start of the lesson, organizational activities, attendance list check.
2. Repetition of the most important information from previous lesson, e.g.:
  - Weather definition;
  - What is meteorology and synoptic meteorology?
  - What measurements are conducted using: thermometer, hygrometer, anemometer, barometer, heliograph?
  - Where the Polish Polar Station Hornsund is located?

3. Time to complete prepared tasks. The teacher distributes the worksheet „Monthly bulletins” (no. 5). Students go to the website: <https://hornsund.igf.edu.pl/weather/>



Then they open "Meteorological Bulletins" tab. The bulletins web page appears.

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 <a href="#">Parent Directory</a>		-	
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 <a href="#">BIULETYN_35/</a>	2016-08-31 14:50	-	
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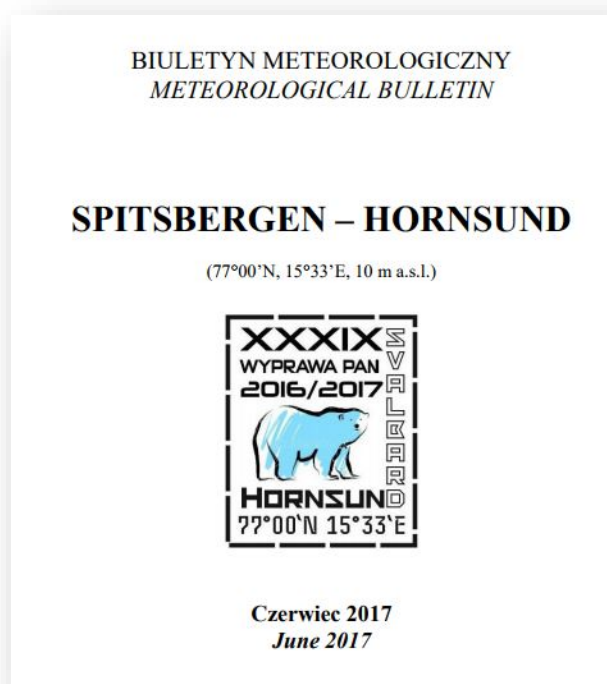
Choose one of the folders. Then you will see the individual bulletin files:



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 <a href="#">Parent Directory</a>		-	
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 <a href="#">report_2016_07.pdf</a>	2016-09-01 11:25	1.6M	
 <a href="#">report_2016_08.pdf</a>	2016-09-14 00:13	1.9M	
 <a href="#">report_2016_09.pdf</a>	2016-10-13 11:59	2.0M	
 <a href="#">report_2016_10.pdf</a>	2016-11-15 15:54	1.9M	

Select one bulletin from the list, remembering that for example, report\_2017\_06\_pdf denotes the Meteorological Bulletin of June 2017.



- The teacher assigns to students different bulletins to complete the tasks. Work can be done in groups (e.g. in pairs). Students perform tasks on the worksheet. During this time the teacher gives the necessary explanations.
- An assessment of students' work ends the lesson.



## Lesson 3.

### Subject: Identifying clouds

Lesson plan for "Meteorological measurements in the Arctic – basic package"

Weather forecasting and dangerous atmospheric phenomena that threaten people, are topics that arouse curiosity among young people. Every day we get information about these phenomena from information services on the internet, television and radio. Not everyone knows that on the internet there are many services that show the current meteorological situation. The way of presenting data is increasingly accessible and visually appealing. At this lesson, students will follow some meteorological websites to describe clouds and related phenomena. These services can be used successfully to observe other meteorological parameters and processes in the atmosphere.

In order to conduct the lesson, it will be necessary to provide:

- computer with internet access for each student (or group of students);
- worksheet "Cloudiness" (no. 6) printed for each student.

Expected educational goals of the lesson:

Same as of the educational package "Meteorological measurements in the Arctic - basic package"

The lesson "Identifying clouds" aims to familiarize students with the most popular websites presenting meteorological data and their visualization. On this basis, students will be able to analyse the presented material, describe phenomena and draw conclusions.

Suggested forms of work:

- practical: exercises based on worksheets.

Lesson procedure:

1. Start of the lesson, organizational activities, attendance list check.
2. The teacher reminds students what the weather is and what are the meteorological parameters. Teacher explains what is the cloudiness and how clouds form. Identifying the types and species of clouds is complicated and difficult even for Geography students, but it is a very useful skill e.g. when practicing such sports as sailing, paragliding, etc. In 2017 World Meteorological Organization presented new online Cloud Atlas to make identifying clouds easier.
3. Students open the website <https://cloudatlas.wmo.int/> and learn how to recognize cloud types. Then they complete task no. 1 from the worksheet.

4. Students get acquainted with the website [www.windy.com](http://www.windy.com) - a popular service used by television stations to visualize phenomena such as tornados, tropical cyclones. Cloudiness is one of the layers. Students complete tasks 2 and 3.
5. Changes of cloudiness above Europe can be observed from satellite images published in [www.sat24.com](http://www.sat24.com). Students using this website complete tasks 4 and 5.
6. Using [www.windy.com](http://www.windy.com) students complete task no. 6.
7. The Norwegian weather service [www.yr.no](http://www.yr.no) is renowned for its very accurate and verifiable weather forecasts. Students using aforementioned website complete tasks 8 and 9.
8. On the [www.blitzortung.org](http://www.blitzortung.org) website one can check the storms and lightning strikes in real time across the planet. Students complete task 9, which is to describe the cumulonimbus cloud, and then describe the location of the most lightning strikes.
9. The lesson summary is to identify the types of clouds in a schematic image - students complete task 10.

## Lesson 4.

### Subject: Mathematical brain teasers

#### Lesson plan for "Meteorological measurements in the Arctic – basic package"

The Arctic is an extremely attractive area for students. As a remote and inaccessible place, it has a bit of mystery. Many young people dream of taking part in a polar expedition, wade through snowdrifts, and notice and photograph a polar bear somewhere in the distance. For this reason, we decided to place several mathematical tasks in the scenery of Spitsbergen, near the Polish Polar Station.

#### In order to conduct the lesson, it will be necessary to provide:

- worksheet "Mathematical tasks" (no. 7) printed for each student.

#### Expected educational goals of the lesson:

- training in mathematical skills and logical thinking

#### Suggested forms of work:

- practical: exercises based on worksheets.

#### Lesson procedure:

1. Start of the lesson, organizational activities, attendance list check.
2. The teacher distributes the worksheets.
3. Students complete tasks included in worksheets. In the same time teacher gives the necessary guidance.
4. At the end of the lesson students give feedback, which tasks were most difficult for them and how did they manage to complete them.