



Exploitation of Research results In School practice



Guide



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Wind and Waves

Guide

“Wind and waves” is aimed at students between 13-14 and 17-18 years of age, lower and upper secondary schools, depending on the accumulated physics notions, divided on the level of understanding. Some materials from the package may be used when discussing about the physics of waves, pressure, Coriolis force etc.

The package can be used during lessons following the core curriculum and also during extracurricular lesson or school trips. In the second case the teacher has more freedom in terms of the amount of time and can devote to the materials included in the package, and combine the package with other additional materials (for example, the packages about Weather and Digital Maps).

Title	Wind and Waves
Pupils' age	17-18 y old (level II)
Level of education or type of school	Upper Secondary School
School subject	Physics , but also Mathematics, Geography, Informatics
Short description of content	
The educational package proposes to investigate the relation between the direction and speed of the wind and wave formation. We review concepts related to wind characteristics with an emphasis on the most relevant factors for the generation of waves. A detailed characterization of wind waves adapted to the level of study (lower or upper secondary schools) is provided. In the upper secondary school, pupils study notions on mechanical oscillations, allowing a more detailed investigation of wind waves features.	



Using free online data available on several forecast websites, the lower and upper secondary pupils will have to make predictions and as a subsequent step, compare their prediction with real data, on the formation and characteristics of the wind waves, such as the wave height in relation with the wind properties, the propagation direction of the wave front taking into account besides the wind, also the specific geographical characteristics, marine currents etc. For a start, the wind waves' formation on the Romanian Black Sea Coast will be analysed.

Even if meteorological data is made freely available online, the amount of time for which you can access them is limited, and usually for extended periods of time the data is provided for a fee. Education communities need to build their own databases in relation with pedagogic and didactic aspects: access to the data, record it and compile case studies, in areas of interest for the pupils (the examples in the lessons are provided from the Romanian Black Sea Coastline).



Concept and learning outcomes

Pupils know:

- Atmospheric pressure (isobar maps)
- To read meteorological maps
- Wind characteristics (direction, speed etc.) and why it is generated
- Wave characteristics (wind wave formation, amplitude, wavelength, frequency, period, propagation direction of the wave front etc.)
- Geographical characteristics and marine currents in the Black Sea

Pupils understand:

- Relation between wind and waves characteristics
- Wind waves formation mechanism
- Interaction between waves and currents
- Interaction between waves and geographical characteristics

Pupils are able to:

- Make predictions on waves height depending on wind speed
- Predict wave direction considering general and specific geographical characteristics, marine currents etc.
- Compare their predictions with actual data from forecast websites



- Search online using the provided tools for interesting patterns of erosion on coastal areas and are able to explain the mechanism behind their birth.

Elements of educational package (created in ERIS)

Multimedia presentation	Presentation containing theoretical support, animations, graphs and videos
Worksheets	Support materials to be used during and/or after theoretical presentation, including description of simple experiments
Assessment	Worksheet to determine the wave height Worksheet to determine the wave front direction Short assessment forms (quizzes or simple questions) – Kahoot!

Additional materials for teachers (websites links, science articles, etc.)

http://www.windfinder.com/weat/herforecast/constantia_port/	Web page that contains forecast and meteorological reports including air temperature, pressure, wind speed, gusts and direction, wave direction, height and period.
http://vremea.meteoromania.ro/taxonomy/term/17	Pressure map
http://vremea.meteoromania.ro/taxonomy/term/22 http://vremea.meteoromania.ro/taxonomy/term/15	Wind on Romania Seashore
https://www.windy.com/?43.985,29.103,7	Graphic online tool to visualise wind/waves in real time
https://zoom.earth/#44.177372,28.664918,16z,sat	Satellite view over Constanta Tomis Port – wave front visualisation
http://explorer.worldwind.earth/	Satellite view for interesting patterns of erosion on coastal areas



Online lesson

Subject	Wind and Waves
Duration	50 min.
Materials/Preparation	
Computer, Projector Printed work procedure (optional) Printed worksheet (optional) Printed assessment forms (optional) Kahoot! Assessment tool (optional)	
Lesson flow	
Typical mode for conducting a lesson will involve viewing the multimedia presentation (theoretical concepts presented in a blend of text-video-graph content) with at least 2 points of interaction in the form of short activities (10 min each). In the end a short assessment form will be used to observe how important notions presented have been/or not understood by the pupils.	
Homework	
• Study for several weeks the wind and wave characteristics • Make predictions on waves height depending on wind speed • Predict wave direction considering general and specific geographical characteristics, marine currents etc. • Compare their predictions with actual data from forecast websites • Improve your prediction procedure according to local geographical characteristics • Search the online tools for interesting patterns of erosion on coastal areas and explain the mechanism behind their formation.	



Lesson 1

Subject: Wind and Waves - the relationship between the wind direction and intensity and the wave formation

Lesson plan for “Wind and Waves”

Necessary materials and equipment:

- multimedia projector, computer, loudspeakers;
- printed materials for each student:
 - Observation Chart and Support Charts 1 and 2;
- physical map of Europe or the world;
- mobile phone with internet connection for playing kahoot game;

Lesson aims:

General and specific aims as specified in “Wind and Waves” package – please correlate these aims with your student’s level

Methodological suggestions:

- expository methods: lecture, talk;
- demonstration methods: presentation, video;
- activation methods: brainstorming;
- practical methods: worksheets;
- evaluation: quiz test (paper or kahoot)

Lesson procedure:

1. Start of the lesson, administrative activities, checking the register.
2. Information (or reminder) on how to use the mobile phones for the “Kahoot” quiz.
3. Introduction of the topic. The teacher asks the group following questions and moderates the brainstorm:

Question	Expected answer
Do you know what sea waves are? Do you like to interact with them at the sea-side?	<i>Yes, I do!</i>
Do you know how the water waves are formed?	<i>No/yes. Try to extrapolate some plausible answers and write them on the blackboard for later comparison</i>



4. Students will be introduced to the PowerPoint presentation content, with the mention that, as much as the time will have allowed, there will be interactions and hands on activities.
5. Students will watch the presentation that comes with a running commentary provided by the author of the package. Throughout the duration of the presentation, the teacher should monitor to ensure that everything is clear and provide additional explanations whenever necessary.
6. The initial answers to the “Do you know how the water waves are formed?” are compared now with the newly accumulated knowledge
7. Students will learn how to start to gather data from various meteorological sites using the Observation Chart, and correlate those data using the Support sheets to transform wind data in predictions for wave heights
8. As an alternative, using the online satellite view tool, different types of coastal erosion and wave patterns in a familiar area for the students can be found.
9. To conclude the lesson, the group may use the assessment form delivered in the package or complete the evaluation tests in an interactive way with the help of kahoot.it.