



Educational package

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 the online 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/constantaport/	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 assesment 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.