

How can storms affect erosion rates?

Predict what will happen to a landscape if it is affected by a storm

The Cambridge Dictionary defines a storm as, “a violent disturbance of the atmosphere with strong winds and usually rain, thunder, lightning, or snow”. Meteorologists use the Beaufort Wind Scale, which defines a Storm as having wind speeds of 48-55 knots; a Violent Storm with winds between 56-63 knots and a Hurricane when wind speeds are more than 64 knots.

When a storm is accompanied by rain, it can release far more water than in normal times. For example, some parts of the UK experienced a month’s average rainfall in just one day in February 2020, followed by a similar amount only a week or so later, resulting in serious flooding and washing away of river banks and bridges. In arid areas, high winds can pick up much more material than they can normally carry and will blow it away, eroding the landscape as they pass. On exposed coasts, the rate of erosion by waves is greatly speeded up in a storm.

Look at these photographs. In each case, try to work out what effect a storm will have on the rate at which the nearby landscape is eroded. Check the result with the images from **The back up** below.

Wind in a temperate climate



A peaceful scene in a forest in Scotland.

(© [Iain Thompson](#) and licensed for [reuse](#) under this [Creative Commons Licence](#)).

How might a Violent Storm affect the trees, and the erosion which might follow?

Wind in an arid climate



A sandstorm in a desert region.

(http://www.weatherwizkids.com/?page_id=1333).

Strong winds in arid regions pick up sand and use it to erode the landscape in their path. Most of the sand keeps near to the ground and is carried along between 3 and 25 metres from the ground.

How might the face of this cliff be shaped by wind erosion, if it is in a very dry country?



Sandstone cliff. (Photo: Peter Kennett).

Rainfall



The Gill Beck at Glusburn, Yorkshire, UK under normal flow conditions.



The Gill Beck during a heavy rainstorm.

(Both images © [Allan Friswell](#) and licensed for [reuse](#) under this [Creative Commons Licence](#)).

Imagine that the river rises even higher and flows even faster. What might happen to the things you can see in the picture? Remember that if the

speed of the river doubles, its carrying power increases by several times more than double.

Coastal storms



The sea front at Dawlish, Devon, England in 2003.
(© [Tony Atkin](#) and licensed for [reuse](#) under this [Creative Commons Licence](#)).



A rough sea at Sidmouth, Devon, England.
(© [Christine Matthews](#) and licensed for [reuse](#) under this [Creative Commons Licence](#)).

Every time a big wave crashes against the coast it dumps many tonnes of water in a space of a few seconds. The water also compresses air trapped in cracks in the rocks or in a sea wall, which can force heavy rocks or masonry apart. What might happen to the sea wall and the railway line in the picture of Dawlish in a violent storm?

The back up

Title: How can storms affect erosion rates?

Subtitle: Predict what will happen to a landscape if it is affected by a storm

Topic: Pupils are asked to study images of various landscapes and to predict how the rate of erosion might be affected by storms.

Age range of pupils: 11 -16 years

Time needed to complete activity: about 30 minutes, allowing for discussion.

Pupil learning outcomes: Pupils can:

- suggest what will happen to a landscape when it is hit by a storm;
- extract evidence of the erosion caused by a storm event from a photograph;
- make comparisons between “before and after” images.

Context:

Suggested observations are given below, but pupils may think of many other things which are equally valid.

Wind in a temperate climate



A wind-blown tree in the same Scottish forest.
(© [Iain Thompson](#) and licensed for [reuse](#) under this [Creative Commons Licence](#)).

Whilst the storm was blowing, the tree roots would have been rocked about, loosening the soil and making it easier for wind to blow it away or for rain to wash it away. The exposed soil, now up in the air, will also fall off and be carried away more quickly.

Wind in an arid climate



Wind erosion in the Altiplano Region of Bolivia.
(Photo: [El Guancho](#), via Flickr: licensed under the [Creative Commons Attribution](#)).

Because the sand carried along in the storm cannot stay very high in the air, most of its erosive action is close to the ground. Such undercut features are typical of wind erosion in dry areas.

Rainfall



Burway Bridge over the River Corve, Ludlow, England after the floods.

(© Copyright [DI Wyman](#) and licensed for [reuse](#) under this [Creative Commons Licence](#)).

This is not the same river, but the effects could have been very similar, with the bridge pillars eroded away until the bridge collapsed, trees washed out, the footings of lampposts eroded away etc.

Coastal storms



The sea front at Dawlish, Devon, England after violent storms in 2014. © Devon Live

This is the main line to Cornwall from the rest of the country, built by the Victorians. The storm broke through the strong sea wall and eroded all the rocks which were supporting the railway, so that the rails were left hanging in the air. At least

one house has been nearly undermined where the waves broke further in from the railway.

Following up the activity:

- Carry out a web search for other examples, looking especially for “before and after” photos – or take your own photographs, when a storm strikes your own area, so long as it is safe and you don’t get blown or washed away! Use the activities given in **Useful Links** below for more details of erosion by rivers, the wind and the sea.
- How could a storm affect the view from your window?

Underlying principles:

- Erosion by natural processes and by human activity is taking place nearly all the time but is often so slow that it is seldom noticed.
- A storm event greatly speeds up the normal processes and makes erosion much more dramatic.
- Major storms can cause extensive damage, and even loss of life of humans and wildlife.
- Further principles are given in the activities shown below.

Thinking skill development: Investigating the photographic evidence for erosion is a constructive activity. Cognitive conflict arises when trying to predict how a storm event will affect the rate of erosion. Applying the principles to a real landscape where active erosion is taking place involves bridging.

Resource list: Paper copies of these sheets, or the facility to project the photographs.

Useful links:

https://www.earthlearningidea.com/PDF/235_Sedimentary_structures.pdf
https://www.earthlearningidea.com/PDF/61_Dust_bowl.pdf
https://www.earthlearningidea.com/PDF/73_Coastal_crumble.pdf

Source: Written by Peter Kennett of the Earthlearningidea Team.

© **Earthlearningidea team.** The Earthlearningidea team seeks to produce a teaching idea regularly, at minimal cost, with minimal resources, for teacher educators and teachers of Earth science through school-level geography or science, with an online discussion around every idea in order to develop a global support network. ‘Earthlearningidea’ has little funding and is produced largely by voluntary effort. Copyright is waived for original material contained in this activity if it is required for use within the laboratory or classroom. Copyright material contained herein from other publishers rests with them. Any organisation wishing to use this material should contact the Earthlearningidea team. Every effort has been made to locate and contact copyright holders of materials included in this activity in order to obtain their permission. Please contact us if, however, you believe your copyright is being infringed: we welcome any information that will help us to update our records. If you have any difficulty with the readability of these documents, please contact the Earthlearningidea team for further help. Contact the Earthlearningidea team.

