

Learning Material

Aralkum - A Lake Disappears

Grades 8-9

Teaching material

Project Information

These learning materials originated from the project “Columbus Eye – live images of the ISS in school lessons”. The project Columbus Eye is funded by the German Aerospace Center with resources of the Federal Ministry of Economic Affairs and Energy based on an order of the German Bundestag under the project number 50JR1307.

The overriding project objective is the development of a widespread range of digital learning materials for educational use. This includes interactive learning tools and worksheets, which are provided through a learning portal: <http://www.columbuseye.uni-bonn.de>

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Gefördert durch:



aufgrund eines Beschlusses
des Deutschen Bundestages



Overview

Grades

7-9

Difficulty



Time requirement

2 hours

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Objectives

Students shall...

- interpret and spatially allocate satellite images (ISS),
- allocate the Aral Sea area and the processes occurring in the region,
- identify and analyze the conflict potential between nature and humans,
- understand earth as a system of subsystems and
- predict and critically evaluate the development of water bodies.

Topics

Predictions

Analysis of aerial images

Retreat of the Aral Sea

Materials

Worksheet “A Lake Disappears”

App “A Lake Disappears”

Didactic remarks

Time schedule

General information: Phase 1 is also suitable as an initializing homework assignment. Phase 2 can be done in team work. The attained “expert knowledge” of the groups will then be assembled in phase 3.

Phase 1: After receiving the worksheets and a short introduction, students will attend to work through the historic development of the Aral Sea's retreat. They can follow this progress based on the images provided by the satellite Landsat, which are included in the app (marker 1, page 1). The ISS video (marker 2, page 1) additionally shows a fly-over of the Aral Sea in 2016. Subsequently, the students will work on the first task. Part b will help them get a feel for the region and connect the area with their own knowledge. It is recommended to use an atlas to locate the area.

Phase 2a: The second task deals with the backgrounds of the retreat of the Aral Sea and the development of Aralkum. The task primarily focuses on the artificial canals and the resulting water shortages of the Amu-Darja and the Syr-Darja.
Optional: excursus on the communist past of the region.

Phase 2b: The third task deals with analysis of transformation and leads the students into making their own predictions. They will learn that predictions are affected by many factors and are therefore uncertain. A panel discussion can be added at the end of part 2b.

Phase 3: In phase 3, the results of the first two phases will be brought together using task 4. This can be done in a panel discussion or by developing a chart. It is recommended to first collect the information of the two groups from phase 2 and answer question 5 after that.

Tip: When displaying the waterlines, students can simultaneously draw on the satellite image and will be able to see the pencil on their smartphone screens. That way, they can easily set the marks, which they will need for the calculations following in task 3a and check the measured distances with their rulers. If necessary, point out the scale bar in the bottom right corner!



Preparation/Postprocessing

There are further materials on the topic of deserts included in Columbus Eye. The topics of deserts and desertification are discussed separately in the **worksheet “Earth’s deserts”**. The **Observatory “West Africa – crossing the Earth’s biggest desert”** enables you to do a classification of a desert area by yourself. Both units can be found here: <http://columbuseye.uni-bonn.de/english/>

Solutions

1. Get an overview of the situation at the Aral Sea by starting the app and aiming the camera at markers 1 and 2 on page 1. Tap the pictures to start the underlying videos.

Additional information:

Marker 2 shows a flyover of the Aral Sea in 2016 (HDEV video).

a) Describe the current situation and the historic development of the Aral Sea. Use the images of the Landsat programme from 2000-2016 in the video of marker 1. Which sections are changing?

The image used as the marker shows the former state of the Aral Sea. Since then the lake has dried up immensely. As seen in the video, the southern part of the lake sizes down every year, while the northern part remains almost unaffected. Especially the center is subject to considerable fluctuations. The image on the right illustrates the temporarily and permanently flooded areas of the past 17 years.



b) What can you see in the ISS video of marker 2? Elucidate, what strikes your attention, when comparing the ISS video to the ground images and the other satellite images.

The lake is displayed in dark colors, surrounded by desert and salt-encrusted terrain, the white stripes are clouds. You can also make out settlements and agricultural areas. Even though you can't see the whole area in the video, you will still be able to recognize that the lake's surface has heavily decreased. The anchor you can see in the ground image is further proof of that. In the areas that are now dried up, you were still able to fish around 50 years ago. Neither the video nor the aerial image are north-oriented.

2. Why does the Aral Sea silt up? Use materials 1 and 2 and the atlas to get information about the region.

a) Why was the Karakum Canal built? What is and was the water of the canal used for?

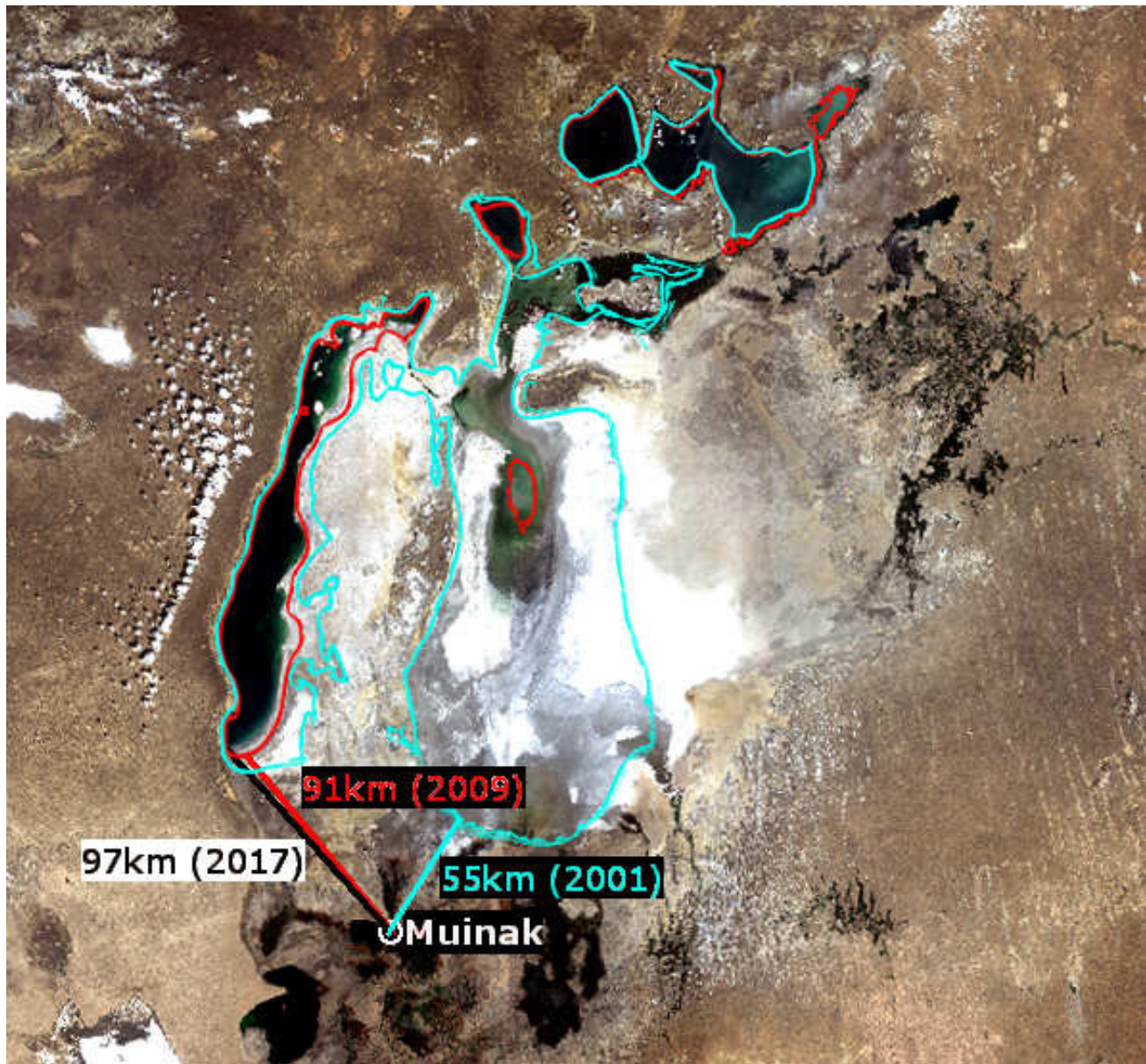
The Karakum Canal, built by the USSR, which is fed by Amu-Darja, is the foundation of the regions irrigation system. Without it, the huge cotton farms could not be worked in this dry-arid climate. In context of the planned economy, cotton export was the most important business for people in the area.

b) Why are the rivers Syr-Darja and Amu-Darja important to the Aral Sea? What happens when water from the Amu-Darja is diverted by Karakum Canal?

The two rivers are the main water source for the Aral Sea. Caused by the redirection of Amu-Darja, the river now only ever reaches the lake in times of high tide. To date, no measures have been taken to reduce the evaporation, so that the drainage of the lake continues. As a result, former harbors and beach resorts are now miles away from water.

3. How fast is the Aral Sea changing? Use the app and marker 3 on page 5.

a) Measure the shortest distance from the city Muinak to the lakefront in the years 2001, 2009 and 2017. Use the app to display the shorelines and check the distance to the city with a ruler. Use the scale bar in the bottom right corner of Marker 3 for your calculations.



b) Compare the changes from 2001 to 2009 and from 2009 to 2017. Does the Aral Sea change consistently, faster or slower? Make a guess: what will the Aral Sea look like in 2025?

According to the calculations in 3a the Aral Sea retracted from the city Muinak by 36 kilometres between 2001 and 2009. From 2009 to 2017 it has only been about 8 kilometres. Thus, the Aral Sea's area is decreasing slower. You should notice that the distances are measured from two different parts of the lake. For 2025, it can be predicted that the area of the western part will probably decrease slower than the eastern part. The northern part will presumably remain as it is.

4. Which problems stem from the lakes recession? Consult your answers for questions 1-3.

a) The newspaper article “The Poison Underneath” is from the year 1988. Is the situation today exactly as it was described in the article?

The Aral Sea does not dry up as fast as predicted by the soviet scientists (according to their prediction, the lake would have dried up in 2010). The northern part of the lake has been stabilized since 1988. That way, agriculture was able to persist. As predicted, the dried up areas have been replaced by salt desert and the desertification is further advancing

b) Make a list describing the possible consequences of the draining of the Aral Sea for humans and the environment. Discuss with your classmates!

Humans	Environment
no more fishing	fish die-off
no more agriculture	salinization
no more animal husbandry	desertification
drinking water shortage	reduction of biodiversity
damages to health	water shortage
...	...