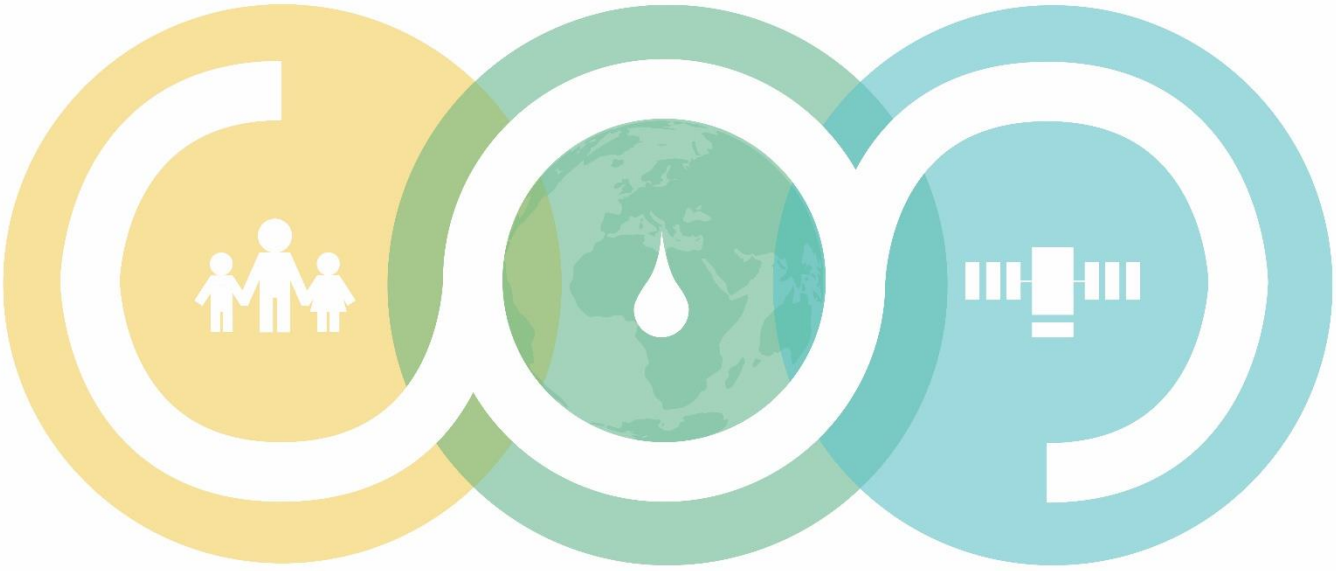
TEACHERS MANUAL - SAS

Climate change education lesson plan for the project Schools and Satellites



Schools and Satellites

ACKNOWLEDGEMENT AND BACKGROUND

This teacher's manual has been created by PULSAQUA, together with partners TAHMO, GMet, Technical University Delft, and Smartphones4Water. The manual aims to give guidelines and an overview of the lesson plan for teachers that join the project Schools and Satellites (SaS).

The SaS project aims to take manual rainfall measurements with teachers and their students, in order for them to learn how to take rainfall measurements and what this means, and for training and validating an algorithm that uses satellite data to give good rainfall information. For more information about the SaS project, please go to www.tahmo.org/schoolandsatellites

CONTENT

LEARNING GOALS OF THE LESSON PLAN

By joining the SaS project, and while taking rainfall measurements, there are certain learning goals that we aim to reach, but in a way that give benefits because this way of teaching is:

- Learning by doing, in practice
- Adding value with actuality, with real life opportunities
- Giving a route and tools towards solving the problem

Learning goals of SaS

- Student will grasp the implications and situation of climate change.
- Students will be able to understand the water cycle and how climate change influences this cycle.
- Students will understand that precipitation information is critical for farming, and how precipitation data is gathered, both in situ as with satellites.
- Students will be able to prepare a research plan and actively do research themselves.
- Students will learn how to analyze the data using mathematics and graphs, and draw conclusions, and how to discuss if they see differences.
- Students will learn how to work in groups when doing research.
- Students learn to act.

Climate change in the Ghanaian Curriculum - JHS

This lesson plan aims to fit well into the Ghanaian Curriculum for JHS Integrated Science Education.

UNIT	SPECIFIC OBJECTIVES	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
UNIT 2 **CLIMATE**	The pupil will be able to: 2.2.1 distinguish between weather and climate	Meaning of weather and climate Elements of Climate.	Let pupils: - brainstorm to bring out the meaning of weather and climate. - discuss the differences between weather and climate - identify the elements of climate, and discuss how each element affects agriculture.	
	2.2.2 explain that weather and climate change do occur in a cyclic manner	Cyclic nature of weather and climate: Incidences of weather and climatic changes- The 1983 drought, 1969 Heavy rains, 1963 Heavy rains, etc.	- collect information on the incidences and effects of weather and climatic changes that occurred over the past 30 – 50 years from people, libraries, internet and scientific journals. - discuss the effects that these changes had on the environment (agriculture, vegetation, water cycle, etc).	How have climatic changes affected your daily activities? Explain why the climate of Tamale is different from that of Axim.
	2.2.3 use weather measuring equipment.	Weather Measuring Equipment: rain gauge, wind vane, sun dial, thermometer etc.	- visit a Meteorological Station, observe various weather measuring equipment and satellite images and how they are used. - list the various weather measuring equipment and discuss how each one is used. - practise the use of some of the equipment	
	2.2.4 prepare a weather chart	Weather chart	- collect data by using the equipment and make a simple weather chart. - relate the weather charts to activities undertaken by humans in the locality.	
	2.2.5 relate climate to vegetation zones	Relationship between climate and vegetation zones	- collect information on the climate of the various vegetation zones in Ghana from libraries and the Internet - compare the information on climate to the vegetation zones and note the differences - draw the map of Ghana showing the vegetation zones and the distribution of crops and animals. - list agencies involved in providing weather and climatic information to the public and discuss their roles.	Give reasons why sorghum thrives best in Northern Ghana. while cocoa does well in the rain forest belt..

Figure 1 Integrated Science Syllabus for JHS in Ghana, figure on Climate curriculum activities

STRUCTURE OF THE LESSON PLAN

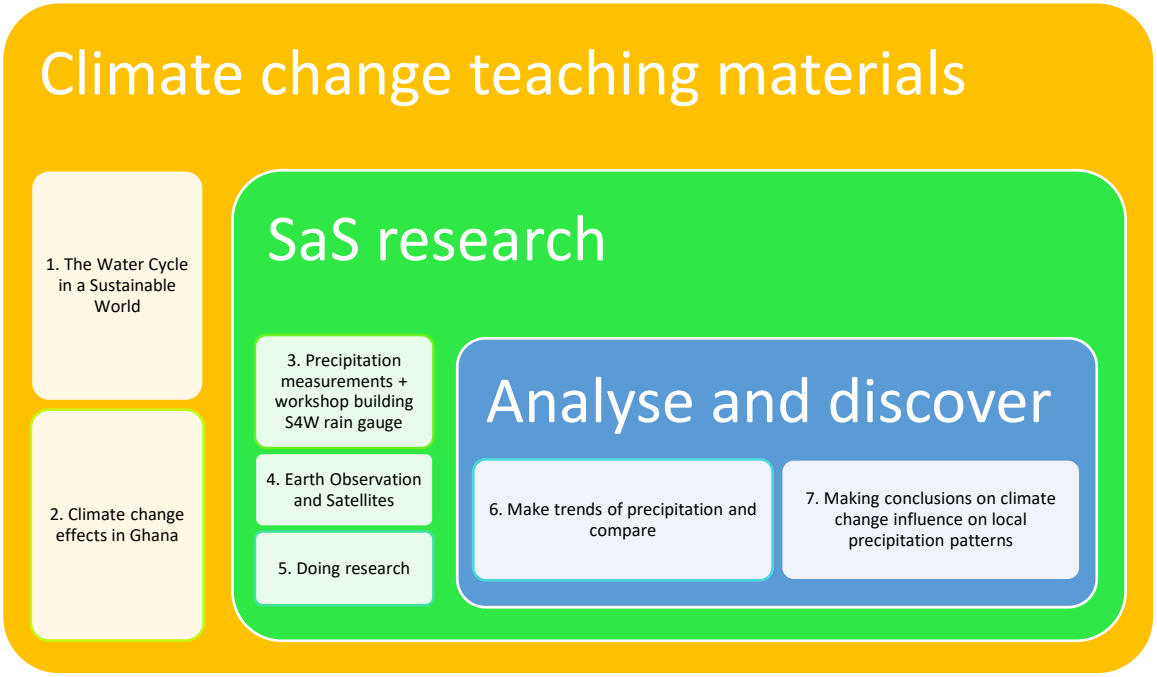


Figure 2 SaS Climate change educational module

Lesson 1 – The Water Cycle in a Sustainable World

Section 1 exists of a multitude of lessons that can be used to explain to your students the different stages of the Water Cycle and the factors that influence them.

Lesson	Content	Go To Source
1a – Watch an introductory video with your students	A video that introduces the natural water cycle on Earth and briefly describes the processes involved in it.	https://www.khanacademy.org/science/high-school-biology/hs-ecology/hs-biogeochemical-cycles/v/the-water-cycle
1b – Prepare a reading and assignment for your students	A reading that describes the different components of the water cycle in detail. It also includes downloadable diagrams of the water cycle, and assignments and discussion topics.	• https://www.usgs.gov/special-topic/water-science-school/science/water-cycle-adults-and-advanced-students?qt-science_center_objects=0#qt-science_center_objects • https://school2school.net/wp-content/uploads/2018/05/01.watercycle.pdf
1c – Play a game	Explain that students will play a game; they will role-play water as it moves throughout Earth.	https://school2school.net/wp-content/uploads/2018/05/05.watercyclegame.pdf
1d – Prepare a reading for your students	A reading that explains how climate change affects the water cycle on Earth.	https://scied.ucar.edu/longcontent/water-cycle-climate-change

Lesson 2 – Climate change effects in Ghana

Lesson	Content	Go To Source
2a – Watch videos for introduction	Causes and effects of Climate change – National Geographic Climate change in Ghana – A news report Climate change and human influence – A TED talk by Greta Thunberg	https://www.youtube.com/watch?v=G4H1N_yXBiA https://www.youtube.com/watch?v=gHGVj_iUmuA https://www.youtube.com/watch?v=EAmmUIEsN9A
2b – Prepare a reading based on literature	Hold a reading about Climate change in Ghana and its effects	https://www.ghanaweb.com/GhanaHomePage/features/Climate-Change-in-Ghana-its-effects-634377 https://yen.com.gh/117108-effects-climate-change-ghana.html
2c – Discussion	Discuss the following topics in class	• How do they see that Climate change is affecting their own community? • Can they share stories of how Climate change affected the rainfall season?

Lesson 3 – Taking rainfall measurements

Lesson	Content	Go To Source
3a – Reading	Who is taking rainfall measurements in Ghana and how?	Explain about rainfall measurement network of: • Ghana Meteorological Agency • TAHMO
3b – Exercise	How to make your own rain gauge?	Use the additional material provided with this manual: • Manual 'How to make your own raingauge' • Watch the DIY video on how to make your own rain gauge
3c – Exercise	Practice taking correct pictures of the rain gauge with the smartphone	Teach them that: • The camera should be held perpendicular to the rain gauge. • Have the different groups test it, and comment on each other's techniques and resulting pictures.
3d – Practical assignment	Start taking measurements	Divide the students in groups and use the Rainfall Measurement Syllabus and a smartphone to start taking measurements.
3e – Discussion	Discuss the following topics in class	Discussion topics: • Why do we use the Fanta bottle and not another type of bottle? • Why do you add a picture to the online measurements? • Why do we take the rainfall measurement around the same time every day? • Why do we pass on the rainfall measurement, even if there was no rainfall? So, we pass on 0 mm. Why? Not sure what the answer is, or do you have another question? Put the question online via the WhatsApp group to ask others to join the discussion.

Lesson 4 – Earth Observation via Satellites and its possibilities

Lesson	Content	Go To Source
4a – What will be done with your rainfall measurements	Show an introduction video about the goal of the SaS project, and why there is a need the data to improve the rainfall information in their country.	For now, watch this video: https://youtu.be/cLQgzfm8NCA
4b – Introduction video to Earth Observation	To learn about Earth Observation and how it works	https://www.youtube.com/watch?v=Q4WK_J9HtDE
4c – Introduction to Machine Learning	To learn about how rainfall measurements can be used in machine learning to make a rainfall information model	https://www.youtube.com/watch?v=3bJ7RChxMWQ https://www.youtube.com/watch?v=ukzFI9rgwfU
4d – Discussion	What did we learn? Why are we taking rainfall measurements, and how is that used to create better rainfall information?	Discussion points: • Why are we taking manual rainfall measurements if there are already measurements taken by GMet and TAHMO? • How will our rainfall measurements be combined with satellite information? • Why is it good to have good rainfall information?

Lesson 5 – Doing research

Lesson	Content	Go To Source
5a – Exercise	Explain to the students how to plot a graph of the rainfall measurements they took	Additional material: Print the 'How to draw a graph' working material provided with this lesson plan[1]. This can be a weekly graph, but also a monthly graph.
5b – Exercise	Watch the collected data from all the schools online and compare!	Use the new skills on making graphs: a. Go to data.smartphones4water.org and find another measurement point near to your own. b. Ask the students to compare their own measurements with these measurements, by for example plotting a graph with both measurement locations in the same graph. c. Are they the similar? Or quite different? d. Compare the total amount of rainfall measured in both locations.
5c – Discussion	What do these rainfall graphs tell us?	Discussion points: • Is this a dry or a wet year? • Is there a big variability in rainfall in space or in time? • How does this relate to information farmers need for their crops?

[1] https://www.tes.com/teaching-resource/how-to-draw-a-graph-factsheet-6257615