

MJERENJE KOLIČINE OBORINE

Tatijana Mihovilović
&

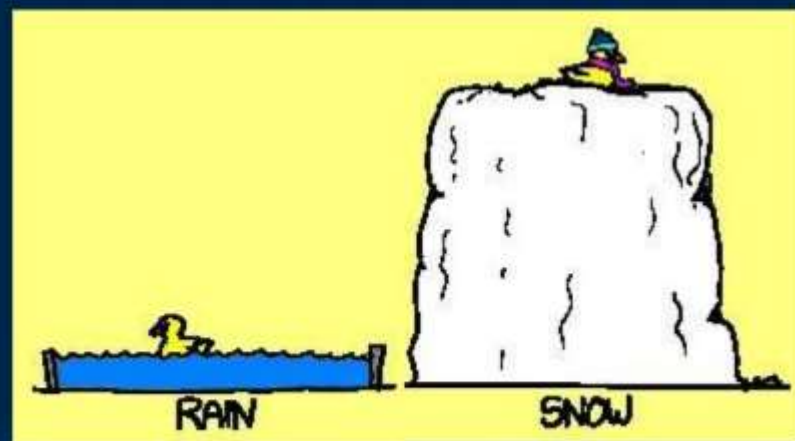
Mladen Matvijev

Šumarska i drvodjeljska škola
Karlovac

1. Općenito o meteorološkom mjeranju oborine
2. Mjerenje oborine unutar programa GLOBE
3. Mjerenje oborine tijekom intenzivnog razdoblja 1.II. – 15.IV. za projekt GPM GLOBE
4. Unos podataka na GLOBE poslužitelj

1. Općenito o meteorološkom mjeranju oborine

- mjeranje tekuće oborine
- mjeranje krute oborine

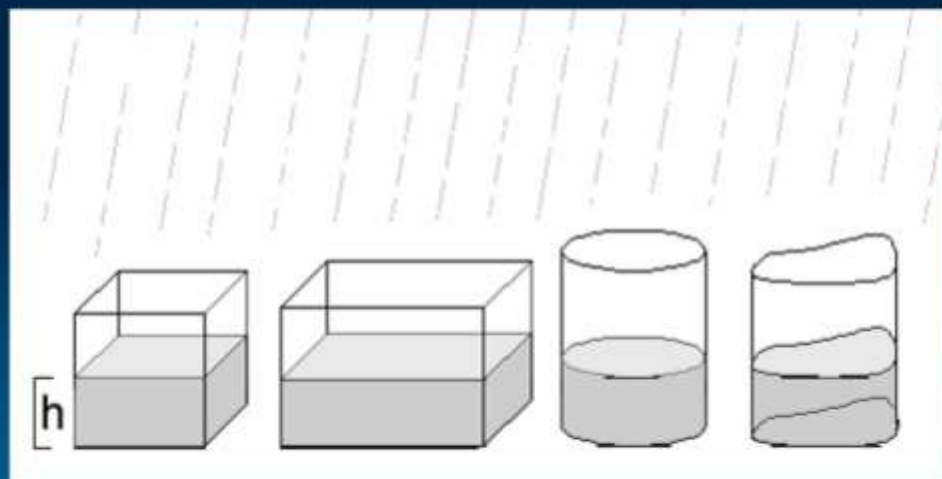


METEOROLOŠKO MJERENJE KOLIČINE OBORINE

- mjerenje tekuće oborine

➤ DEFINICIJA KOLIČINE OBORINE

- Bez otjecanja
- Bez upijanja
- Bez isparavanja



- **visina sloja vode**
 - u [mm]
 - u [mL/m²]

$$V[L] = S[m^2] \cdot h[mm]$$

$$[L] = [dm^3] = 10^{-3}[m^3]$$

METEOROLOŠKO MJERENJE KOLIČINE OBORINE

- mjerenje tekuće oborine

- instrument za mjerenje količine oborine:
HELLMANOV KIŠOMJER
- dijelovi Hellmanovog kišomjera:

1. gornja posuda s lijevkom i
zjalom površine $S = 200 \text{ cm}^2$



2. donja posuda s
kanticom



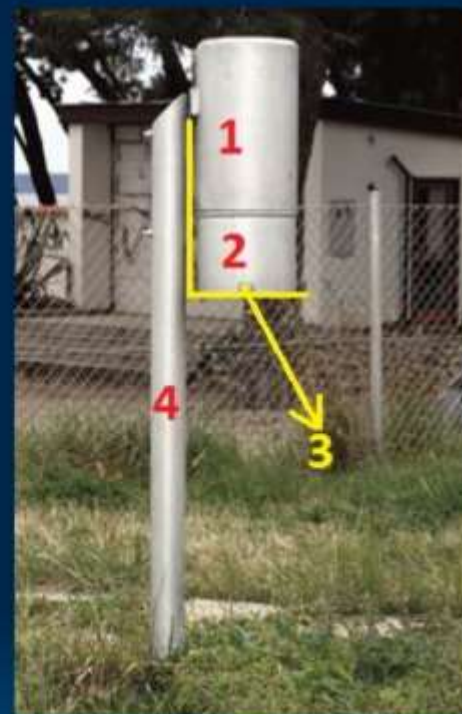
3. nosač kišomjera



4. stup kišomjera



5. kišomjerna menzura

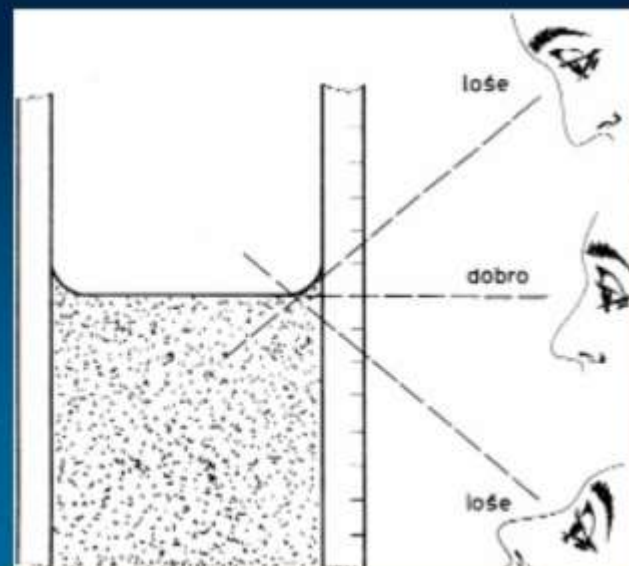


METEOROLOŠKO MJERENJE KOLIČINE OBORINE

- mjerenje tekuće oborine

➤ POSTUPAK MJERENJA:

1. podići gornju posudu kišomjera i izvaditi kanticu
2. oborinu iz kantice pažljivo izliti u menzuru
 - izliti vodu iz kantice do posljednje kapi
 - paziti da se ništa oborine ne prolije
3. menzuru postaviti na vodoravnu površinu ili je pridržati za gornji rub tako da slobodno visi
4. očitati visinu vode u menzuri
 - očitati visinu srednjeg dijela površine (DONJU CRTU)
 - očitati visinu u cijelim i desetim dijelovima mm ili mL (ako se mjeri običnom menzuruom)
 - paziti da se pri očitavanju oko drži točno u razini površine vode



METEOROLOŠKO MJERENJE KOLIČINE OBORINE

- mjerenje tekuće oborine

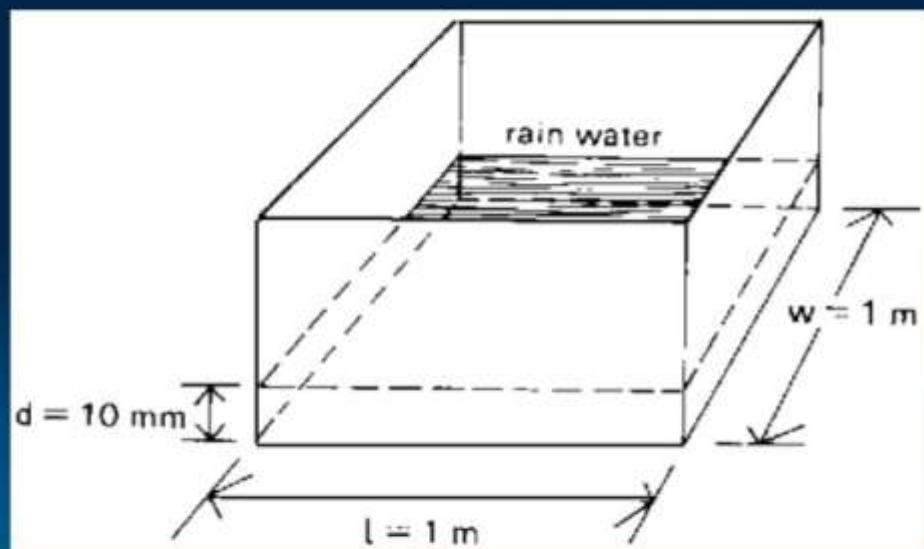
6. ukoliko je **u donjoj posudi ostalo oborine** i nju treba izliti u menzuru i izmjeriti
7. ako je **količina oborine veća od one koja stane u menzuru**, izlijevanje i mjerenje valja vršiti više puta, sve dok se ne izmjeri sva oborina (i pritom sve količine zbrojiti)
8. u slučaju kada **pada oborina za vrijeme mjerenja**, u motrilište uzeti rezervnu kanticu (ili cijeli kišomjer, ako je oborina jaka) te ih brzo zamijeniti a prikupljenu oborinu izmjeriti na natkrivenu mjestu
9. ako je **prikupljena oborina u kišomjeru u krutom stanju**, kišomjer treba unijeti u prostoriju a njega zamijeniti rezervnim te pustiti da se **prikupljena oborina otopi** (pritom što je moguće više spriječiti isparavanje)

METEOROLOŠKO MJERENJE KOLIČINE OBORINE

- mjerenje tekuće oborine

➤ POSTUPAK MJERENJA:

9. ukoliko **nema kišomjerne menzure**, mjerenje se može izvršiti običnom menzutom s podjelom u mL (=cm³) ili vagom te nakon mjerenja količinu preračunati na mm:



$$V[L] = S[m^2] \cdot h[mm]$$

$$h[cm] = \frac{V[cm^3]}{S[cm^2]}$$

$$h[mm] = h[cm] \cdot 10$$

$$S = 200cm^2$$

$$h[mm] = \frac{V[cm^3]}{200} \cdot 10 = \frac{V[cm^3]}{20}$$

METEOROLOŠKO MJERENJE KOLIČINE OBORINE

- mjerenje tekuće oborine

➤ TERMINI REDOVITIH MJERENJA:

SINOPTIČKA
MJERENJA

KLIMATOLOŠKA
MJERENJA

- u glavnim sinoptičkim terminima (*svakih 6h*)

➤ **01, 07, 13, 19 h SEV**
(za 6, 12, 18 i 24 - satna razdoblja)

- 24 – satna oborina

➤ **u 07 h SEV za prethodna 24 h**
(za razdoblje od 07 h jučer do 07 h danas)

METEOROLOŠKO MJERENJE KOLIČINE OBORINE

- mjerenje tekuće oborine

➤ TERMINI IZVANREDNIH (dopunskih) MJERENJA:

➤ vrše se izvan redovitih mjerenja, može i više puta u danu, u slijedećim slučajevima:

1. **nakon svakog jakog pljuska**

(kako bi se utvrdila količina oborine od pljuskovitih oborina)

2. **pri jakom padanju snijega**

(kako se kišomjer ne bi prepunio snijegom ili ga otpuhao vjetar)

3. **predvečer ako je tijekom cijelog dana padala kiša / snijeg**

(da se preko noći kišomjer ne bi prepunio oborinom)

METEOROLOŠKO MJERENJE KOLIČINE OBORINE

- mjerenje tekuće oborine

➤ BILJEŽENJE IZMJERENIH KOLIČINA U DNEVNIK MOTRENJA:

➤ redovna mjerenja :

Dnevnik motrenja GMP (veliki dnevnik):

DNEVNI PODACI

ZA DAN	BG _X	BG _N	TG _X	TG _N
25				

G'G'gg

• • •

R ₀₁	R ₀₇	R ₁₃	R ₁₉	R ₀₇₋₀₇	R ₁

$$R_{07-07} = (R_{13} + R_{19})_{\text{preth.dan}} + (R_{01} + R_{07})_{\text{današnji.dan}}$$

METEOROLOŠKO MJERENJE KOLIČINE OBORINE

- mjerenje tekuće oborine

➤ BILJEŽENJE IZMJERENIH KOLIČINA U DNEVNIK MOTRENJA:

- izvanredna (dopunska) mjerenja :

Dnevnik motrenja OMP (mali dnevnik):

graf ³⁾	korekcija						
Količina oborine u mm za zadnja 24 sata, mjerena danas u 07 sati SEV				Snježni pokrivač u 7 sati SEV	Snijeg izvađen vadilicom	Visina ukupnog sloja (cm)	
Izvanredno mjerenje oborine sat min količina u mm ²⁾						Sacrtaj vode	ukupnog sloja u mm
Visina snježnog pokrivača u cm (po snjegomjernoj letvi)	ukupnog sloja novog snijega				prosječno na 1 cm u mm		

- *može se bilježiti i kao napomena u veliki dnevnik – zbraja se zajedno sa prvim slijedećim mjerenjem oborine i bilježi u odgovarajuće polje za redovito mjerenje*

METEOROLOŠKO MJERENJE KOLIČINE OBORINE

- mjerenje krute oborine

- **Visina ukupnog snježnog pokrivača**



- **Visina novog snježnog pokrivača**



METEOROLOŠKO MJERENJE KOLIČINE OBORINE

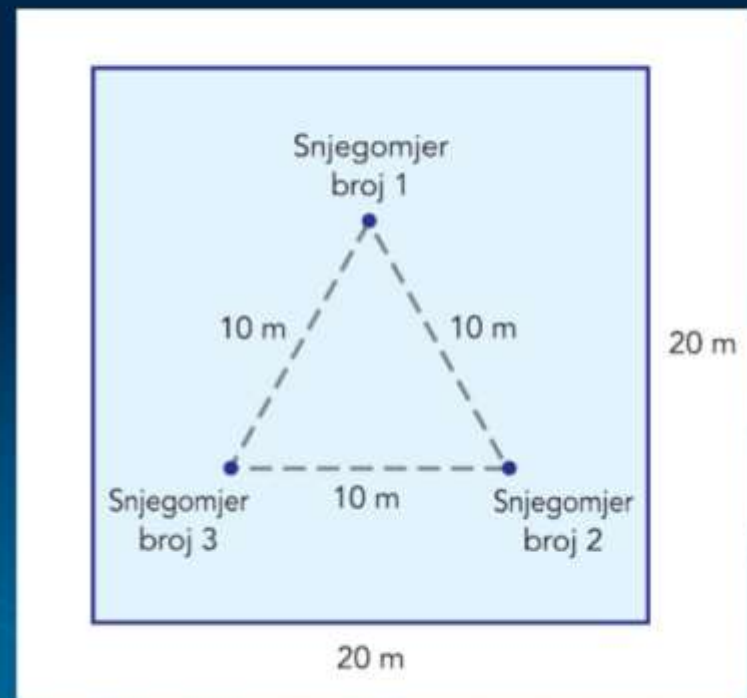
- mjerenje krute oborine

- **Visina ukupnog snježnog pokrivača**
 - gdje mjeriti ?

1. PRIMARNO: **izvan, ali u blizini motrilišta**

- ako su ispunjeni uvjeti:

- veličine 20x20 m
- reprezentativan nagib terena
- nije u sjeni ili izloženo vjetru
- travnato tlo



METEOROLOŠKO MJERENJE KOLIČINE OBORINE

- mjerenje krute oborine

➤ Visina ukupnog snježnog pokrivača

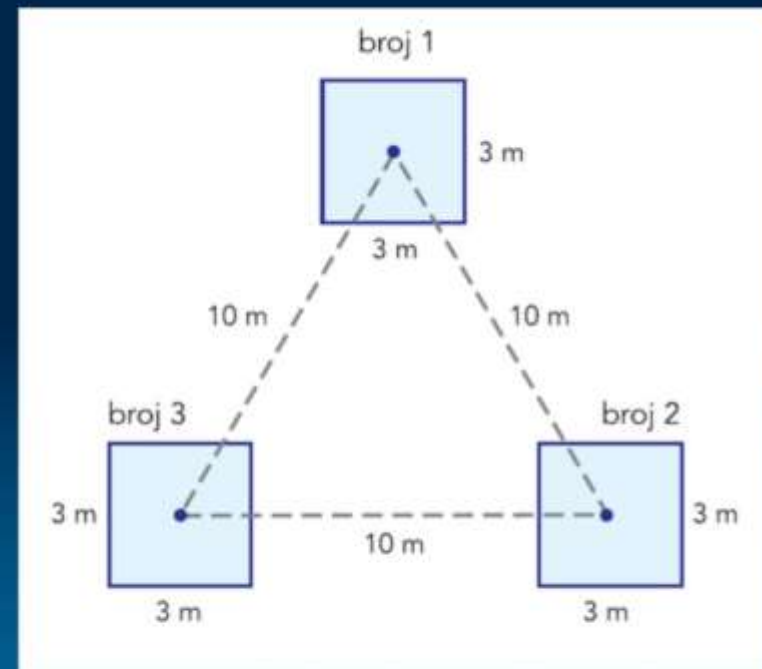
➤ gdje mjeriti ?

2. SEKUNDARNO: unutar motrilišta

➤ ako nisu ispunjeni uvjeti za mjerenje izvan kruga:

➤ Pronaći u krugu (prednost južni dio) tri mjesta koja zadovoljavaju uvjete:

- slobodna površina 3x3m
- ravno tlo obraslo travom
- nije stalno u sjeni
- nije prolazno mjesto



METEOROLOŠKO MJERENJE KOLIČINE OBORINE

- mjerenje krute oborine

➤ Visina ukupnog snježnog pokrivača

INSTRUMENTI:

➤ kako i čime mjeriti ?

STALNI SNJEGOMJER

- stalno izložen; postavlja se na tri mjesta na stupiće koji ostaju trajno ukopani u tlo (letva se preko ljeta sprema)

POKRETNI SNJEGOMJER

- izlaže se samo za vrijeme mjerenja; treba paziti da se pri zabadanju što manje poremeti snježni pokrivač i da se zabada uvijek na istom mjestu



METEOROLOŠKO MJERENJE KOLIČINE OBORINE

- mjerenje krute oborine

➤ Visina novog snježnog pokrivača

- gdje mjeriti ?
- u blizini mjesta na kojem se mjeri ukupni snježni pokrivač
- kako i čime mjeriti ?

INSTRUMENTI:

DASKA ZA NOVI SNIJEG

- postavlja se na vrh snježnog pokrivača i lagano utisne; nakon mjerenja se snijeg sa daske ukloni nastojeći što manje poremetiti snježni pokrivač, daska obriše i ponovno postavi



2. Mjerenje oborine u GLOBE programu



Precipitation Protocols



Purpose

To determine the amount of moisture input to the local environment by measuring rain and snowfall and to measure the pH of precipitation.

Overview

Students use a rain gauge and a snowboard to measure the daily amount of precipitation that has occurred. Students measure the depth and rain equivalent of each day's snow and of the total snowpack. Special pH measuring techniques for precipitation are used to determine the pH of rain and melted snow.

Student Outcomes

Students will understand that precipitation is measured in depth and this depth is assumed to apply to a large area, that precipitation has a pH that can vary, and that snow is an input of water to the surface just like rain and each snowfall is equivalent to some amount of rainfall.

Science Concepts

Earth and Space Science

Weather can be described by quantitative measurements.
Weather changes from day to day and over the seasons.
Weather varies on local, regional, and global spatial scales.
Precipitation forms by condensation of water vapor in the atmosphere.

Physical Science

Materials exist in different states.

Geography

The nature and extent of precipitation affects the characteristics of the physical geographic system.

Scientific Inquiry Abilities

Use a rain gauge to measure rainfall and rain equivalent of snow.
Use pH paper, pen, or meter to measure pH.

Use meter sticks to measure snow depth.

Identify answerable questions. Design and conduct scientific investigations.

Use appropriate mathematics to analyze data.

Develop descriptions and explanations using evidence.

Recognize and analyze alternative explanations.

Communicate procedures and explanations.

Time

In the field: 5 minutes for rain, 10-15 minutes for snow

In the lab: 5 minutes for snow rain equivalent 5 minutes for pH

Maintenance: 10 minutes weekly for cleaning the rain gauge

Level

All

Frequency

Daily within one hour of local solar noon

Materials and Tools

Installed rain gauge
Snowboard
Clean containers for pH samples 100 mL or larger

Two or three containers for snow samples

Carpenter's level

Meter stick

pH paper OR meter and pH buffers

Salt and salt card or tweezers

Sampling jar with lid

300 mL beakers or cups

Tweezers

Stirring rods or spoon

Latex gloves

[Integrated 1-Day Data Sheet](#)

Distilled water for cleaning rain gauge

GLOBE PROTOKOL ZA MJERENJE OBORINE

- mjerjenja oborine unutar GLOBE programa imaju za cilj doći do podataka o količini i kvaliteti vode koja ulazi u okoliš i na taj način sudjeluje u hidrološkom ciklusu
- ova mjerjenja oborine uključuju:
 - 1. mjerjenja tekuće oborine kišomjerom
 - 2. mjerjenja visine ukupnog i novog snježnog pokrivača
 - 3. mjerjenja vodenog ekvivalenta za krutu oborinu
 - 4. mjerjenja pH oborine

1. mjerenja tekuće oborine kišomjerom

- Mjerenja odgovaraju pojednostavljenim meteorološkim mjerenjima:

- 1. jednostavniji tip kišomjera

- 2. mjerenja jednom dnevno oko mjesnog podneva (11 - 13 h SEV)

- 3. mogućnost višednevnog mjerenja oborine (do 7 dana)

- 4. oborina se također mjeri s točnošću od 0,1mm (oborina manja od 0,5 mm se smatra oborinom „u tragovima“)



- **kako koristiti naša meteorološka mjerenja količine oborine za GLOBE?**
 - GLOBE mjerenja oborine uključuju 24-satno razdoblje od 12 SEV jučer do 12 SEV danas
 - 1. pored mjerenja oborine u 08, 13 i 19 h
NUŽNO MJERITI OBORINU I U 12 h
 - 2. 24-satna oborina za GLOBE se dobiva zbrajanjem:

$$R_{13} \text{ jučer} + R_{19} \text{ jučer} + R_{08} \text{ danas} + R_{12} \text{ danas}$$

➤ Podaci mjerenja se mogu unijeti kao:

Table AT-PP-1: Reporting Precipitation

Type of Event	Report to GLOBE the # of days since your last measurement AND...
No rainfall	0
Rainfall > 0.5 mm with no problems reading the gauge	The rainfall amount in your rain gauge
Very small amount of rain < 0.5 mm	T (for Trace)
Spilled rain gauge before measurement could be made; gauge post fell over; etc	M (for Missing)

➤ **Unos podataka mjerenja tekuće oborine:**

Precipitation (record only when collected at Local Solar Noon)

Days of accumulation: _____

Rainfall select one: Measurable Trace Missing

(if measurable is selected, complete the following fields)

Accumulation (mm): _____

Rain pH Measured With (select one): pH Paper pH Meter

pH of Rain: _____ (pH measurements only allowed when liquid amount is 3.5 mm or more)

Comments: _____

2. mjerenja snježnog pokrivača

➤ Mjerenja uglavnom odgovaraju meteorološkim mjerenjima:

➤ 1. ukupni i novi pokrivač se mjere na tri mjesta

➤ 2. mjerenja jednom dnevno oko mjesnog podneva (11 - 13 h SEV)

➤ 3. mogućnost višednevnog prikupljanja snježnog pokrivača (do 7 dana)

➤ 4. snježni pokrivač se mjeri u cijelim cm (visina manja od 1 cm se smatra tragovima)



➤ **Unos podataka mjerenja visine snježnog pokrivača:**

Snowpack

New Snowfall

Sample 1	Sample 2	Sample 3
Select one: <input type="checkbox"/> Measurable <input type="checkbox"/> Trace <input type="checkbox"/> Missing	Select one: <input type="checkbox"/> Measurable <input type="checkbox"/> Trace <input type="checkbox"/> Missing	Select one: <input type="checkbox"/> Measurable <input type="checkbox"/> Trace <input type="checkbox"/> Missing
If measurable, record amount (mm): _____	If measurable, record amount (mm): _____	If measurable, record amount (mm): _____

Rain Equivalent of New Snow

Select one: Measurable Trace Missing

If measurable, record amount (mm): _____

Snowfall pH Measured with (select one): pH Paper pH Meter

pH of New Snowfall: _____ (pH measurements only allowed when liquid amount is 3.5 mm or more)

Comments: _____

3. Mjerenje oborine tijekom intenzivnog razdoblja

1.II. – 15.IV.



GPM-GLOBE Precipitation Student Field Campaign



Global Precipitation Measurement Mission

Developed by the GPM Education and Communications Team

NASA Goddard Space Flight Center, December 2014



INSTRUMENTARIJ I MJERNA MJESTA

Koriste se postojeći instrumenti za mjerenje količine oborine:

- Kišomjeri u skladu s GLOBE protokolom
- Kišomjer po Hellmanu
- Kišomjeri u automatskim postajama (npr. Vantage Proplus2)

Unos podataka

- Sukladno dosadašnjim obvezama



The screenshot shows the GLOBE Program website interface. At the top, there is a navigation bar with the GLOBE logo and the text "THE GLOBE PROGRAM". Below this, a large globe graphic is visible. A news article is featured in the center, with a photo of children measuring a mud puddle. The article title is "Pre-K GLOBE Students Utilize Mud Puddles for Research in Louisiana". The text of the article reads: "Young scientists in Alexandria, Louisiana measure the ever-changing aspects of their environment. With rulers in hand, a group of four-year-old students study Atmosphere and Phenology factors within selected areas and begin to learn the meaning of terms such as length, width, height,..." Below the article, there are navigation arrows and a page number "6/75". At the bottom of the page, there is a navigation menu with links: Home, Teaching & Learning, Explore Science, Community, News, Events, Media, About GLOBE, and Join. A search bar is also present.

THE GLOBE PROGRAM

English

Log In

Pre-K GLOBE Students Utilize Mud Puddles for Research in Louisiana

Young scientists in Alexandria, Louisiana measure the ever-changing aspects of their environment. With rulers in hand, a group of four-year-old students study Atmosphere and Phenology factors within selected areas and begin to learn the meaning of terms such as length, width, height,

6/75 ◀ prev next ▶

Home Teaching & Learning Explore Science Community News Events Media About GLOBE Join Search

GLOBE Community

Welcome to GLOBE

The Global Learning and Observations to Benefit the Environment (GLOBE) program is a worldwide hands-on, primary and secondary school-based science and education program.

[Learn More about GLOBE](#)



New to GLOBE?



GLOBE Community

[See Members](#)

[Enter Live Data](#)

[Enter Training Data](#)

Collaboration Groups

Recent Postings in:
Hydrology

Suggestion for new protocols: phosphate, bacteria
Could a protocol for phosphate and a protocol for bacteriological condition of water be added? These are parameters that are very useful for scientists. The >>

[View All Groups](#)

Schools: 27,918
Teachers: 21,236
Total Measurements: 127,111,832
Measurements This Month: 392,171

Be a Student ZONE

Learn how to be a student GLOBE scientist

Visualize and Retrieve Data


Connect Students to GLOBE Partner Satellite Missions

File Edit View History Bookmarks Tools Help

Trojan/Fack... Vijeme.net CASNet - Ad... CASNet Adobe C... Http://www... WPC Probak... Winter Stor... Http://...2.html New Tab Home - GLO... Home - ...

https://www.globe.gov/home?y_p_id=588&p_WorldView588_p_state=main&id588_p_model=view&navet=off&hr=588... metesalb

Most Visited Vijeme.net Facebook CloudPotter App MCUNOS WONL TENDRI DVMZ PODLOGE EMAIL Brussels Sumarska i drvodjejsk... VODA MONEY BPRIJEVOZ Vanden Bone



1997. The GLOBE Games bring together environmentally concerned students, teachers, scientists and special guests from the Czech Republic and neighboring countries and have become a unifying tradition

3/75 prev next

Home Teaching & Learning Explore Science Community News Events Media About GLOBE Join Search

Email Address
sumarski_student2@gk

Password
[Redacted]

Remember Me

Sign In


[Join GLOBE](#) [Forgot Password](#)

File Edit View History Bookmarks Tools Help

The GPM - GLO... x Adobe Connect ... x (1) WEBINAR Mj... x Winter Storm in ... x Home - GLOBE... x The GLOBE Prog... x +

https://training.globe.gov/#/entry Search

Most Visited Vrijeme.net Facebook CloudSpotter App MCUNOS WONL TENDERI DHMZ PODLOGE EMAIL Brussels


 **THE GLOBE PROGRAM** *SCIENCE Data Entry Training Site* Welcome Student of Mladen Matvije

Welcome to the GLOBE data entry site. x

My Bookmarks

You have not bookmarked any investigations yet. Expand the organizations and click the stars next to the investigations to create a bookmark.

My Organizations and Sites

+ [Sumarska i drvodieljska skola](#)  Add Site

Welcome to the GLOBE data entry site. ✕

My Bookmarks ?

You have not bookmarked any investigations yet. Expand the organizations and click the stars next to the investigations to create a bookmark.

My Organizations and Sites ?

- [Sumarska i drvodjejska skola](#) 📍 Add Site

+ [atmossite:ATM-01](#) ✎ Edit site | ✕ Delete site

Latitude 45.4928, Longitude 15.5625, Elevation 119m

- [KLASP:ATM-02](#) ✎ Edit site | ✕ Delete site

Latitude 45.4928, Longitude 15.5625, Elevation 119m

Atmosphere

Aerosols ★

Clouds 1-Day ★

Multi-Day Soil And Air Temperatures ★

Surface Ozone ★

Air Temperature 1-Day ★

Integrated 1-Day ★

Multi-Day Soil And Soil Temperatures ★

Water Vapor ★

Integrated 1-Day *Creating*

Enter The Date And Time Of The Observation (UTC 24hr)

2015-01-28 11:00

Solar Noon: 11:10 UTC



• Use the buttons on the left to select what measurements you want to include in the GLOBE Science Database.

Icon Key



- Click the *Send Data* button when you are finished.
- If you need to reset the form to its original state, click the *Reset* button.

Send Data Cancel

Reset







 Observation created successfully. [Print this submission](#) or [create a new one](#). ✕

Integrated 1-Day *Editing*

Enter The Date And Time Of The Observation (UTC 24hr)

2015-01-28  11:00 

Solar Noon: 11:10 UTC

- 
- 
- 
- 
- 
- 

Air Temperature

* indicates required sections or files
- Expand/Collapse | ✕ Remove

You cannot enter a maximum or minimum temperature because no current temperature was recorded within one hour of solar noon the day before this observation.

Current Temperature

12.1 °C



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