Teaching Climate Change: Evidence and effects

Gina P. Correia | Giulia Realdon | Guillaume Coupechoux |

Pete Loader | Xavier Juan

EGU – Geoscience Education Field Officers

Geoscience Information for Teachers | Vienna 15th April 2024

Meetings | Publications | Outreach | www.egu.eu

EGU and the birth of GEFO Programme

- Among the different STEM subjects, **geosciences are probably the most neglected**, both in school curricula and in the teaching practices of many countries.

- 2019 - **EGU** launched a programme with the objective to promote geoscience education in Europe and beyond, creating a first group of teacher trainers, the **Geoscience Education Field Officers (GEFO)** in 6 countries (France, India, Italy, Morocco, Portugal, and Spain) with the support of the International Union of Geological Sciences (**IUGS**) and the International Geoscience Education Organisation (**IGEO**).

1st GEFO's trainee (Vienna, 2019)

New GEFO's trainee (Barcelona, 2022)

- 2022 - Due to its success, a second call was open and **13 new GEFO** were appointed to represent Albania, Burkina Faso, Chile, Colombia, Estonia, Germany, Greece, India, Malaysia, Romania, Togo, Turkey, and the United Kingdom.

Geoscience Education Field Officers in the world
EGU + IUGS-COGE

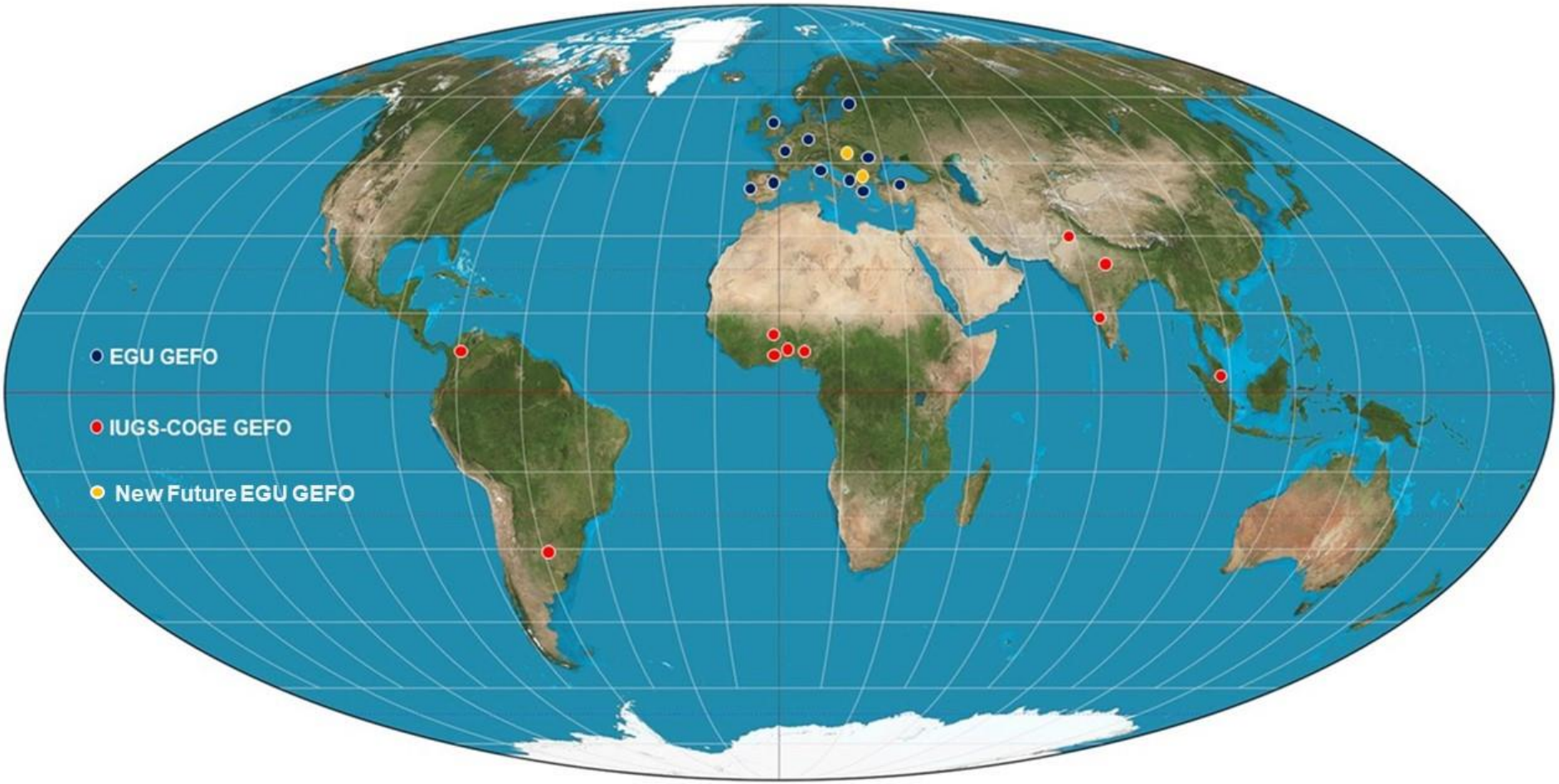


Image: Hélder Pereira

EGU Geoscience Education Field Officers

Goal:

providing professional development for school teachers and future teachers, from primary to secondary schools, in teaching the elements of geoscience appropriate for their teaching curriculum, through interactive workshops.

https://www.egu.eu/education/field-officers/

EGU Geoscience Education Field Officers

- GEFO offers face to face and online workshops at national and international level.

Images: Candan Kafali, Fotios Danaskos, Gina P. Correia, Giulia Realdon, Pete Loader

EGU Geoscience Education Field Officers

Workshops:

- Interactive
- Hands-on
- Activities: practical, simple, requiring max. one teaching time
- Materials: inexpensive, easy to obtain/build and/or readily available in normal school classrooms and science labs.

Images: examples of workshop materials, Chris King, ESEU

Topics:

Plate tectonics | Rock cycle | Seismology | Time Scale and history of Earth | Volcanology | Hydrology and oceanography | Earth in space | Natural hazards | Geopark training courses

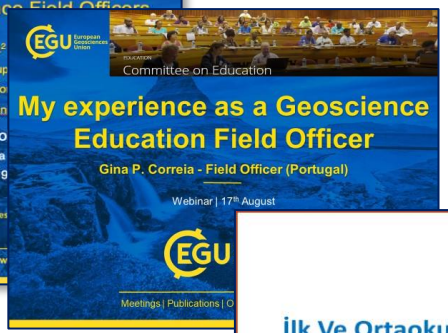
EGU Geoscience Education Field Officers

- GEFO promote geosciences teaching by presenting GEFO programme in National and international Conferences and magazines.

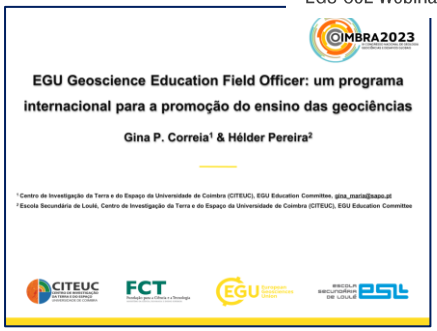
Since 2019 - 2023

- 156 WS;
- ≈ 3000 participants;
- 8 papers + 18 abstracts;
- 23 conferences/webinars.

Le Geoscienze a Scuola.
2019, Parma, Italy

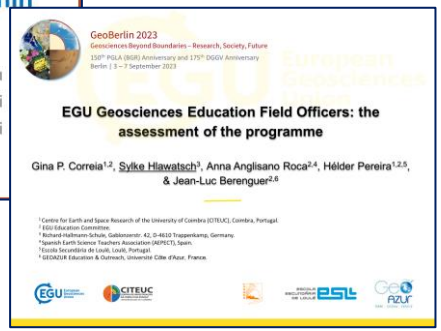


EGU CoE Webinar, 2020



Geology National Congress. 2023, Coimbra, Portugal

74th Geological Congress of Turkey.
2022, Ankara, Turkey



GeoBerlin 2023.
Berlin, Germany

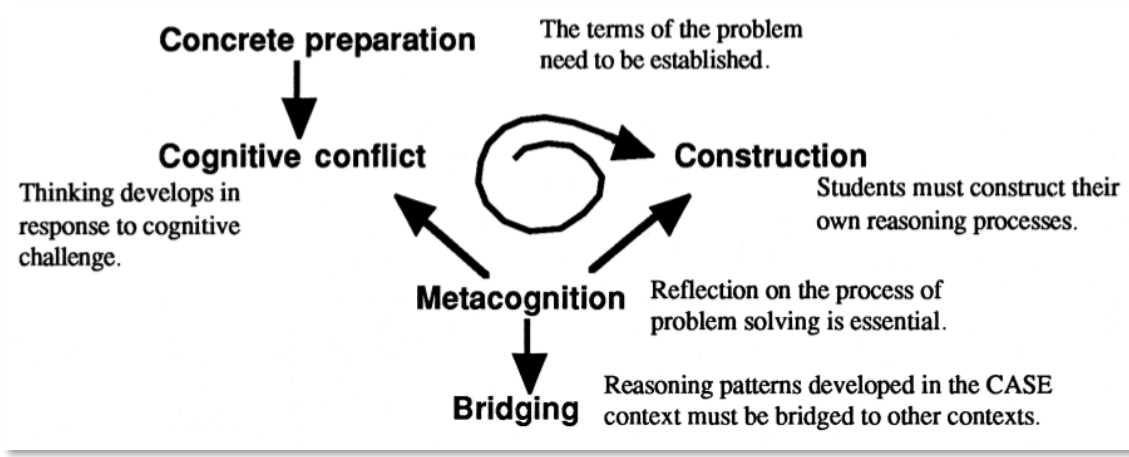
Workshop theoretical base: the CASE model

CASE - **C**ognitive **A**cceleration through **S**cience **E**ducation Programme

- Aimed at the development of cognitive skills **through** science teaching
- Based on the work of educational psychologists Piaget and Vygotsky
- Successfully tested in the '90 in UK and used worldwide

The five pillars of CASE methodology

1. **Concrete preparation**: preparing the ground, ensuring familiarity with the apparatus, the terminology, and the problem being addressed.
2. **Construction**: collecting data and detecting patterns in the data.
3. **Cognitive conflict**: when new data does not fit the expected pattern, challenging students' previous knowledge.
4. **Metacognition**: reflecting on one's own thinking, verbally or on paper.
5. **Bridging**: applying this new understanding to new contexts and to the real world.



Images:Center for Language Education, HKUST, P. Adey 1999

Geoscience Education Field Officers: the activities repository

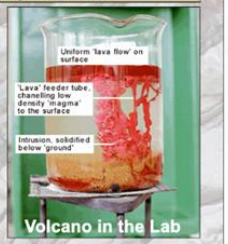
Earth Learning Idea : 15 years on and still going strong!

The ELI team - Chris King, Peter Kennett, Elizabeth Devon, Pete Loader.

The EARTHLEARNINGIDEA ("ELI") concept was born in 2007 following a failed bid by the International Geoscience Education Organisation (IGEO) to present Earth science teaching workshops, to teachers in developing countries during the 2008 International Year of Planet Earth. Masterminded by the late Professor Chris King and two colleagues on a volunteer basis, the initial plan was to publish a new activity every week for the year on a specially designated website. Each activity presented an Earth science topic using an interactive, inquiry-based approach to educate and motivate pupils, whilst developing their thinking and investigative skills.

Secondary age (11-18 yrs) activities

SCAN ME



SCAN ME

There are now over 400 activities, many with accompanying teaching videos (based on the CASE model), and extension ideas. All are FREE to download with a new topic published every two weeks. Most are aimed at teachers and teacher trainers in developing countries and so use simple apparatus that might be available in classrooms with few resources, whilst focusing on fairly simple ideas. They are designed to cover the geoscience curricula of Primary to Upper Secondary education.

Primary/Junior age (5-11 yrs) activities

SCAN ME

Innovative, Earth-related teaching ideas website

SCAN ME

ESTA Earth Science Teachers' Association

www.earthlearningidea.com

Earth Learning Idea

Innovative, Earth-related teaching ideas

EGU European Geosciences Union

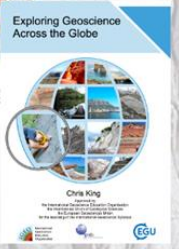
ELI PAGES | CHILDREN'S FUN | RESOURCES | TRANSLATIONS | ELI IN THE WORLD

Brickquake Video

SCAN ME

The ELI Blog

Free open-source textbooks



SCAN ME

New in 2023

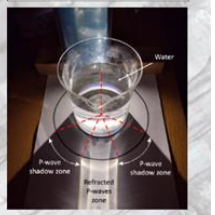
Our website now includes videos of many of our activities in action

Natural Hazard ELIs

Future Earthlearningidea activities

Critical minerals series

Earthquake Shadow Zones



The Earthlearningidea in Feb 2023 :

- ELIs in English are currently being published at one per fortnight; over 400 English activities have so far been published
- ELI PDF, videos and PowerPoint files have been downloaded more than 6.2 million times
- ELI has been accessed in most countries and more than 12,500 cities globally
- ELIs have been translated into 10 other languages: Spanish, Catalan, Norwegian, Italian, German, Portuguese, Polish, Japanese, South Korean
- ELIs have been used as the basis of teacher training education workshops in many countries

Mining and the Green Revolution

Contact details

Web: www.earthlearningidea.com

Follow us on Twitter: @ELI_Earth

E-mail: pete@Earthlearningidea.com

Geoscience Education Field Officers: the activities repository

www.earthlearningidea.com

Earth Learning Idea

Innovative, Earth-related teaching ideas

ESTA Earth Science Teachers' Association

EGU European Geosciences Union

ELI pages | Children's Fun | Teaching strategies | Virtual Rock Kit | Teaching videos | Teaching workshops | ELI translations | ELI in the world

Number of Earth Learning Idea ACTIVITY DOWNLOADS, December 2008 - March 2023

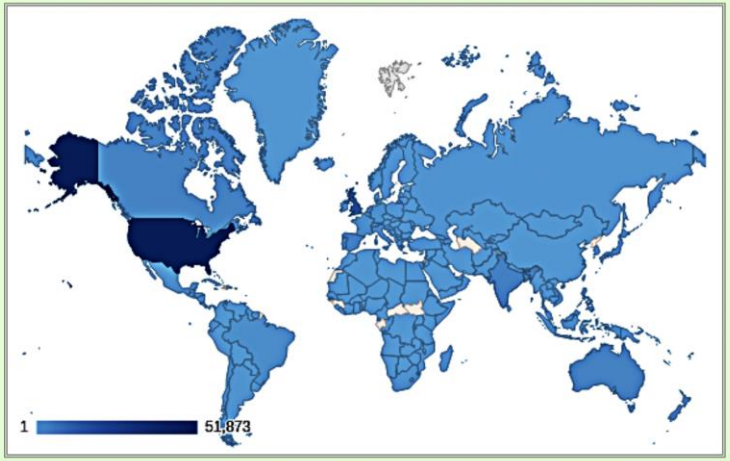
6,236,985

Data provided by Webalizer

Earth Learning Idea around the world as on February 28th 2023

The map below shows how far **Earth learning idea blog** has spread across the world since we started on 6th May 2007. There have been visits from **213** countries. The darker the colour, the more hits. We have not reached the countries coloured grey.

Data provided by Google Analytics



ELI Translations

- Castellano — Proyecto Internacional de Investigación
- Català — Projecte Internacional de Recerca
- Norsk
- Italiano
- Deutsch
- Português (países de língua portuguesa)
- Polski
- Slovensky
- Japanese
- South Korean
- Tamil

- Earth as a System *(27 activities)*
- Earth Energy/Processes *(111 activities)*
- Earth in Space *(13 activities)*
- Earth Materials *(53 activities)*
- Evolution of Life *(27 activities)*
- Geological Time *(14 activities)*
- Investigating the Earth *(83 activities)*
- Natural Hazards *(21 activities)*
- Resources and Environment *(41 activities)*

http://www.earthlearningidea.com

Teaching Resources

- Topics & Teaching strategies
- Teaching videos & workshops ages 5-11
- Teaching videos & workshops ages 11-18
- Geography teaching videos & workshops ages 11-14
- Mining and the Green Revolution, ages 14-18
- ELI Virtual Rock Kit
- Geoscience textbooks

- > 400 available activities
- Explanatory videos
- Translated into different languages
- 2008 to 2024 ⇨ over 6,6 million downloads

Geoscience Education Field Officers: the activities repository

ESTA Earth Science Teachers' Association
earth-science-teachers.uk

www.earthlearningidea.com

Earth Learning Idea

Innovative, Earth-related teaching ideas

EGU European Geosciences Union

Shaken but not stirred?
How earthquakes affect buildings

Make up a model as shown in either of the two photographs, depending on what materials you have to hand.

Photo 1: Model 'buildings' of different heights, using helium-filled balloons (*Photo: Peter Kennett*)

Photo 2: Blutak™ 'buildings', secured to a wooden base by more Blutak™. The middle 'building' is swaying as the base is moved backwards and forwards on the table top. (*Photo: Peter Kennett*)

Show the model to the pupils and ask them to say which of the three structures will sway the most when the base is shaken forwards and backwards several times on the bench. Most pupils will say that the tallest structure will sway the most, but this is not always the case. The amount of movement at the top of each column depends upon the frequency with which the base is moved – a high frequency will cause the shortest structure to sway the most, while a lower frequency causes the tallest structure to sway the most. With practice you can find the right frequency to get any of the buildings to sway the most – so that the pupils' predictions are wrong each time!

Ask the pupils to suggest what relevance this demonstration has in the real world. Most will suggest that the model is showing what happens to buildings when they are affected by an earthquake. No doubt, pupils will relate their observations to images seen on T.V., filmed during a recent earthquake.

Damaged buildings in the Port-au-Prince neighbourhood of Bel-Air, after the 2010 Haiti earthquake. The tall block remains standing amid the ruins of lower, less well-constructed buildings.

Show pupils the animated cartoon on the website below, to help them to relate the model aid to a high rise building. Ask them what may not be correct about the cartoon (*Tall buildings are not necessarily the ones to collapse in an earthquake, if they have been properly constructed*).
http://upload.wikimedia.org/wikipedia/commons/b/b4/Bldg_1sss.gif

The back up

Title: Shaken but not stirred?

Subtitle: How earthquakes affect buildings

Topic: A teacher-led demonstration of the relationship between the frequency of the shaking of the 'ground' and the movement of model 'buildings' of various heights.

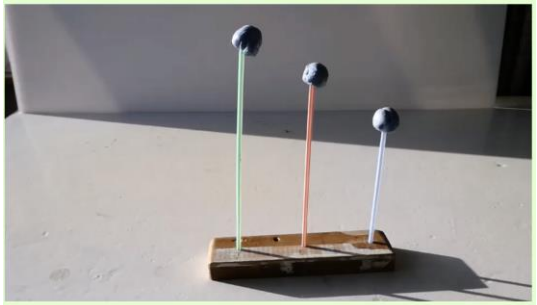
Age range of pupils: 14 – 18 years

Time needed to complete activity: 10 minutes

Shaken but not stirred? How earthquakes affect buildings

ELI activity: Shaken but not stirred? How earthquakes affect buildings

Video demonstrations



Shaken but not stirred? How earthquakes affect buildings

ELI activity: Shaken but not stirred? How earthquakes affect buildings

Pupil learning outcomes: Pupils can:

- observe the movement of a structure when its base is shaken;
- establish a visual relationship between the height of a structure and the frequency with which it is shaken;
- relate their observations to the damage caused by an earthquake in a built-up area.

Context: The activity can be used to help students to explore the effects of earthquakes in densely populated areas, and to dispel misconceptions about the relative safety of high rise buildings in seismically active regions.

Following up the activity:
Pupils could:

- look for a relationship between the height of structures and the frequency of vibration by timing the movement to and fro of the base and using a range of heights for their 'buildings'; *In the model shown in Photo 2, the 21cm tall structure swayed at 1.7 shakes (cycles) per second: the 17cm structure at 3.1 cycles per second and the 13 cm structure at 4.0 cycles per second.*
- investigate other materials in place of the ones shown in the photographs, using 'stalks' of different rigidity, and with different masses on top of their structures;
- carry out a web search for images of buildings which have survived/been destroyed by the same earthquake and suggest reasons for their findings;
- carry out a web search for various engineering solutions in the design of earthquake-resistant buildings.

Underlying principles:

- All buildings have a natural frequency of vibration. They shake in response to the ground being shaken by the passage of seismic waves, generated by an earthquake.
- When the natural frequency of vibration is the same as the frequency of the seismic waves, the building is said to resonate, and it is at this point that the building sways the most and so is most liable to be damaged.
- Tall buildings are not necessarily the ones at most risk from earthquake damage.
- Engineering solutions depend on calculating the natural frequency of the building and on knowing the normal range of frequencies of the relevant types of seismic waves, before designing strengthening measures etc.
- Existing buildings can sometimes be made more earthquake resistant by adding extra struts, or flexible joints. This is termed retrofitting.

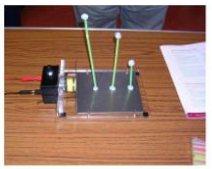
Thinking skill development:
Students usually experience a cognitive conflict at the start of the activity, when the structure which they had expected to move the most does not always do so. Explaining why they were wrong involves metacognition. Linking the model to real earthquakes is a relatively simple bridging skill.

Resource list:

- a model of three 'high rise buildings', made up before the lesson. Photograph 1 shows three helium-filled balloons on 'party sticks' cut to different lengths, fixed to holes drilled in a block of wood. Photograph 2 shows three drinking straws with blobs of Blutak™ of similar mass, fixed to a wooden base with more Blutak™.

Useful links: See below. Also see the Earthlearningidea activities: '*Quake shake – will my home collapse?*', '*Surviving an earthquake*', and '*Earthquake through the window – what would you see, what would you feel?*'

Source: Based on an idea by Peter Loader, in 'Teaching Earth Sciences', Vol. 36 No. 1 2011. A more sophisticated method, using an electrically operated shaker table, is given in 'Innovations in Practical Work: Seismology', 2007, Gatsby Science Enhancement Programme, ISBN: 978-1-901351-72-9.



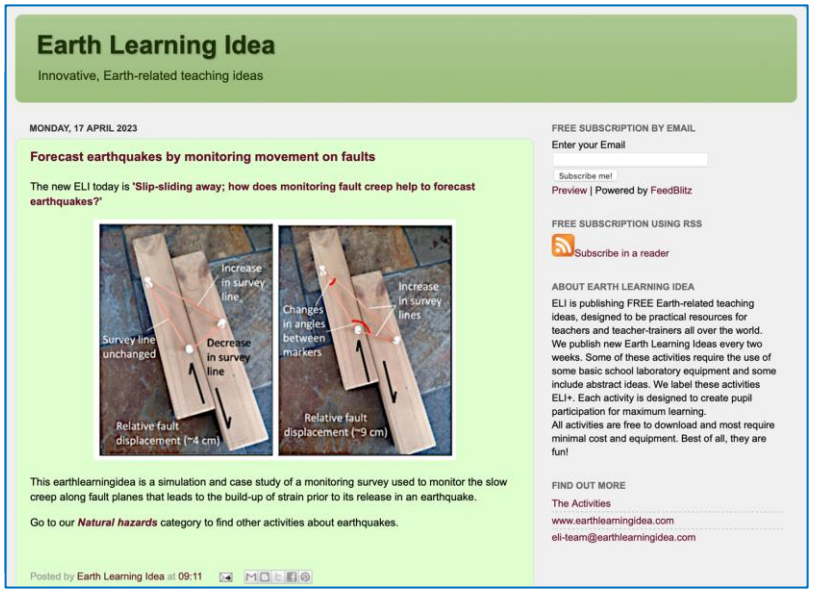
Model 'buildings' using an electrically operated shaker table, from the SEP kit. (*Photo: Peter Kennett*)

Details of publications and equipment, including a working seismograph, capable of recording real earthquakes, are given on the website:
http://www.sep.org.uk

Geoscience Education Field Officers: the activities repository in social media

https://www.facebook.com/earthlearningidea

https://twitter.com/ELI_Earth



- a new Blog update every Monday
- a new activity posted every 2 weeks
- New videos uploaded all the time.

http://earthlearningidea.blogspot.com/

Teaching Climate Change: Evidence and effects

In this workshop we are presenting a few **examples of practical labs**:

- addressing some topics **included in the Geosciences curriculum** for different age groups;
- useful for **understanding the functioning** of our planet and how it is **affected by climate changes**;
- requiring students to **apply their new learning** to the other situations and **to real phenomena happening on the Earth**;
- fostering **students' awareness and positive attitudes** towards the protection and sustainable management of our planet.

Image: NOAA, permitted use

Teaching Climate Change: Evidence and effects

The workshop we are presenting today address:

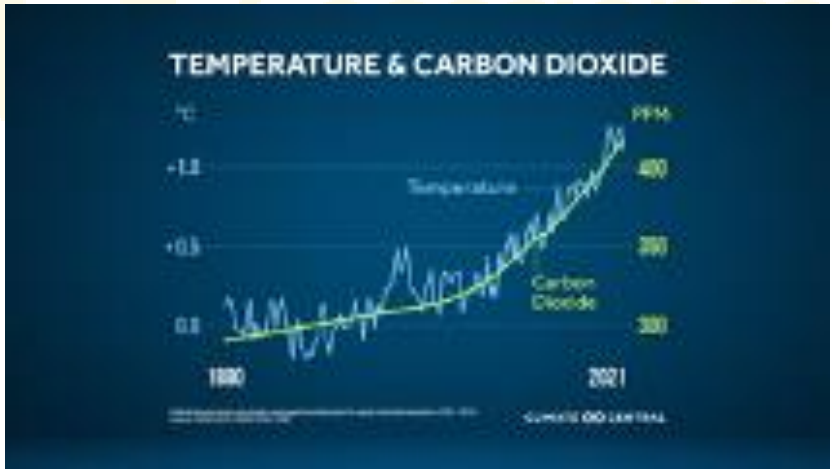
- **'Greenhouse effect in a bottle'** (How to simulate the effect of increased CO_2 level on Earth temperature)
- **'Earth's oxygen thermometers'** (Simulating how ocean sediment and continental ice cores record past changes in Earth's temperature)
- **'Sea level in a plastic cup'** (Eight ways to change the water level in a plastic cup - and global sea level)
- **'Ocean acidification – The other CO_2 problem'.** (See how acidified water affects calcareous marine organisms)
- **How do I choose the best insulation ?** (Investigating enhanced insulation for buildings)

Greenhouse effect in a bottle

https://www.earthlearningidea.com/PDF/441_Greenhouse_bottle.pdf

BACKGROUND INFORMATION

- The greenhouse effect occurs because solar radiation enters the atmosphere and is partly reflected by Earth's surface, atmosphere and clouds, but lower energy radiation (heat), reflected from the surface, is "trapped" by certain atmospheric gases and cannot return to space.
- These gases, called **greenhouse gases**, are water vapour, carbon dioxide (CO_2), methane (CH_4), and others minor components.
- Apart water vapour, the most abundant and persistent greenhouse gas is CO_2, produced mainly by the burning of fossil fuels, industrial processes, farming, and land use.
- Its abundance has dramatically risen since the industrial revolution, around 1750



(image: Climate Central, permitted use)

- A consequence of the increase in greenhouse gases is excess heat in the atmosphere, which has caused an increase in global average temperature, known as **global warming**, leading to rapid climate change, dangerous to the environment and to most living organisms, which have evolved under more stable climate conditions.

Greenhouse effect in a bottle

https://www.earthlearningidea.com/PDF/441_Greenhouse_bottle.pdf

THE ACTIVITY

MATERIALS: two transparent plastic bottles with a small hole in the cap (enough to fit a thermometer suspended in the bottle), two thermometers, tap water, fizzy tablets, a hot bulb lamp or a sunny day, a stopwatch, pen and paper

Images: Giulia Realdon

The two bottles at the beginning of the experiment and after adding the fizzy tablet to the left one and exposing them to a hot-bulb lamp.

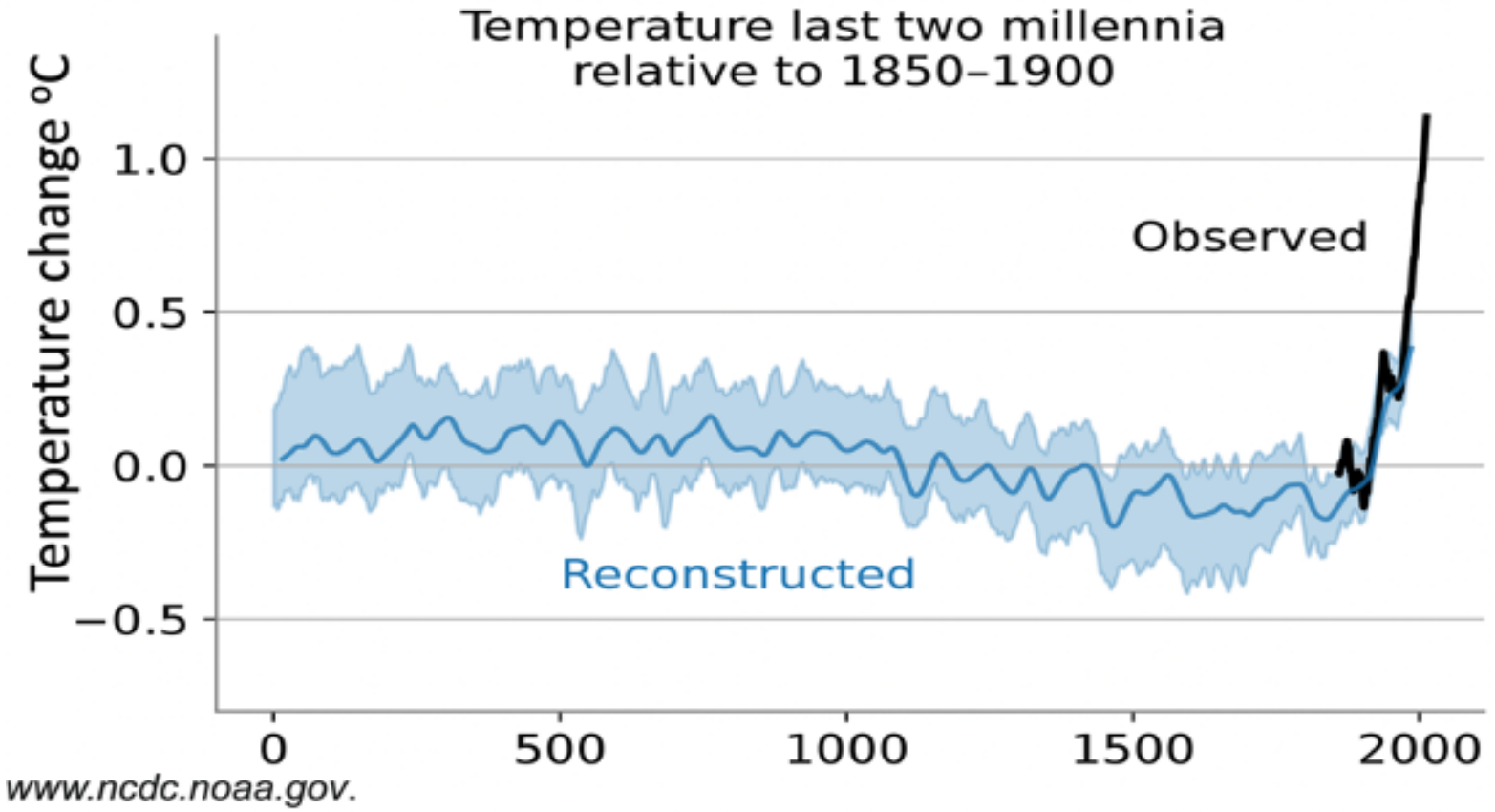
PROCEDURE

- Drill a small hole in the cap of two plastic beverage bottles and insert a thermometer that fits in it.
- Label the bottles as EXP (experimental) and CTRL (control).
- Pour the same amount of water into the bottles and check that the thermometers don't touch the liquid
- Close the bottles so that the caps are NOT airtight,
- Check that the initial temperature is the same in the two bottles
- Open the EXP bottle, add two fizzy tablets and close it quickly.
- Place an incandescent lamp so that it projects light and heat onto the two bottles or, on warm days, expose the two bottles to direct sunlight.
- Record the temperature inside the two bottles every 3 minutes for 15 minutes and enter the data into a time/temperature graph

Earth's Oxygen Thermometers

https://www.earthlearningidea.com/PDF/440_Oxygen_thermometers.pdf

Past climate change. How do we know?



https://www.earthlearningidea.com/PDF/440_Oxygen_thermometers.pdf

Oxygen isotopes in water

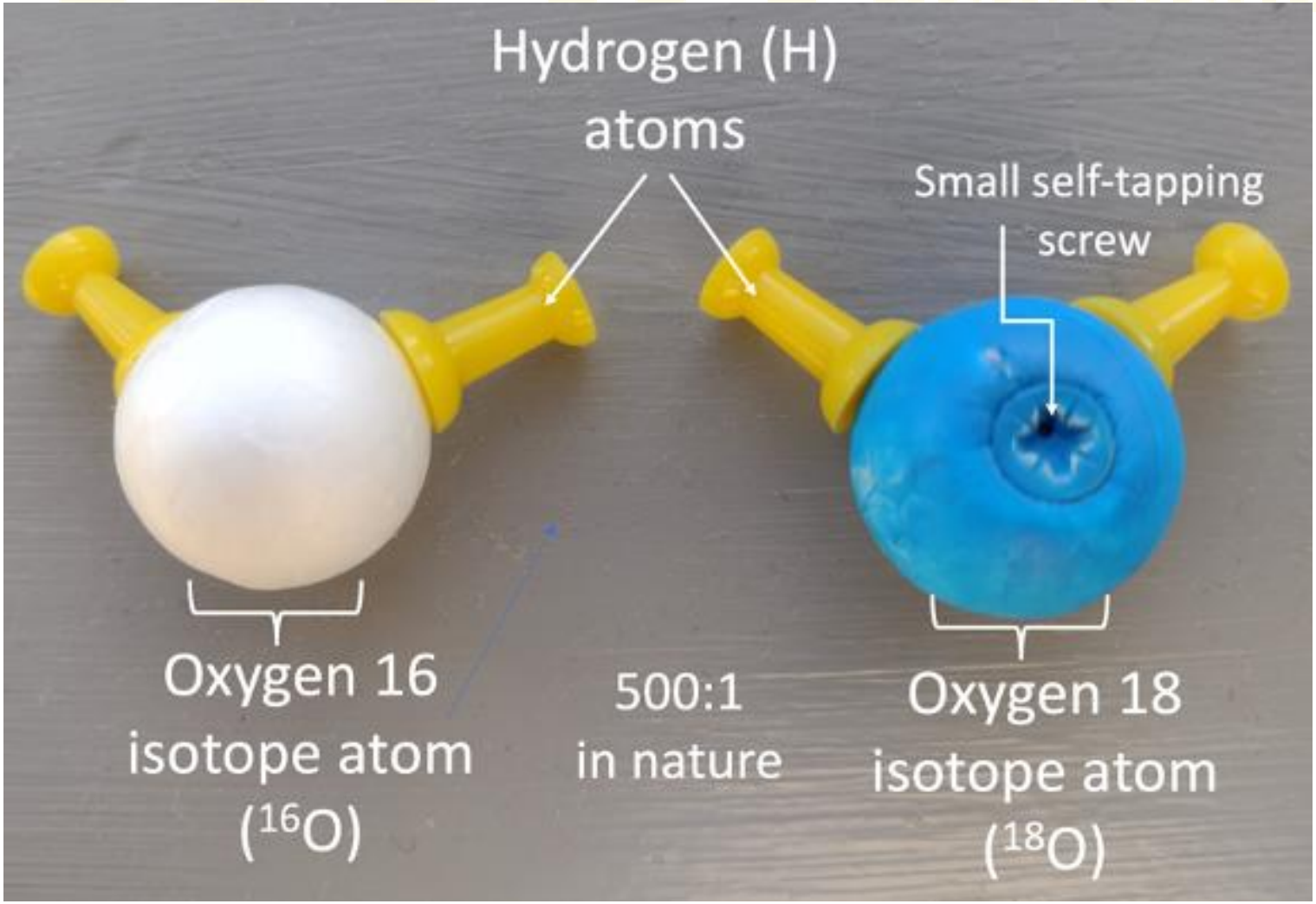


Image: Pete Loader

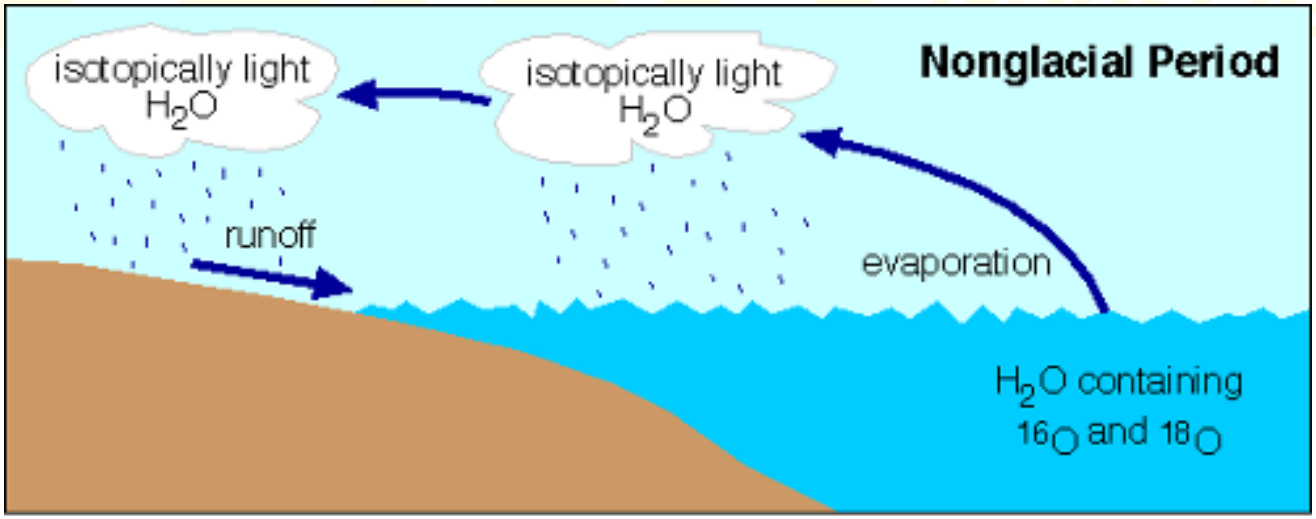
https://www.earthlearningidea.com/PDF/440_Oxygen_thermometers.pdf

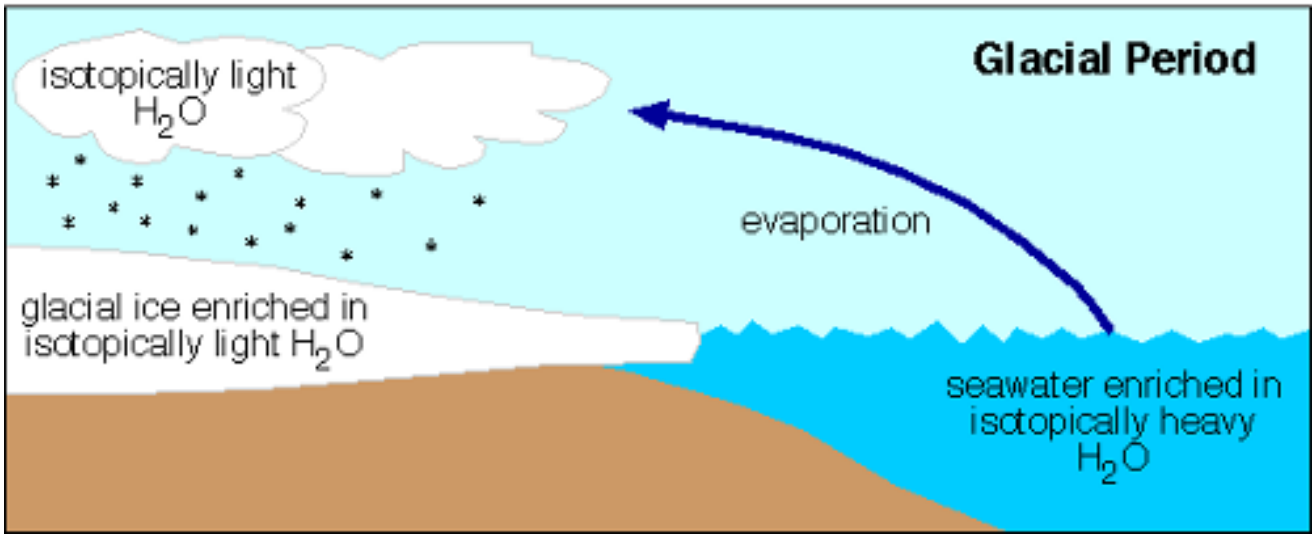
Oxygen isotope fractionation

Image: Pete Loader

https://www.earthlearningidea.com/PDF/440_Oxygen_thermometers.pdf

Oxygen isotope fractionation





Earth's Oxygen Thermometers

https://www.earthlearningidea.com/PDF/440_Oxygen_thermometers.pdf

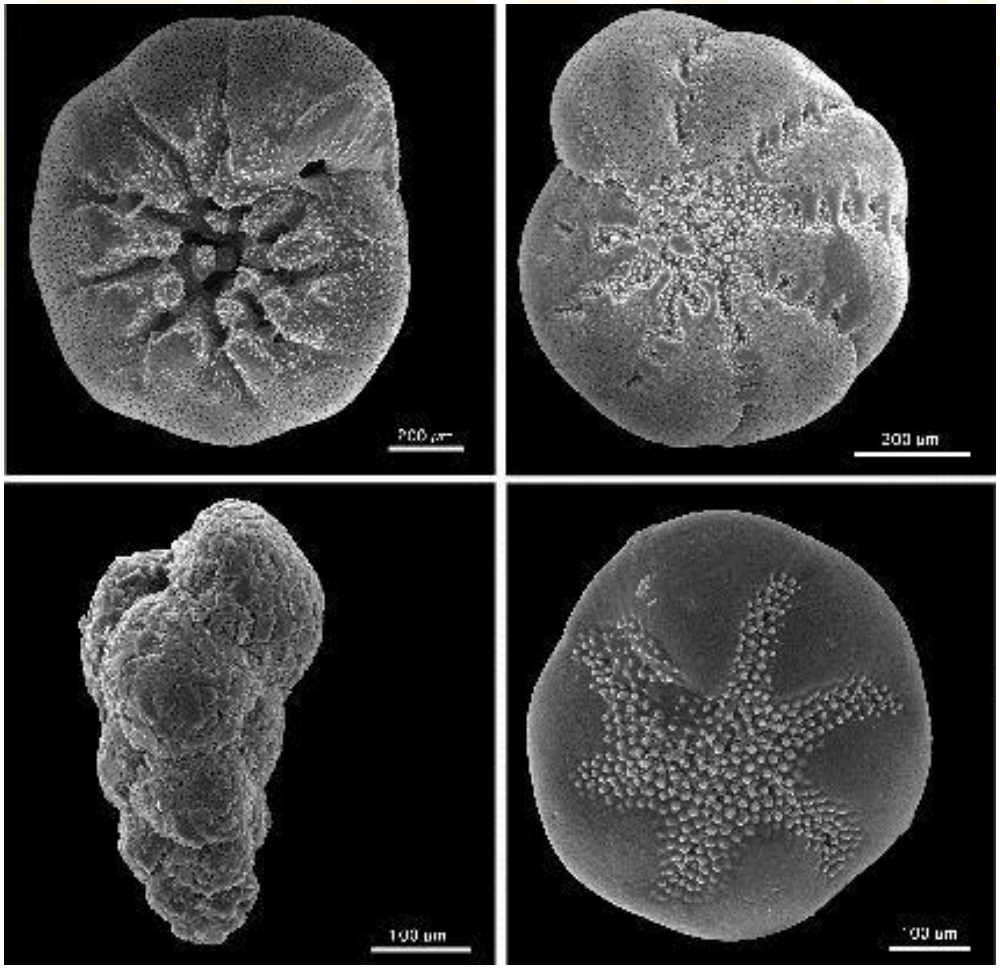
Oxygen isotope fractionation

Image: Pete Loader

Earth's Oxygen Thermometers

https://www.earthlearningidea.com/PDF/440_Oxygen_thermometers.pdf

Calcareous foraminifera

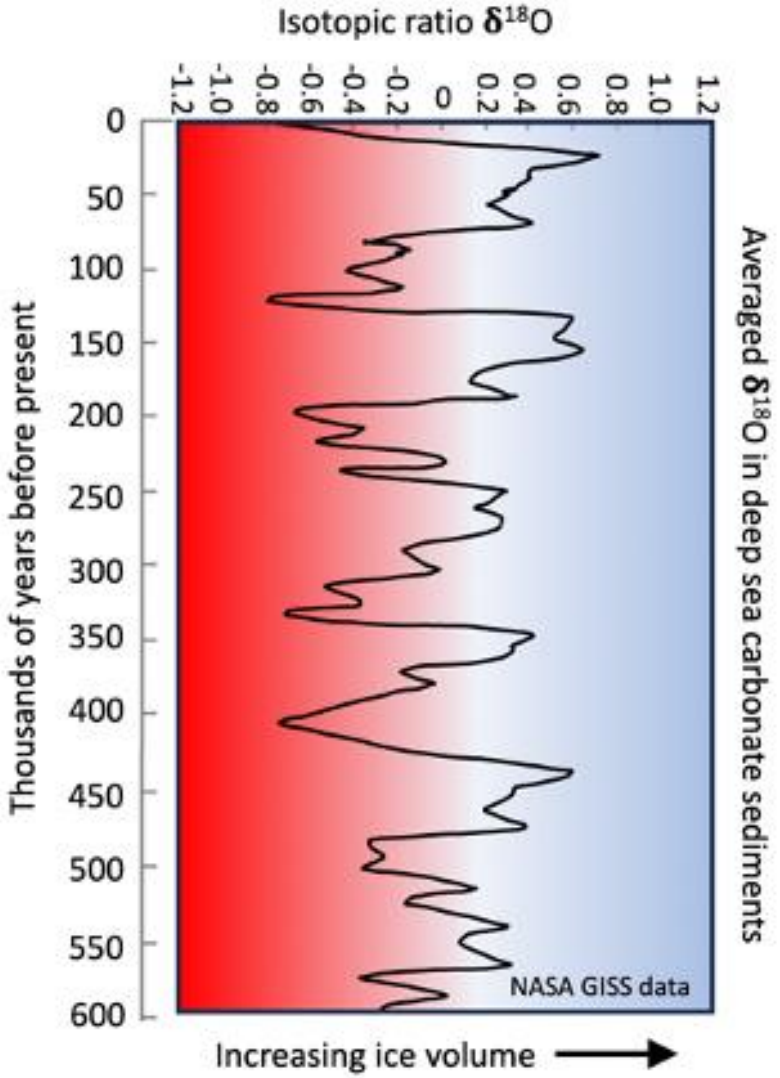


Images: Wikimedia Commons

Carbonate sediment analysis

Earth's Oxygen Thermometers

https://www.earthlearningidea.com/PDF/440_Oxygen_thermometers.pdf



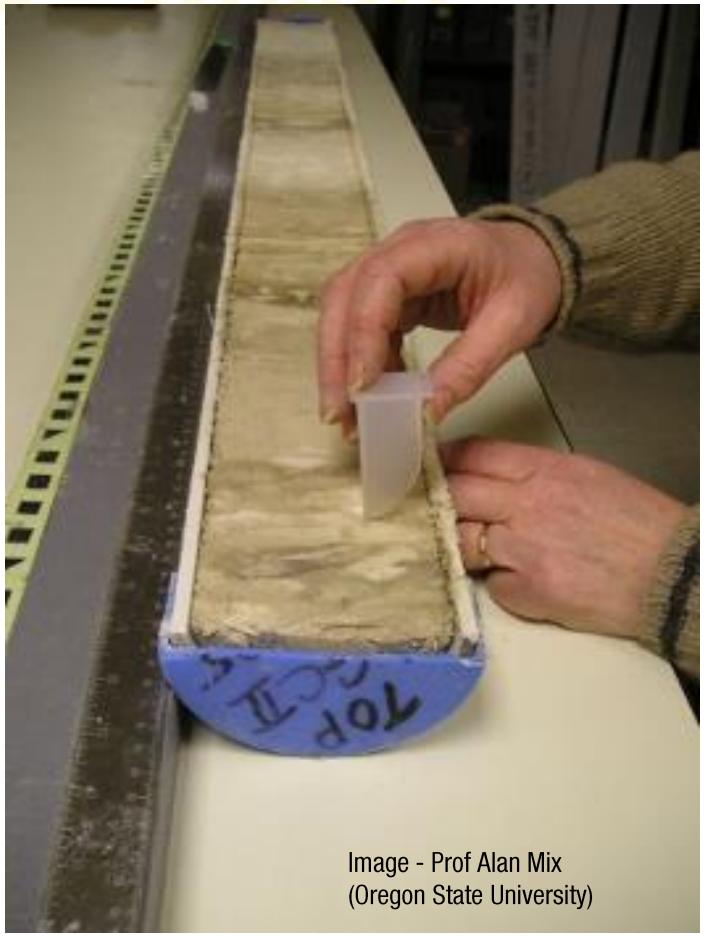
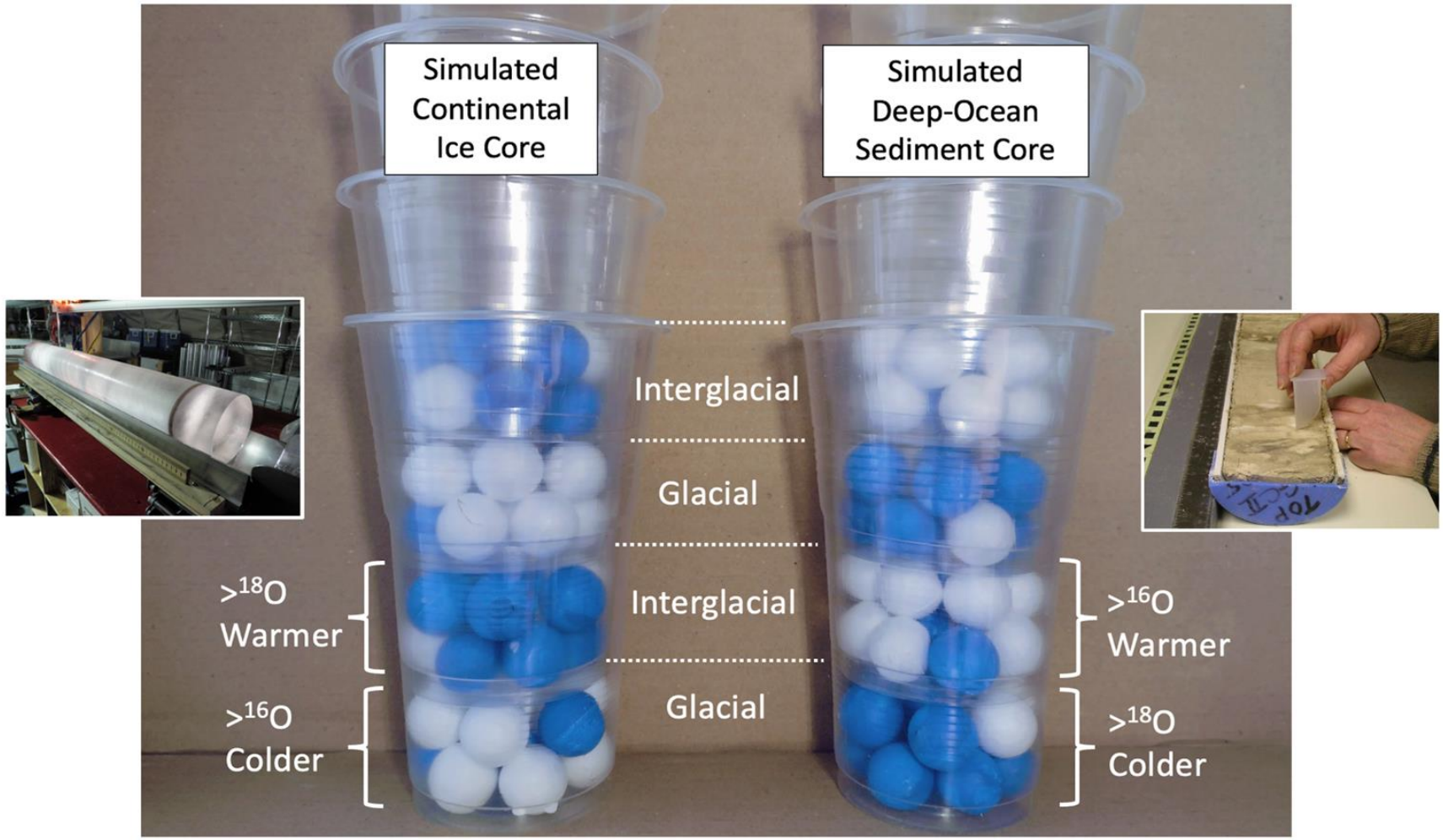


Image - Prof Alan Mix
(Oregon State University)

Ice core - ocean sediment core analysis

Earth's Oxygen Thermometers

https://www.earthlearningidea.com/PDF/440_Oxygen_thermometers.pdf



Credit: Heidi Roop.NSF

Credit: Prof Alan Mix

Image: Pete Loader

Sea level in a plastic cup

https://www.earthlearningidea.com/PDF/369_Global_sea_level.pdf

Imagine that the line in your plastic glass is the global sea level today.

Suggest as many ways as you can to change the level of water in the cup (up or down) without removing water from the top.

1. add ice or water;
2. heat the water (but many students may not know that heating water makes it expand a little);
3. make a hole in the cup so it leaks;
4. push up the base;
5. deform the sides (they may combine 4 and 5 together in 'deform the cup');
6. put things in the cup;
7. tilt the cup (when one side of the water will be higher);
8. change gravity (pupils usually do not suggest this).

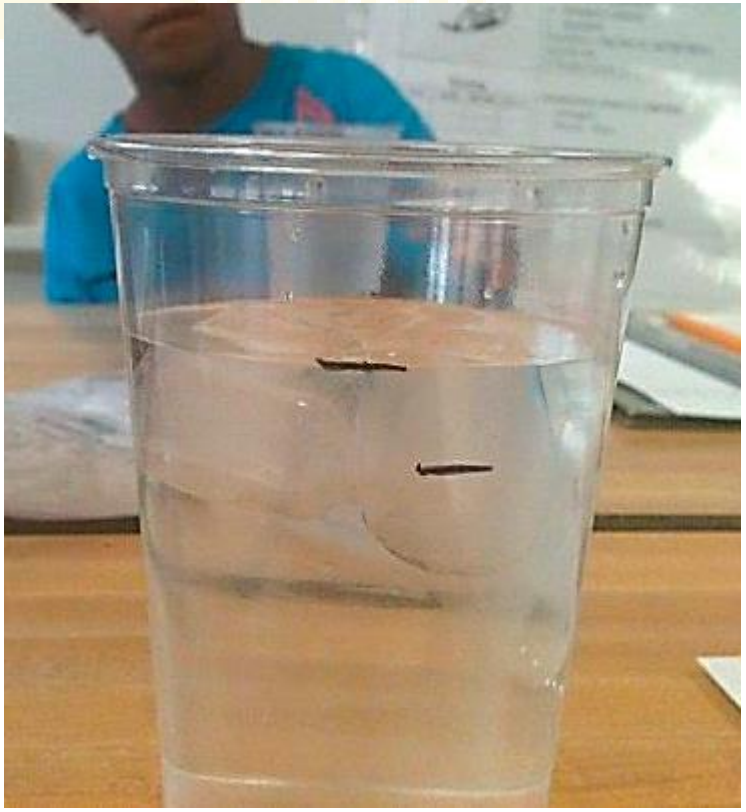


Image: Clinton Conrad

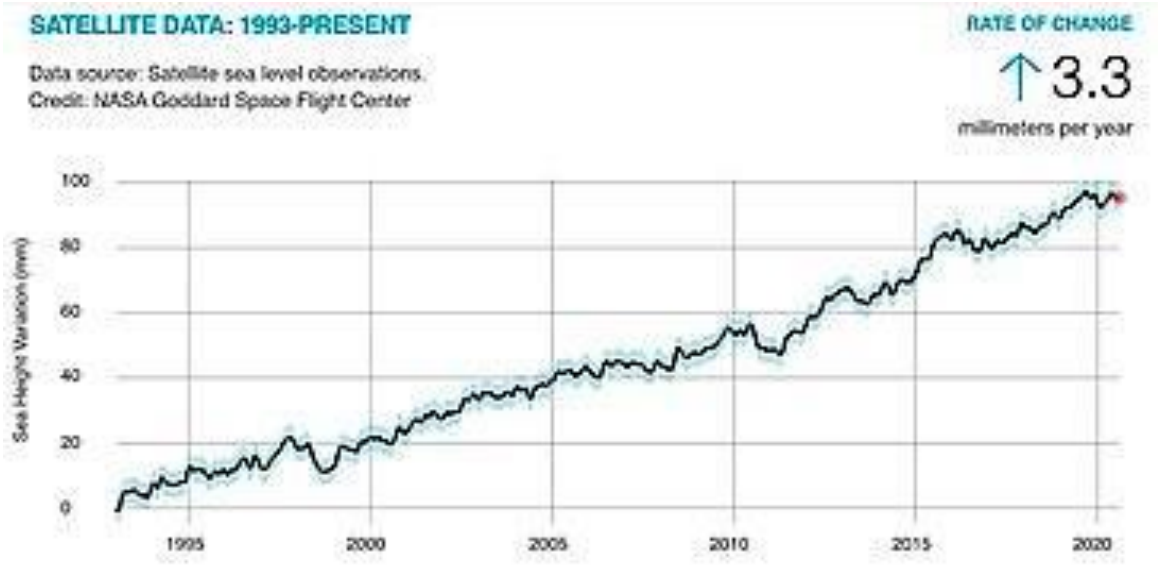
Sea level in a plastic cup

https://www.earthlearningidea.com/PDF/369_Global_sea_level.pdf

Years ↑ Billions of years	Change gravity
	Heat the water
	Tilt the cup
	Add water or ice
	Deform the sides
	Put things in the cup
	Deform the base
	Make a hole

Relative **time scales of** the processes involved

Sea level change in mm per year from 1993 to 2020 based on satellite data. (NASA – in the public domain).

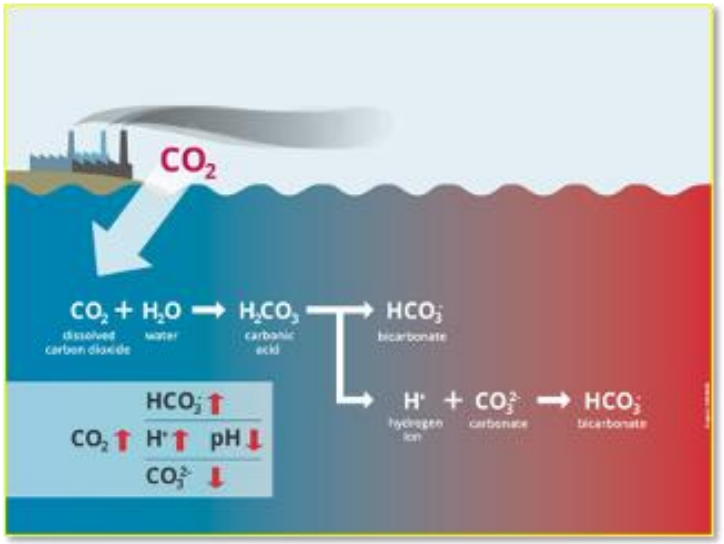


Ocean acidification – The other CO_2 problem

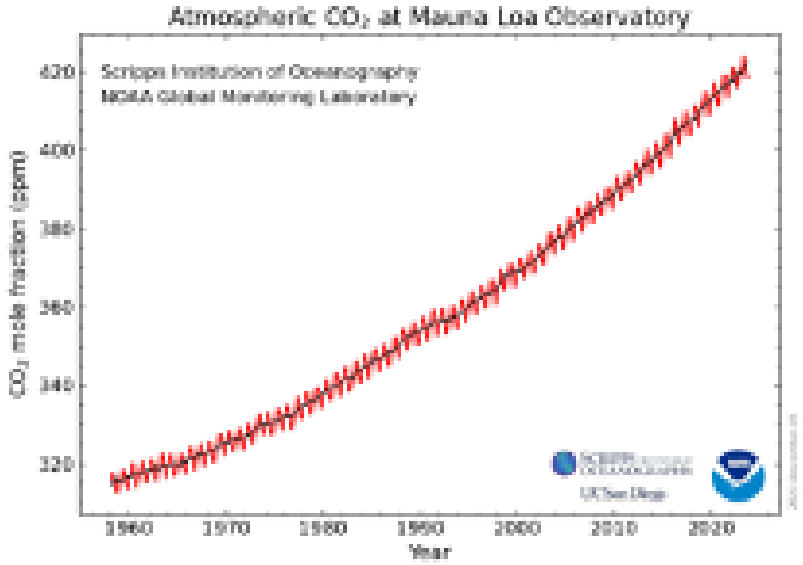
https://www.earthlearningidea.com/PDF/439_Ocean_acidification.pdf

BACKGROUND INFORMATION

- It is estimated that, from 1750 to 2021, 474 Pg of carbon (1 Pg = 10^{15} g = billion tonnes) were emitted as CO_2 from the use of fossil fuels.
- About half of the CO_2 emitted remains in the atmosphere, now exceeding 400 parts per million, the rest is partially dissolved in the ocean.



(Images: Bioacid.de and NOAA, permitted non-commercial use)



- The consequence is that, since the Industrial Revolution, the pH of the ocean's surface waters has decreased from 8.21 to 8.10, indicating about a 30% increase in acidity.
- This means that as the ocean acidifies, the concentration of CO_3^{2-} carbonate ions decreases.
- Calcifying organisms, such as molluscs, corals, and various plankton species, need carbonate ions to build their shells or skeletons

Ocean acidification – The other CO_2 problem

https://www.earthlearningidea.com/PDF/439_Ocean_acidification.pdf

THE ACTIVITY

MATERIALS: a small glass bottle or beaker, a drinking straw, "distilled" (demineralised) water for ironing, universal liquid pH indicator with colour scale, a few shells (or eggshell) reduced to powder, a teaspoon

- Use a small bottle or boiling tube 2/3 filled with distilled (or deionized) water to simulate ocean water*
- Add some drops of universal pH indicator to the water until it becomes a medium-green colour and mix it by rotating the bottle.
- Observe the colour and compare it with the pH colour scale
- Use a straw and blow into the solution for at least 30 seconds.
- Estimate the new pH value
- Add one teaspoon of shell powder to the solution and stir it by rotating the bottle.
- Observe what is happening in the solution

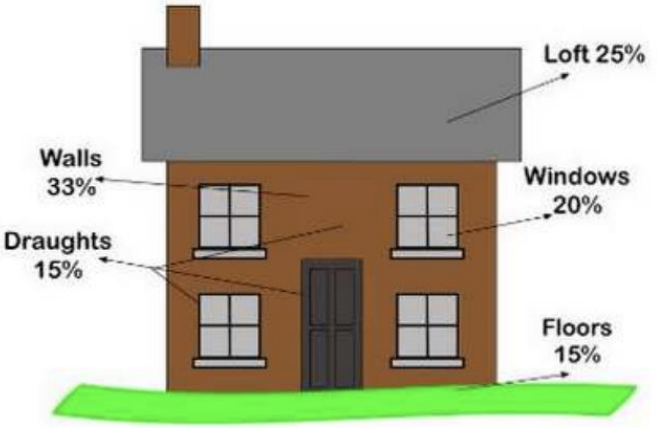
Images: Giulia Realdon

***Disclaimer**: this simplified model using distilled water does not consider the buffering power of seawater resulting from dissolved ions like HCO_3^- and CO_3^{2-}.

How do I choose the best insulation ?

Investigating enhanced insulation for building

https://www.earthlearningidea.com/PDF/400_Net_zero_Building_insulation.pdf



Heat loss diagram for a typical house (% figures rounded up)

© Eco-Home-Essentials

This diagram shows that much heat can be wasted from a house that is not well insulated. If all buildings were well insulated, heating costs would be reduced and energy consumption lowered.

Properties of some currently-used insulating materials

Open structure

- Fibreglass
- Mineral wool (rock wool)
- Sheep's wool
- Horse hair
- Straw bales
- Straw or reed thatch for roofs
- Cellulose materials such as newspaper and cardboard

How do I choose the best insulation ?

Investigating enhanced insulation for building

https://www.earthlearningidea.com/PDF/400_Net_zero_Building_insulation.pdf

Properties of some currently-used insulating materials

Open structure

- Fibreglass
- Mineral wool (rock wool)
- Sheep's wool
- Horse hair
- Straw bales
- Straw or reed thatch for roofs
- Cellulose materials such as newspaper and cardboard

Fibreglass in the loft of a church
Peter Kennett

Straw bale building,Centre for Alternative Technology Machynlleth, Wales

How do I choose the best insulation ?

Investigating enhanced insulation for building

https://www.earthlearningidea.com/PDF/400_Net_zero_Building_insulation.pdf

Properties of some currently-used insulating materials

Open structure

- Fibreglass
- Mineral wool (rock wool)
- Sheep's wool
- Horse hair
- Straw bales
- Straw or reed thatch for roofs
- Cellulose materials such as newspaper and cardboard

Example of sheep's wool insulation

Example of Cellulose materials insulation

How do I choose the best insulation ?

Investigating enhanced insulation for building

https://www.earthlearningidea.com/PDF/400_Net_zero_Building_insulation.pdf

Properties of some currently-used insulating materials

- **closed cellular structure**

These materials have better insulating values than the materials in the previous slides but are derived from the petrochemical industry and so have a bigger carbon footprint than other materials.

Polyethylene boards

Polystyrene boards

Polyisocyanurate boards

left - Polyisocyanurate board
above - charred board

Elizabeth Devon

How do I choose the best insulation ?

Investigating enhanced insulation for building

https://www.earthlearningidea.com/PDF/400_Net_zero_Building_insulation.pdf

Ask the pupils

The motion for a classroom debate is “The best and most effective insulation for buildings is Polyisocyanurate boards even though they are made from by-products of the petro-chemical industry”.

Ask the pupils, in small groups, to consider their arguments for and against the motion for that debate. They must be able to give reasons both for and against the motion.

How do I choose the best insulation ?

Investigating enhanced insulation for building

https://www.earthlearningidea.com/PDF/400_Net_zero_Building_insulation.pdf

Back up:

An investigation into the properties of various insulation materials for buildings with a discussion on their advantages and disadvantages

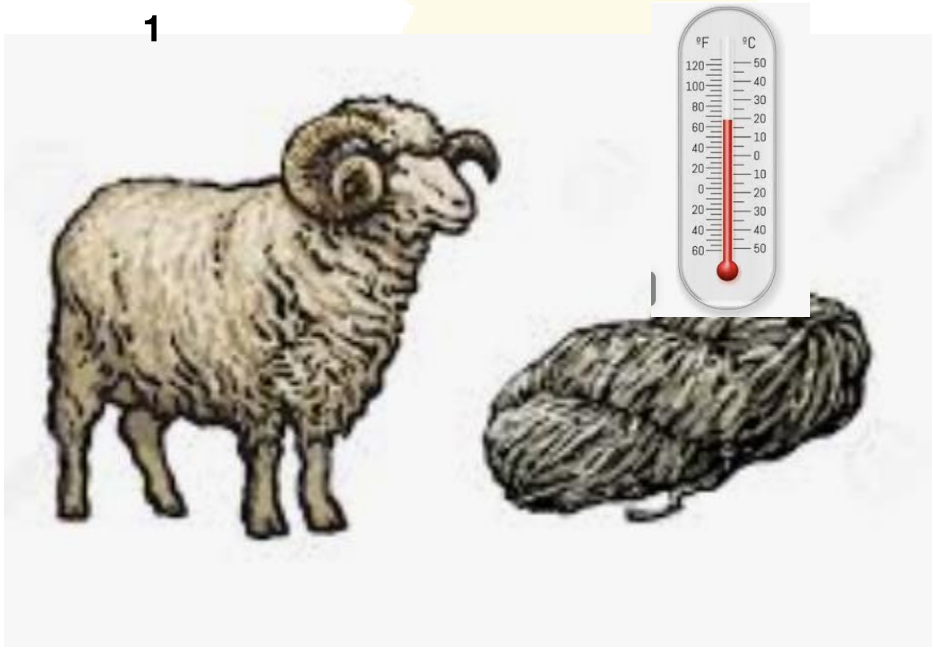
How do I choose the best insulation ?

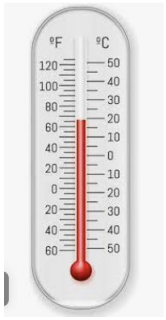
Investigating enhanced insulation for building

https://www.earthlearningidea.com/PDF/400_Net_zero_Building_insulation.pdf

Possible experiments

1





If you let a thermometer in wool and another in the air, are you going to see a difference after 30 minutes ?

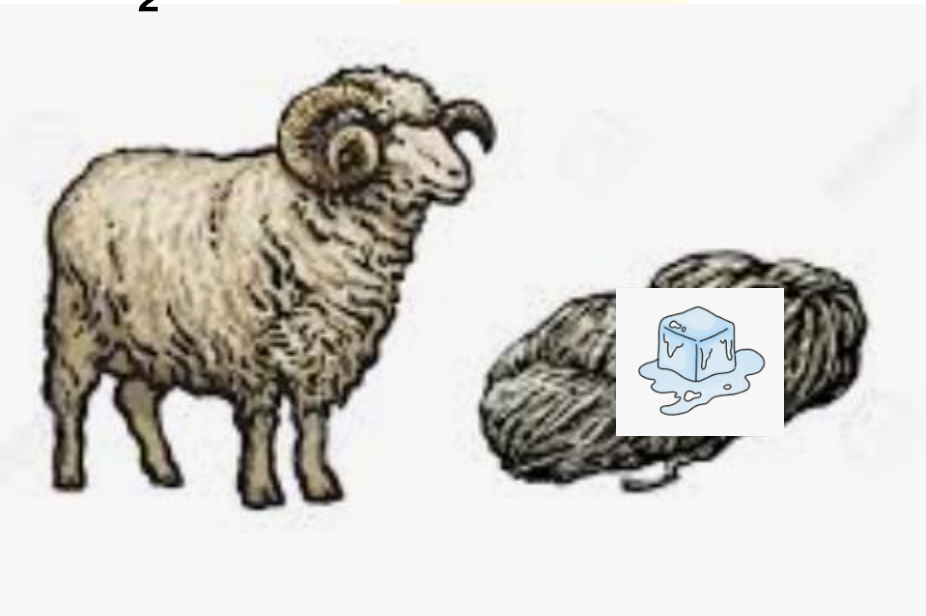
How do I choose the best insulation ?

Investigating enhanced insulation for building

https://www.earthlearningidea.com/PDF/400_Net_zero_Building_insulation.pdf

Possible experiments

2



If you let a ice cube in wool and another in the air, which one will melt the quickest ?

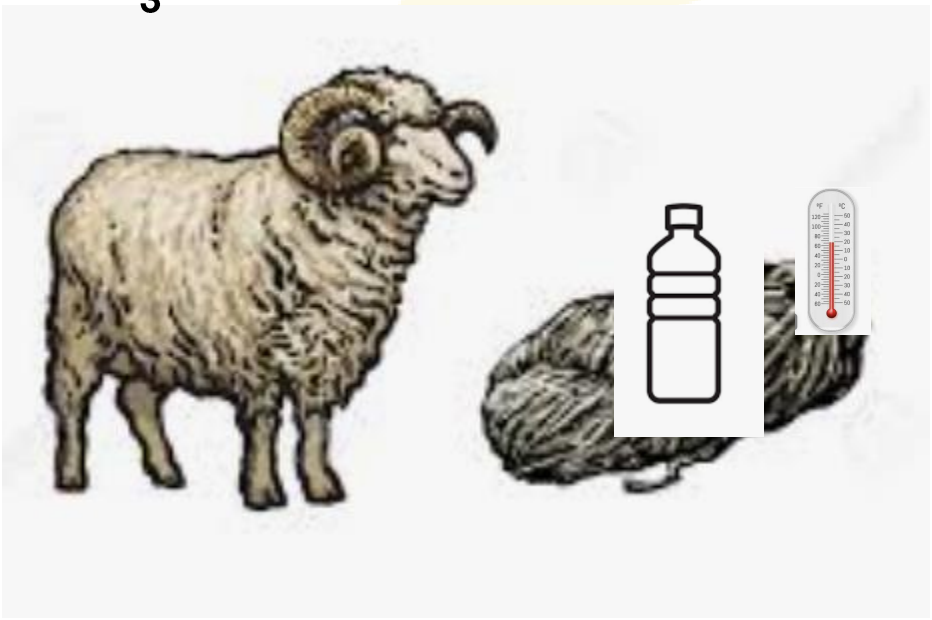
How do I choose the best insulation ?

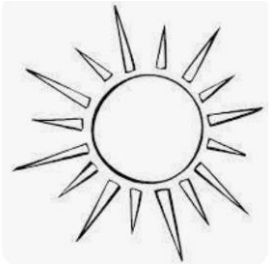
Investigating enhanced insulation for building

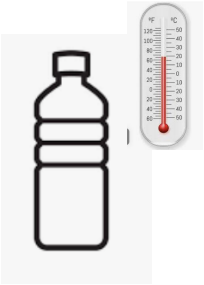
https://www.earthlearningidea.com/PDF/400_Net_zero_Building_insulation.pdf

Possible experiments

3







If you let two bottles outside under the sun (and previously in the fridge) and if wool is around one of them, are you going to see any temperature differences of water after 30 minutes ?

A tribute to Professor Chris King

(1949 – 2022)

GEFO run this workshop in the memory and honor of **Professor Chris King**.

He was a guide and an inspiration not only for us but for many generations of Geoscience teachers across the world.

Images: Giulia Realdon, Xavier Juan

Bring EGU workshops to your area!

- This and **other workshops** are also available **free of charge** (funded, up to a certain number, by EGU) in your area
- **How?**

  Identify topics of interest and possible dates
- **Write to the GEFO in your country** (see next slide) to check availability
- Collect at least 10-15 registrations
- Provide a suitable classroom for the activity (projector, microphone, if needed, water, other depending on activity required)

Contacts to request EGU or IUGS-COGE GEFO for teachers' workshops

Country	Name	e-mail
Albania	Almida Cerciziida	cerciziida@yahoo.it
Estonia	Inga Zaitseva-Pärnaste	inga.zaitseva@gmail.com
France	Guillaume Coupechoux	gcoupechoux21@gmail.com
Germany	Sylke Hlawatsch	kontakt@sylke-hlawatsch.de
Greece	Fotios Danaskos	fdanas@yahoo.gr
Italy	Giulia Realdon	giuliarealdon@gmail.com
Portugal	Gina P. Correia	gina_maria@sapo.pt
Romania	Dragos Tataru	dragos@infp.ro
Spain	Xavier Juan	xjuan03@gmail.com
Turkey	Candan Kafali	candan26.ck@gmail.com
United Kingdom	Pete Loader	pete@earthlearningidea.com
Burkina Faso	Seydou Sogoba	Seydousogoba21@gmail.com
Colombia	Carlos Echeverría Barajas	carlos.echeverria@uptc.edu.co
Ghana	Raymond Kudzawu-D'Pherdd	eforay@hotmail.com
India (North)	R. Baskar	rbaskar@ignou.ac.in
India (South)	Venkatraman Hegde	vshegde2009@yahoo.com
Malaysia	Jasmi Hafiz Bin Abdul Aziz	jasmihafiz@um.edu.my
Nigeria	Agogo Abraham	abrahamagogo@yahoo.com
Pakistan	Muhammad Yaseen	yaseengeo@awkum.edu.pk
Paraguay	Nestor Damian Salinas Franco	nestorsalinas@facen.una.py
Togo	Pauline Yawoa da Costa	dzycosta@yahoo.fr

Don’t forget to fill in the evaluation form

- Go to: https://forms.gle/e7x6YVs6so5fmGr48
- Or frame the QR code:

Image: Pete Loader

In memory of Chris King
1949 - 2022

TEACHING CLIMATE CHANGE: USING Earth Learning Idea

Pete Loader, Giulia Realdon, Guillaume Coupechoux, Xavier Juan, and Gina P. Correia. (EGU Geoscience Education Field Officers)

- The EARTHLEARNINGIDEA ("ELI") concept was born in 2007 to present Earth science teaching workshops to teachers.
- Each activity presents an Earth science topic using an interactive, inquiry-based approach to educate and motivate pupils, whilst developing their thinking and investigative skills.
- ELIs, in English, are currently being published at one per fortnight and translated into 10 other languages.
- They have been used as the basis for teacher training education workshops in many countries by GEFOs.

www.earthlearningidea.com

Earth Learning Idea

Innovative, Earth-related teaching ideas

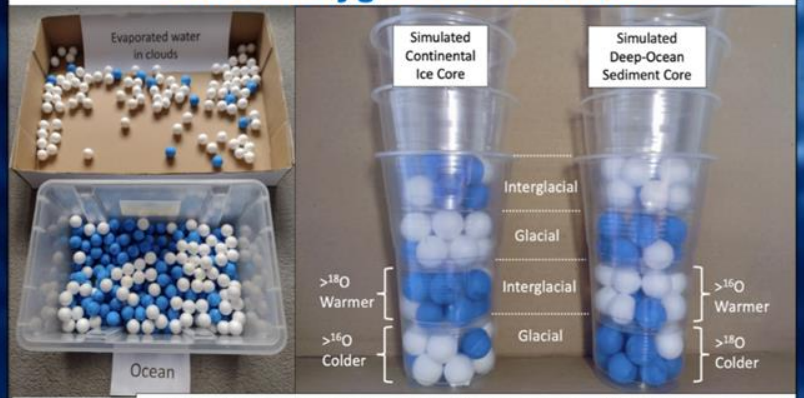
- **EGU Geoscience Education Field Officers (GEFO)** are a team of geoscience teachers and researchers who provide professional development to schoolteachers who have elements of geoscience in their teaching curricula, through interactive hands-on workshops.
- The team is supported by the European Geosciences Union Education Committee and is active in thirteen countries around Europe.

Greenhouse effect in a bottle

- An investigation to simulate the effect of increased CO_2 levels on Earth temperature (global warming). CO_2 is added to the air in a bottle to test its effect on temperature when the closed system is heated by a lamp (sun).

SCAN ME

Earth's oxygen thermometers



SCAN ME

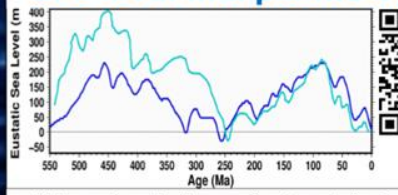
- A simulation of changing oxygen isotopes ratios (^{18}O:^{16}O) measured in deep-ocean sediments and continental ice cores over time.
- This is used as a proxy for changes in global temperatures and continental ice sheet development. Coloured balls are used to demonstrate isotope fractionation during evaporation.

Ocean Acidification

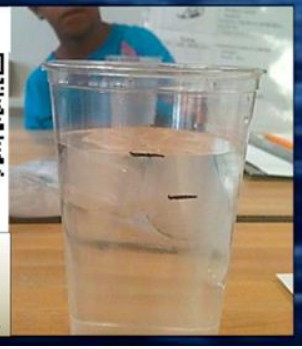
SCAN ME

- A demonstration of how increased CO_2 levels in the atmosphere affect the calcium carbonate shells and skeletons of marine organisms.

Sea level in a plastic cup



SCAN ME



- Using a clear plastic cup of water, students are asked to discuss 8 ways to change the water level in the cup (up or down) without removing any water from the top and then link these to natural processes of sea-level change.

Choosing the best insulation

Heat loss diagram for a typical house (% figures rounded up)
© Eco-Home-Essentials

SCAN ME

Straw bale building

- An investigation into the properties of various insulation materials for buildings to promote a discussion on their advantages and disadvantages.

Contact details.
Web: www.earthlearningidea.com
Follow us on X: @ELI_Earth
E-mail: pete@earthlearningidea.com

SCAN ME

Teaching Climate Change: Evidence and effects

Gina P. Correia | Giulia Realdon | Guillaume Coupechoux |

Pete Loader | Xavier Juan

EGU – Geoscience Education Field Officers

Geoscience Information for Teachers | Vienna 15th April 2024

Meetings | Publications | Outreach | www.egu.eu