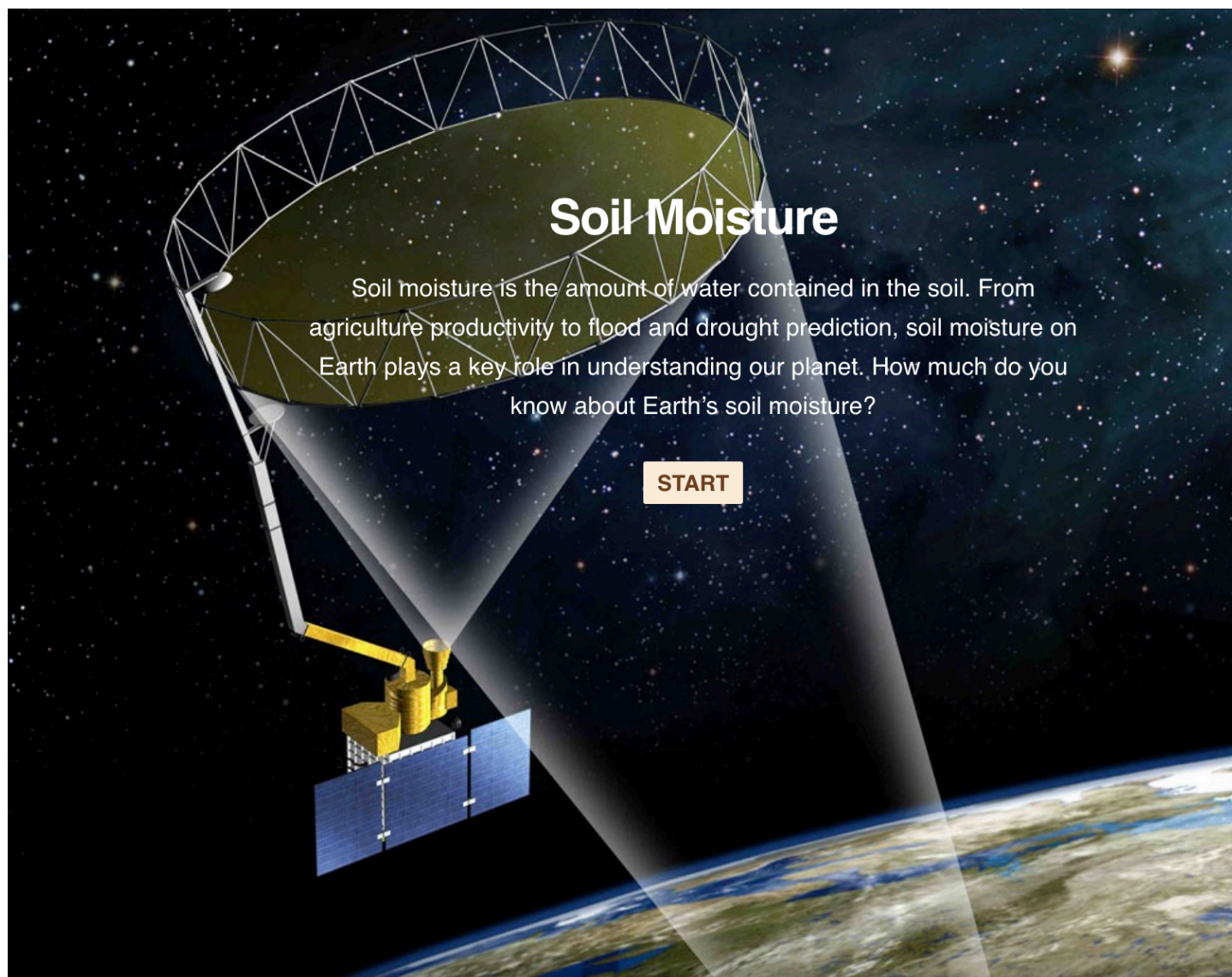


My NASA Data - Lesson Plans

The Soil Moisture Quiz



Overview

[Test your knowledge](#) of soil moisture and its effect on global populations. Soil moisture is the amount of water contained in the soil. From agriculture productivity to flood and drought prediction, soil moisture on Earth plays a key role in understanding our planet. How much do you know about Earth's soil moisture?

You can browse a gallery containing this quiz and others at the [Know Your Earth](#) Quiz Collection.

The current phase of the *Know Your Earth* Project aligns to the larger NASA Earth Right Now

Campaign through the creation of NASA Earth science quizzes. The quizzes focus on current NASA Earth science research topics and will be centered on an Earth science theme. The Earth Right Now campaign is a largescale, NASA-wide campaign that, at its focal point, are the five NASA Earth science missions. The quizzes will highlight these missions during their respective launch and will highlight many NASA Earth science airborne and field campaigns.

We hope you enjoy learning more about NASA Earth Science and all the vital data and information that can be used to better understand our planet.

Learning Objectives

The student will assess his/her current understanding of soil moisture through an online quiz.

Why Does NASA Study This Phenomenon?

Scientists worldwide warn of increasing temperatures in the future. There is a relationship between soil moisture and surface air temperature and this plays an important role in climate change that involves not only weather and climate but also the entire Earth System. NASA scientists strive to better understand how water availability changes around the globe, as well as better predict floods and drought in weather models. As Earth's temperature rises, our soils dry out and affect crop production, drought extent, and forest fire to name a few. NASA also researches additional phenomenon connected to soil moisture properties including landslide risks and vector-borne diseases (i.e., include but are not limited to cholera, malaria, dengue fever, Zika, schistosomiasis, and West Nile fever).

Materials Required

computer

internet access

Technology Requirements

- One-to-One (tablet, laptop, or CPU)

Teacher Background Information

1. **Some satellites use one sensor to measure soil moisture over land and another surface property over the ocean. What is this ocean surface property?** The concentration of dissolved salts: Although they use different types of technology, NASA's SMAP and Aquarius instruments include radiometers (instruments for measuring the intensity of radiant energy) that operate at the same frequency (i.e., 1.41 GHz). At this frequency, the emission of natural radiation from Earth's surface is affected by both the moisture content of soil and the saltiness of ocean. Continually measuring these properties helps us understand water cycle processes across the globe. For example, SMAP observations help with flood assessment and drought monitoring on land. Over the ocean, Aquarius data are being used to study the outflow of rivers and melting of polar ice, both of which decrease ocean salinity.
2. **Why is it difficult for farmers in parts of India and the Middle East to forecast water shortages?** They rely heavily on underground water. Those resources are harder to estimate

than rain or bodies of water and snow in plain sight. SMAP's measurements can help people in these and other parts of the world to understand how much water is at hand and to plan accordingly.

3. **About how much of California's water supply comes from the Sierra Nevada Mountains' snowpack?** 65 percent According to the California Department of Water Resources, about 65 percent of California's water supply comes from the Sierra Nevada Mountains' snowpack. Winter rain and snow replenish rivers and groundwater for the year. The amount of snow and when it melts in the spring directly affects how much water is available to cities and to the agricultural industries of the Central Valley. The Global Precipitation Measurement Mission Core Satellite has advanced instruments that can see the snow in clouds to add data to hydrologic models necessary for determining freshwater availability for agriculture and other uses.
4. **India is known for its monsoons. Where does the water come from and where does it go** Ocean evaporation fuels heavy rain, feeding rivers that drain out to sea. Soil moisture conditions on the Indian subcontinent vary dramatically as a result of seasonal monsoons. During some months, evaporation of seawater feeds monsoon rains, which saturate Indian soil for weeks. The resulting freshwater discharge from rivers such as the Ganges reduces salinity levels in the Bay of Bengal. Thus monsoons can be seen in sea surface salinity patterns around India: the relatively salty Arabian Sea to the west contrasts sharply with the low-salinity Bay of Bengal to the east.
5. **Measuring soil moisture (the amount of water in the soil) can help scientists with which of the following:** Soil moisture variations affect the evolution of weather and climate over continental regions. Initialization of numerical weather prediction and seasonal climate models with accurate soil moisture information enhances their prediction skills and extends their skillful lead-times. Improved seasonal climate predictions will benefit climate-sensitive socioeconomic activities, including water management, agriculture, and fire, flood and drought hazards monitoring
6. **Which of these is not a soil condition indicating high risk of a flash flood during a rainstorm?** When the soil is sandy with wider spaces between particles Using precipitation data from satellites such as the Global Precipitation Measurement mission, plus soil moisture data from the upcoming Soil Moisture Active Passive (SMAP) mission, allows scientists to more accurately model potential flood conditions. In addition, the instruments onboard SMAP will have difficulty obtaining a clear observation of the soil surface when it is raining, which is expected to cause errors in the SMAP soil moisture retrievals. The addition of GPM data to the SMAP soil moisture algorithm will provide a more robust approach for assessing the times and locations of rainfall events so that the SMAP mission can correctly interpret the soil moisture data.
7. **The only way to accurately estimate the amount of soil moisture available to a plant's roots is to measure it in place.** In addition to ground-based measurements, NASA uses airborne and spaceborne remote sensing instruments to estimate soil moisture. For example, measurements from NASA's Airborne Microwave Observatory of Subcanopy and Subsurface (AirMOSS) radar are used to estimate soil moisture profiles, from surface to the root zone, at many representative locations in the North American continent. AirMOSS uses long-wavelength microwave radar to penetrate through the vegetation, and into the soil where plants' roots are. The radar imagery is converted into estimates of Root Zone Soil Moisture.
8. **Which of the following is the leading cause of weather-related deaths in the U.S.?** Floods: In addition to causing deaths, floods are responsible for losses that average billions of dollars per year in the U.S. alone. SMAP will help communities to predict and prepare for flooding to minimize loss of life and property.
9. **The circulation of water through the air, bodies of liquid or solid water, and the ground**

.is called the water cycle. The processes and places involved in the water cycle

involve. All of the above and more: The water cycle involves more than evaporation from the oceans and land forming clouds that drop rain or snow on the ground, where it flows across the land before returning to the sea. For example, plants absorb water from the soil to grow but also “transpire” some of it straight back into the air. Animals drink water and eat plants, delivering water back to the ground where it may end up flowing to the ocean or be evaporated as the ground dries. NASA’s Soil Moisture Active Passive (SMAP) spacecraft will measure soil moisture over all of Earth’s land surface that is not frozen every three days. Its data will permit scientists to better understand the details of the water cycle.

10. **Measurements from spacecraft orbiting Earth can illuminate the effects of climate change on the environment.** True: By measuring the nature, extent, timing, and duration of landscape seasonal freezing and thawing transitions on Earth’s land surface, NASA’s SMAP freeze/thaw measurements will also contribute to understanding how ecosystems respond to and affect global environmental change. SMAP will improve regional mapping and prediction of high latitude ecosystem processes.