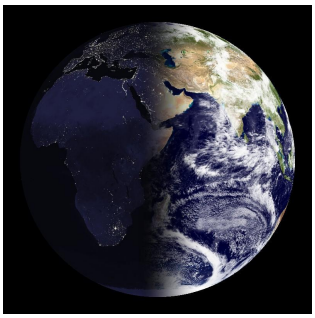
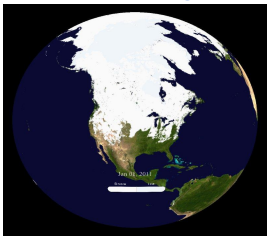
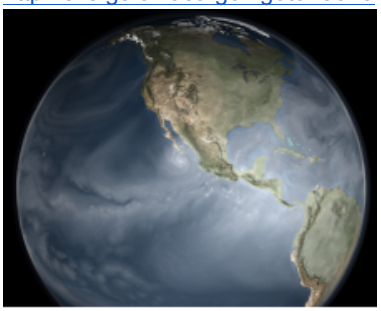
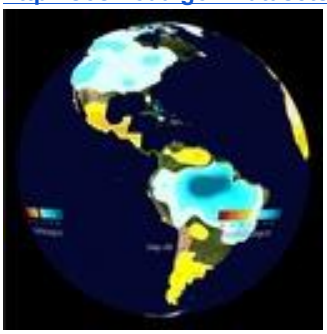
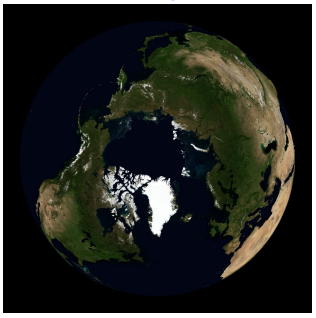
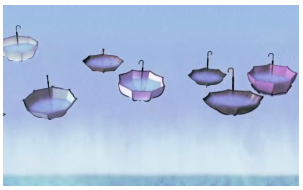
WATER FALLS DOCENT SCRIPT: IMPORTANCE OF FRESH WATER

Key Points	Visuals
Water supports life on Earth. Called a 'Blue Marble' by the astronauts who first saw Earth from space: **- about 70% of Earth's surface is water** **- about 3% is fresh water, the rest is salty** **- Humans need fresh water** **- fresh water is distributed unevenly due to climate and weather processes, including:** **- more sunlight received in the tropics compared to the poles** **- Earth's rotation** **- ocean currents** **- location of land and mountains** **Where is the freshwater?**	**1) Blue Marble (23 degree tilt)** **NASA GSFC, DMSP** **http://sos.noaa.gov/Datasets/dataset.php?id=85** 
Earth's polar regions hold fresh water in ice and snow. From the National Snow and Ice Data Center website: **- 70% of fresh water is frozen in ice, snow** **- 10% of land covered in ice sheet, glaciers** **- changes in season and climate shrink or expand snow and ice cover** **- the Arctic ice sheet melted to its smallest extent in September, 2012** **- if all glaciers melted, seas would rise about 230 feet (70 meters)**	**2) Real-Time: Snow and Ice Cover** **NOAA, USAF, EUMETSAT** **http://sos.noaa.gov/Datasets/dataset.php?id=193**  *** Note that infrared and microwave imagery from multiple polar-orbiting satellites are used to create these daily maps. Often, their tracks do not perfectly transit the pole, however, giving the appearance of a small hole there which is really just missing data.**

Instruments on satellites measure water vapor, precipitation and its intensity, shown here as white for water vapor, and colored for precipitation with heaviest in red: **- water accounts for just 0.25% of total mass of the atmosphere. If all water vapor were condensed into liquid, it would be 1 inch (2.5cm) deep around the Earth, barely a puddle, yet this atmospheric water makes a world of difference to weather and climate** **- measurements collected over the past 25 years indicate overall moistening of the atmosphere (i.e. more water vapor)** **- most dominant greenhouse gas is water vapor, which has positive feedback on the climate system: warming from more CO_2 in the atmosphere causes more evaporation of water, leading to more water vapor in the atmosphere, which enhances greenhouse warming. This positive feedback is why climate is so sensitive to CO_2 warming.** ***ATMOSPHERIC WATER CONTENT IS SMALLEST* BUT CLOUDS AND PRECIPITATION REDISTRIBUTE HEAT AND MOISTURE ON EARTH AND ACT LIKE INSULATION*** ****2000 to 3000 less than freshwater in glaciers, lakes, rivers, wetlands, and groundwater***	**3) GEOS-5 Modeled Water Vapor** **NASA GSFC** http://svs.gsfc.nasa.gov/goto?3648 
Fresh water on land is visible as lakes, rivers and wetlands. Often too small to see from satellites, global rivers are highlighted here by the NASA Science Visualization Studio using the Groundwater Resources of the World database. **Pulsing fresh water on land shows where water flows from higher elevations on the continents back into the oceans.**	**4) Pulsing Global Rivers from Groundwater Resources of the World** **NASA GSFC** http://svs.gsfc.nasa.gov/goto?3648 

Water that soaks into the ground is held in layers of rocks and sediments. It is very difficult to measure groundwater because we can't see it. Changes in groundwater amounts can be detected by the way they modify Earth's gravity field. **NASA's GRACE mission measures Earth's gravity field and compares it to previous measurements within a model to estimate how Earth's groundwater storage has changed. Here yellows and reds indicate decreases or less groundwater from the month before; blues show increases or more groundwater from the month before. Notice:** • **Large seasonal variability of water storage in the tropics e.g. Amazon** • **Decreases in northwest India are from groundwater depletion** • **Massive decrease in ice mass due to melting in Greenland and Antarctica, especially after 2005**	**5) GRACE: Aug02-Nov09** **(Gravity Recovery And Climate Experiment)** **Groundwater anomaly** http://sos.noaa.gov/Datasets/dataset.php?id=125  *** The coarse resolution of this dataset is due to it being a large area estimate and the fact that groundwater cannot be measured directly by satellites since it's underground.**
In the United States, 23% of water used by people and more than half of all drinking water comes from groundwater: for example, people who get their water from wells and springs directly tap into groundwater.	**6) Water Falls: filling water bottles over GRACE** 
Water's effect on land can be seen in global vegetation which changes by seasons: **- most rain falls where air is moving upward or over water where it has picked up moisture (e.g. tropics, higher latitudes, upwind of mountains)** **- dry regions occur where air moves downward or has travelled some distance over land and already lost moisture** **- wetlands soak up extra, slow moving water and are important for protecting shorelines and river banks from erosion as well as supporting diverse ecosystems**	**7) Seasonal Blue Marble** **NASA GSFC** http://sos.noaa.gov/Datasets/dataset.php?id=86 

Fresh water is important for farming: **This image of the world's croplands shows the most dense areas devoted to growing plants for human in lighter green, with the least dense areas in darker green.** **- total cropland covers about 16 million sq km (about the size of South America)** **- when combined with pastureland, 40% of Earth's land is used for agriculture** **- rainfall patterns determine which crops farmers plant and when** **- natural disasters such as droughts, floods, and persistent snow cover can impair agricultural productivity**	**8) Cropland Density** **University of Minnesota/Institute on the Environment/Global Landscapes Initiative** **http://sos.noaa.gov/Datasets/dataset.php?id=330** 
Water supports life on Earth. **- about 70% of Earth's surface is water** **- about 3% is fresh water, the rest is salty** **- Humans need fresh water** **Recall from WaterFalls: the concept of water evaporating from the ocean, condensing as clouds in the atmosphere, and later raining as fresh water over land. Rain in just the right amount provides the fresh water we need to live.**	**9) Water Falls: Umbrellas** 

References:

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