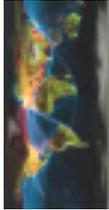


# Annotated Script: Extreme Weather

## Notes & Rationale

## Say

## Show

<p>Slide 1</p>  <p>Blue Marble</p>	<p>Welcome to Science On a Sphere. My name is _____ and I'm an educator here at _____. The image you are looking at is just one way to look at our planet but there are also many other ways.</p>	<p>Introducing yourself as an educator at your institution establishes you, the presenter, as an effective messenger of this information and a trusted resource (<i>Why Zoos and Aquariums Matter</i>, Falk, et. al. 2007 AZA).</p> <p>IMAGE: Blue marble is a composite image of the earth from geostationary satellites.</p>
<p>Slide 2</p>  <p>Anthropocene Transportation</p>	<p>Take a look at this image. This is where we are on the globe {point to location}. These lines show transportation routes – how we move commodities, goods, and people all over the planet. Planes, roads, and ships join our local communities with the world.</p> <p>The image shows how we use our planet, the whole planet, for everything that we have today. This represents people using the planet and the resources it provides, and these resources are not unlimited. We need to protect the environment from harm because we all depend on it, and it depends on us. One major environmental challenge that impacts the planet is climate change. By understanding how climate change impacts the oceans, we are better equipped to protect people, and places, all over the world.</p>	<p>Allow time for the audience to understand and inquire about the information shown with this image. Point out where you live to orient the audience.</p> <p>The talking point here cues the Value of <i>Protection</i>, which research has shown to be an effective way of productively orienting people to ocean conservation as a social issue.</p> <p>The visual helps to establish the interpretation as a matter of global scale and importance.</p> <p>IMAGE: Relays a full year's worth of data on human transportation. Blue is shipping, red is air traffic, and yellow highway traffic.</p>

## Show

Slide 3

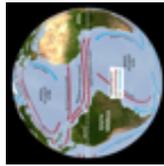


Blue Marble

Have a look at our planet. How much of it is covered by ocean? When you visit the Aquarium it's clear that the ocean is important for many organisms on our planet.

What may not be as apparent is that the oceans also play an important role regulating our long term weather patterns, or climate, similar to how our heart regulates the flow of blood through our body.

Slide 4



Ocean Currents

The movement of heat in the ocean, through currents, affects climate seen around the globe. Take a look at this image; red arrows show warm water currents and where they move. Blue arrows show cool water currents. It almost appears to beat like a heart.

In the Atlantic, warm water from the Gulf Stream extends all the way to England. This is why England typically has a mild climate in comparison to Canada, which is just as far north.

## Notes and Rationale

The talking point here cues the tested Explanatory Metaphor *Climate's Heart*, which research has shown to be an effective way of helping people make sense of the role the ocean plays in regulating the climate system.

IMAGE: Blue marble is a composite image of the earth from geostationary satellites.

This section of the script is intended to fill in the public's "cognitive hole" around the climate as a system. While experts consistently describe climate as an integrated system, the public treats the ocean, atmosphere, climate, and weather as discrete entities and lacks an understanding of these concepts as part of a larger system. The frame elements of the Visual and the Explanatory Examples work together to give the public a more robust understanding of how these elements are interrelated.

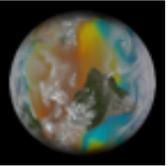
You can add or substitute local examples of how the ocean affects the climate. For example, there is a Mediterranean climate in California due to the California Current bringing down cool water from the north Pacific.

IMAGE: Blue currents are the deep cold water, while red currents are warm surface water. Transport through the whole conveyor belt can take 1000 years.

## Notes and Rationale

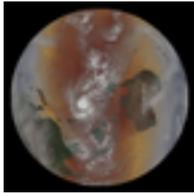
## Say

## Show

<p>Slide 5</p>  <p>SAT IR</p>	<p>Much in the way that the heart is a vital part of healthy body systems, the ocean is a vital part of climate systems. Just like hearts pump blood throughout bodies, the ocean pumps heat and moisture throughout the planet.</p> <p>Thinking about this analogy, what does that mean for how you think about the ocean? [Allow visitors to offer their thoughts.]</p> <p>Yes! This also means the ocean impacts weather.</p>	<p>In testing sessions involving <i>Climate's Heart</i>, visitors were eager to supply examples from a domain they knew fairly well (human heart and heart-healthy behaviors) to reason about a domain that was less familiar but of interest (the ocean). Expect and amplify suggestions along the lines of <i>we need it to survive and the way we treat it matters</i>.</p> <p>IMAGE: SAT IR shows cloud movement over the last month. Point out movement of clouds. Are there any storms that you can point out for your area?</p>
<p>Slide 6</p>  <p>2012 Hurricanes</p>	<p>One way we can see how weather is linked to the ocean is through hurricanes. In this image we can see all the hurricanes from the 2012 season. [Pause for observation.] Can you see the hurricanes as they form over the ocean? Notice how they all rotate in a counter-clockwise direction.</p>	<p>Be sure to offer a few seconds of silence to allow visitors time to absorb what they're seeing. Guide the audience and help point out the formation of hurricanes.</p> <p>IMAGE: Names of 2012 hurricanes will appear in alphabetical order. The eye of Hurricane Isaac is visible on 8/25 near Haiti and Cuba. Sandy forms 10/22, and hits NY and NJ on 10/20</p>
<p>Slide 7</p>  <p>2005 Hurricanes + SST</p>	<p>Now let's look at a slightly different image of hurricanes. This one illustrates that the way hurricanes form depends, in part, on how warm the surface of the ocean is. In this image, warmer water is indicated by reds and yellows; colder water appears blue. Where do you see the hurricanes developing? [Pause/allow for answers.] Hurricanes form in warm water, where it appears red. They typically need ocean surface temperatures of over 79° Fahrenheit to form.</p>	<p>Offering explicit cues to orient to new images helps visitors track the narrative more effectively.</p> <p>This "beat" in the narrative is the pivot point to climate change, as it introduces the topic of temperature increase.</p> <p>IMAGE: 2005 Hurricanes and sea surface temperature. Watch the time stamp to identify the time period for this data set. Wait to point out Katrina (8/24-8/30). Rita and Wilma were other memorable events that season.</p>

## Show

Slide 8



Typhoon  
Haiyan + SST

## Say

Watch as Typhoon Haiyan forms, over the warmer ocean waters. As we saw previously, hurricanes and typhoons form in warm water.

Now consider this: What would happen if the ocean got warmer? (Pause)

As we burn fossil fuels like coal, oil, and natural gas, we add more carbon dioxide gas into the atmosphere.

Some carbon dioxide, or CO<sub>2</sub>, is needed for life processes. We can call this regular CO<sub>2</sub>. But CO<sub>2</sub> is not just something that plants breathe in and we breathe out. It's also something that gets put into the atmosphere when we burn any kind of fossil fuel for transportation or manufacturing. These activities are putting a lot of CO<sub>2</sub> into the atmosphere and ocean. We can call this rampant CO<sub>2</sub> because there is so much of it and it's getting out of control.

As this rampant carbon dioxide builds up, it acts like a blanket, trapping heat inside. This trapped heat warms our ocean and atmosphere, knocking nature out of balance and causing disruptions or shifts in systems on our planet.

Our warmer ocean pumps more moisture and heat into the air. This provides the fuel for more intense hurricanes.

## Notes and Rationale

Typhoons and Hurricanes are the same thing, they are just called different names in different regions.

This section introduces carbon dioxide emissions as the main mechanism of climate change. The way people understand the cause of a problem has a major influence on the way they think about solutions, so effectively framing the role of CO<sub>2</sub> is essential.

Two tested explanatory techniques are used here to help the public understand and remember this critical information, which is typically lacking for ordinary Americans.

- By using the distinction between *Regular and Rampant* CO<sub>2</sub>, you can help your visitors easily add to the knowledge they probably already hold about carbon dioxide – that it plays a role in human respiration and photosynthesis. The taxonomy allows them to hold the newer, counter-intuitive information (that CO<sub>2</sub> can also play a harmful role) alongside existing concepts.
- The second Explanatory Metaphor is *Heat Trapping Blanket*. This easy-to-grasp analogy focuses the public on the key characteristic of carbon dioxide: it traps heat. Use a hand gesture to mimic the blanket covering the globe when you introduce this metaphor.

IMAGE: Typhoon Haiyan, also known in the Philippines as Typhoon Yolanda, with sea surface temperatures. Made landfall with sustained winds up to 195 mph. Look for it to form on 11/4-5, north of Australia and Papua New Guinea. Consider using the country names overlay to help orient guests to the Philippines. On 11/6, it passes over Palau.

## Notes and Rationale

## Say

## Show

<p>Optional</p> <p>Explain the Impacts of Extreme Weather</p>	<p>More intense hurricanes can cause more damage...</p>	<p>This section is available for interpreters to customize if desired. Take care to avoid piling on too many negative consequences, as this can evoke the public's sense of fatalism about climate change. As a rule of thumb, limit this section to two negative consequences – one that affected ecosystems, and one that affected humans directly.</p>
<p>Optional</p> <p>Community Solutions</p>	<p>Many people in our area are already acting responsibly, taking steps to create positive changes...</p>	<p>This section is available for interpreters to customize if desired. Focus <u>ONLY</u> on collective level solutions that engage visitors as citizens. Avoid mentioning actions or consumption decisions that individuals can take in their personal lives, as these work against the overall communications goal.</p>
<p>Slide 9</p>  <p>Blue Marble</p>	<p>As the heat in our ocean and atmosphere increases, we can expect to see an increase in the number of strong hurricanes. While the total number of future events is uncertain, it is likely that those that do occur will be more intense. Hurricane Katrina in 2005 and Typhoon Haiyan in 2013 are examples of the types of intense storms that are likely to occur in the future.</p> <p>The heart of our global system driving climate and weather has already been disrupted. Just like heart health can be improved by changes in behavior (like diet and exercise), the health of the planet's heart can be improved by changes, too. Just like we monitor our hearts to keep them healthy and prevent them from damage, it's important to monitor the oceans so that they can continue to move the right amount of heat and moisture through the climate system and prevent these storms from getting more intense.</p> <p>Communities are coming together both locally and globally developing innovative solutions. We can help by reducing our reliance on fossil fuels, which will reduce the amount of heat trapping gases in our atmosphere.</p>	<p>This section uses precise wording about risk in order to accurately convey the scientific consensus on what we can project about the effect of climate change on extreme weather events. We don't know that the number of hurricanes will increase, but we know that warm water drives hurricanes. So, for those that do form, the warmer water means more intense storms like Haiyan and Katrina.</p> <p>Returning to the metaphor <i>Climate's Heart</i> here helps the narrative segue into the possibility of Solutions: interventions, changes, promising directions that can improve the situation.</p>

## Show

Slide 10



Nighttime Lights +  
Solutions

## Say

In some communities, energy companies are switching at least a third of the fossil fuels they use to cleaner energy sources such as solar arrays, wind turbines, and wave energy buoys. There are other choices we can make by supporting hybrid and clean fuel busses, mass-transit programs, green roof projects, and municipal solar panel. These are all ways of moving toward energy sources that don't contribute to the heat-trapping blanket.

We can all connect to others who care about climate change by following groups on Facebook and Twitter such as 350.org and the Union of Concerned Scientists. Or we can join a local rideshare group, bike share programs, or other groups where we can keep learning, support one another, and be a part of the solution.

Are there any groups in your area that you can join? Are there any online communities, or websites you like to follow?

Learning about your options, voicing your opinions, and promoting and voting for causes you believe in are all ways to make change happen. Discussing these ideas with your families, neighborhoods, and communities is a great start. What will you do today?

Slide 11



Community  
Solutions

## Notes and Rationale

The focus on alternative energy as the “meta-Solution” is an important part of the Visualizing Change strategy for educating the public on the implications of climate science.

Encouraging visitors to keep learning, and to do so in a social way (online or in person) is also part of the strategy. Studies show that when people join groups, follow news feeds, or engage in social media on an issue, they are more likely to continue to build their knowledge base, share what they learn, and advocate for the issue.

In piloting these narratives, interpreters have observed that guests find it challenging to identify community-level solutions. They tend to say “solar and bike programs” since they were previously mentioned. What can we offer to support discussion?

It's important to suggest local, community programs. Suggest municipal projects in your area and groups they can join specifically. Think about groups that are already in place for them to join. Ride shares, bike shares, or educational groups. Are there any other Facebook or Twitter news feeds? Source the crowd so they answer and share their ideas with one another as well. This gives a feeling of community.

Other community projects can be found on websites like <http://www.greenenergyfutures.ca/>

Thanks for joining us today for our Science On a

Sphere program. I will stick around for a few more minutes if you have any questions. Enjoy your visit!