ORANGE PUBLIC SCHOOLS		
ENVIRONMENTAL SCIENCE	**GRADE: 9-12**	**UNIT 3: FLUID EARTH**

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SCOPE AND SEQUENCE UNIT 3

Lesson	**Fluid Earth**	PE's and DCI's	Suggested Pacing Year
1	• Ocean water and environments	HS-ESS2.2,HS-ESS2-5	7
2	• Understanding Weather	HS-ESS2-5, HS-ESS2-4, ESS-2.C,ESS-2.D	4
3	• Understanding Climate	HS-ESS2-2, HS-ESS2-4, HS-ESS2-5	7

- How and why is Earth constantly changing?
- How do the properties and movements of water shape Earth's surface and affect its systems?
- How do Earth's major systems interact?

The performance expectations in ESS2: Earth's Systems, help students formulate an answer to the question: "How and why is Earth constantly changing?" The ESS2 Disciplinary Core Idea from the NRC Framework is broken down into five sub-ideas: Earth materials and systems, plate tectonics and large-scale system interactions, the roles of water in Earth's surface processes, weather and climate, and biogeology. For the purpose of the NGSS, biogeology has been addressed within the life science standards. Students develop models and explanations for the ways that feedbacks between different Earth systems control the appearance of Earth's surface. Central to this is the tension between internal systems, which are largely responsible for creating land at Earth's surface, and the sun-driven surface systems that tear down the land through weathering and erosion. Students begin to examine the ways that human activities cause feedbacks that create changes to other systems. Students understand the system interactions that control weather and climate, with a major emphasis on the mechanisms and implications of climate change. Students model the flow of energy between different components of the weather system and how this affects chemical cycles such as the carbon cycle. The crosscutting concepts of cause and effect, energy and matter, structure and function and stability and change are called out as organizing concepts for these disciplinary core ideas. In the ESS2 performance expectations, students are expected to demonstrate proficiency in developing and using models, planning and carrying out investigations, analyzing and interpreting data, and engaging in argument; and to use these practices to demonstrate understanding of the core ideas.

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January 2017				
Mon	Tue	Wed	Thu	Fri
2	3 Ocean water and environments	4	5	6
9	10	11	12	13
16 MLK Birthday Observance	17	18	19	20
23	24 Understanding Weather	25	26	27
30	31			

February 2107				
Mon	Tue	Wed	Thu	Fri
		1 Understanding Weather	2	3
6 Understanding Climate	7	8	9	10
13	14	15	16	17
20 Recess	21	22	23	24
27	28			

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# Blocks	STUDENT LEARNING OBJECTIVES	CORRESPONDING DCIs	DISCOVERY EDUCATION RESOURCES	ASSESSMENT
	Fluid Earth • *Earth's systems, being dynamic and interacting, cause feedback effects that can increase or decrease the original changes.* • *The foundation for Earth's global climate systems is the electromagnetic radiation from the sun, as well as its reflection, absorption, storage, and redistribution among the atmosphere, ocean, and land systems, and this energy's re-radiation into space.* *Feedback (negative or positive) can stabilize or destabilize a system.* • *The abundance of liquid water on Earth's surface and its unique combination of physical and chemical properties are central to the planet's dynamics.* *The properties include water's exceptional capacity to absorb, store, and release large amounts of energy; transmit sunlight; expand upon freezing, dissolve and transport materials; and lower the viscosities and melting points of rocks.* *Evidence Statement ESS2-2* *Evidence Statement ESS2-5*	***HS-ESS2-2.*** *Analyze geoscience data to make the claim that one change to Earth's surface can create feedbacks that cause changes to other Earth systems.* ***ESS2.A:*** *Earth Materials and Systems* *Earth's systems, being dynamic and interacting, cause feedback effects that can increase or decrease the original changes.* ***ESS2.D****: Weather and Climate* *The foundation for Earth's global climate systems is the electromagnetic radiation from the sun, as well as its reflection, absorption, storage, and redistribution among the atmosphere, ocean, and land systems, and this energy's re-radiation into space.*	***Discovery Education Model Lessons*** ***5E Model*** ***Ocean Water*** *Ocean Water 5E model Lesson* *Ocean Environments 5E model lesson* *Scientific Explanation* *Additional Resources* *(See Sample of Open Education Resources)*	*Students who understand the concepts are able to:* *Analyze geoscience data using tools, technologies, and/or models (e.g., computational, mathematical) to make the claim that one change to Earth's surface can create feedbacks that cause changes to other Earth systems.* Plan and conduct an investigation of the properties of water and its effects on Earth materials and surface processes. ***Assessment 1*** *Constructed responses (Discovery Education)* *Evaluate* ***Assessment 2*** *Labs* *Salinity Lab* *STEM -Ocean Currents* *Suggested GIZMOS* *Carbon Cycle* *Greenhouse Gases*

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Sample Open Educational Resources

MY NASA DATA: Students select satellite datasets to answer questions related to system interactions and feedbacks.

Images of Change: Students explore these images of the impacts of climate change over time to develop explanations from evidence of how an impact in one component of the Earth system has effects in other components of the Earth system.

Climate Reanalyzer: Students use the Environmental Change Model of the Climate Reanlyzer to study the feedbacks in the climate system.

USGS Real-time Water data and Climate data: Students create and run an investigation to determine the relationship between streamflow and precipitation data, or another parameter.

Greenhouse Effect: Students explore the atmosphere during the ice age and today. What happens when you add clouds? Change the greenhouse gas concentration and see how the temperature changes. Then compare to the effect of glass panes. Zoom in and see how light interacts with molecules. Do all atmospheric gases contribute to the greenhouse effect?

Carbon and Climate: Students run a model of carbon sources and sinks and interpret results to develop their own model of the relationship of the carbon cycle to the Earth's climate. Students can also work through the content of the entire module called Carbon Connections which includes numerous models and interactives to gain a deeper understanding of the role of carbon in the climate system. .

Earth Systems Activity: Students model the carbon cycle and it's connection with Earth's climate.

EarthViewer (IPAd or Android) or for Chrome browsers: Students explore the co-evolution of the geology and biology found on Earth to develop arguments from evidence for the co-evolution of geology and biology found on Earth. If IPads, Androids or Chrome browsers are not available, similar interactives may be found at this link, and this link.

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Content Area: 21st Century Life and Careers

SCIENCE, TECHNOLOGY, ENGINEERING & MATHEMATICS CAREER CLUSTER®	
Number	Standard Statement
By the end of Grade 12, Career and Technical Education Program completers will be able to:	
PATHWAY	*SCIENCE & MATHEMATICS CAREER PATHWAY (ST-SM)*
9.3.ST-SM.1	Apply science and mathematics to provide results, answers and algorithms for engineering and technological activities.
9.3.ST-SM.2	Apply science and mathematics concepts to the development of plans, processes and projects that address real world problems
9.3.ST-SM.3	Analyze the impact that science and mathematics has on society.
9.3.ST-SM.4	Apply critical thinking skills to review information, explain statistical analysis, and to translate, interpret and summarize research and statistical data

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Modifications
(Note: Teachers identify the modifications that they will use in the unit. See NGSS Appendix D: All Standards, All Students/Case Studies for vignettes and explanations of the modifications.) • Structure lessons around questions that are authentic, relate to students' interests, social/family background and knowledge of their community. • Provide students with multiple choices for how they can represent their understandings (e.g. multisensory techniques-auditory/visual aids; pictures, illustrations, graphs, charts, data tables, multimedia, modeling). • Provide opportunities for students to connect with people of similar backgrounds (e.g. conversations via digital tool such as SKYPE, experts from the community helping with a project, journal articles, and biographies). • Provide multiple grouping opportunities for students to share their ideas and to encourage work among various backgrounds and cultures (e.g. multiple representation and multimodal experiences). • Engage students with a variety of Science and Engineering practices to provide students with multiple entry points and multiple ways to demonstrate their understandings. • Use project-based science learning to connect science with observable phenomena. • Structure the learning around explaining or solving a social or community-based issue. • Provide ELL students with multiple literacy strategies. • Collaborate with after-school programs or clubs to extend learning opportunities. • Restructure lesson using UDL principals (http://www.cast.org/our-work/about-udl.html#.VXmoXcfD_UA).