Standards-Based Project WET Activity Pool – Middle School

Pool Title: Earth System Interactions Cause Weather – (*California Science Framework - 6th IS2, Preferred Integrated, p: 368*)

This pool of Project WET activities is meant to be a guide for educators on how and where Project WET activities can be integrated into an NGSS instructional sequence or unit to support teaching of the California Next Generation Science Standards (CA NGSS). It is not meant to be an exhaustive list of what can be taught or how it should be taught. A primary goal of this activity pool is to provide an example of how Project WET activities can be applied to support student learning within a bundle of performance expectations based on the instructional sequences provided in the California Science Framework (CSF).

Standards Pool:

MS-ESS2-4. *Develop a model to describe the cycling of water through Earth's systems driven by energy from the sun and the force of gravity.*

MS-ESS2-6. *Develop and use a model to describe how unequal heating and rotation of the Earth cause patterns of atmospheric and oceanic circulation that determine regional climates.*

MS-PS3-3. *Apply scientific principles to design, construct, and test a device that either minimizes or maximizes thermal energy transfer **

Anchoring Phenomenon: The ocean influences California's climate.

Guiding Questions:

- How do models help us understand the water cycle interactions?
- How is weather related to the transfer of energy?
- Why do temperatures inland seem more variable than near the coast?
- Why does it seem to rain or snow more in the mountains than at the beach?

California Environmental Principles and Concepts:

Principle III - Natural systems proceed through cycles that humans depend upon, benefit from and can alter.

Principle IV - The exchange of matter between natural systems and human societies affects the long-term functioning of both.

Principle V - Decisions affecting resources and natural systems are based on a wide range of considerations and decision-making processes.

Performance Expectations *Investigative Phenomena*	Learning Targets by PE Dimensions	Learning Experience Connections	Common Core & Engineering/ Community Action Connections
MS-ESS2-4. Develop a model to describe the cycling of water through Earth's systems driven by energy from the sun and the force of gravity. *How do models help us understand the water cycle interactions?*	**SEP: Develop and Use Models:** Students can develop a diagram describing the interactions of ocean, atmosphere, geography, and energy forces that affect the cycling of water within California climate regions. **DCI**: **ESS2.C: The Roles of Water in Earth's Surface Processes:** Students can describe how water cycles continuously between the ocean, atmosphere and land and the energy forces involved in the process. **CCC**: **Energy and Matter** Students can describe how temperature, sunlight and gravity affect how water moves in the water cycle.	**'The Incredible Journey' (Project WET 2.0, p: 155)** - Students simulate the movement of water to conceptualize the water cycle in a way that more closely approximates the movement of water within and between Earth systems. (CSF, p 387) - California activity supplements available on Water Education Foundation website.	**ELA:** RST.6-12.7; W.3-12.2; WHST.6-12.2 **MATH:** None listed for this PE
MS-ESS2-4. Develop a model to describe the cycling of water through Earth's systems driven by energy from the sun and the force of gravity. *How does is water refreshed during the water cycle?*	**SEP: Develop and Use Models:** Students can develop a diagram describe water cycle processes that refreshes water between ocean, land and atmosphere. **DCI**: **ESS2.C: The Roles of Water in Earth's Surface Processes:** Students can describe how water cycles continuously between the ocean, atmosphere and land and the energy forces involved in the process. **CCC**: **Energy and Matter** Students can describe how temperature and gravity affect the movement of water and matter in the water cycle.	**'Water Models' (Project WET, Portal)** - Use a seawater brine (add 35 grams of salt to 1,000 grams of tap water & stir until the salt is completely dissolved in the water) as the liquid reservoir in the 'Water Models' warm-up activity. - Students can be given a drop of the seawater before the demonstration to verify its saltiness. - Use a pan larger than the seawater reservoir that can be slightly tilted to capture the condensed water in a bowl or cup next to the seawater reservoir.	**ELA:** RST.6–8.3; WHST.6–8.7 **MATH:** None listed for this PE
MS-ESS2-6. Develop and use a model to describe how unequal heating and rotation of the Earth cause patterns of	**SEP: Develop and Use Models:** Students can use evidence from maps and visual images to place and describe climate regions of California.	**'Discovering the Waters of Our National Parks' California version (Project WET 2.0, P: 495)** - Students analyze images of California	**ELA:** RH.6-8.7; RST.6-8.4; SL.8.5; W.6-8.2b; WHST.6-8.7 **MATH:**

atmospheric and oceanic circulation that determine regional climates. *California has different climate zones. (CSF, p: 377)*	**DCI: ESS2.D: Weather and Climate:** Students describe and differentiate evidence of climate and weather interactions based on landforms, living organisms, states of water and evidence related to latitude, altitude, local and regional geography. **CCC: Systems and System Models:** Students can use visual and textual clues to describe the regional climate setting of each National Park area in California.	National Park areas for evidence of weather vs. climate indicators in each area. - Students can research the climate zones where their National Park areas are located in California and report back to the class. (CSF, p: 378)	- Students can aid in the collection of data on climate and Parks by participating in the California Phenology Project.
MS-ESS2-6. Develop and use a model to describe how unequal heating and rotation of the Earth cause patterns of atmospheric and oceanic circulation that determine regional climates. *Coastal towns have mild climates while inland valleys have greater temperature extremes. (CSF, p: 380)* *It rains and snows a lot in the mountains. (CSF, p: 380)*	**SEP: Develop and Use Models:** Students can map weather and climate data to identify the role of geography and atmospheric circulation patterns in California regional climates. **DCI**: **ESS2.D: Weather and Climate:** Students can describe how weather and climate are influenced by the atmosphere, the ocean and landforms, and vary with latitude, altitude, and local and regional geography. **CCC**: **Systems and System Models:** Students use a map to describe the interaction of geography, latitude and atmospheric flow patterns based on weather and climate data.	**'Wet Vacation' (Project WET, Portal)** - Students research and analyze monthly precipitation and average temperatures trends for a region, state or country – including climate regions of California. - Rather than a travel brochure, students can plan a trip east from a California coastal location to the eastern border and explore weather data at locations along the route. (CSF, p: 378) - Students compare route graphs from north to south and to address the (CSF, p: 380) phenomena listed for this activity.	**ELA:** RST.6-8.1; SL.8.5; WHST.6-8.2 **MATH:** MP.2 - Students can help add to the body of data to improve the accuracy of current and future weather models by setting up or engaging in a campus CoCoRAHS or GLOBE program.
MS-PS3-3. Apply scientific principles to design, construct, and test a device that either minimizes or maximizes thermal energy transfer * *Does water move through the water cycle in a desert as it would in a rain forest?*	**SEP**: **Construct Explanations and Design Solutions:** Students can develop a simple model to demonstrate the effect of water and air volume, temperature and land features on the cycling of water in a climate region. Students can also develop a simple device to retrieve water from air. **DCI**: **PS3.B: Conservation of Energy and Energy Transfer**	**'Water Models' (Project WET, Portal)** - Students construct models of the water cycle to illustrate its major components and processes. - Students can investigate the effect of temperature changes by modifying the models with different volumes of air versus water. (CSF, p: 379 -380)	**ELA:** RST.6–8.3; W.2.8; WHST.6–8.7 **MATH:** - Students develop a device to retrieve water from the air. - Students research current use of 'water from air' devices to collect water around the world and rate

	Students are able to explain why the same volume of air is heated faster that water, and why small water bodies heat faster than large water bodies. **CCC**: **Energy and Matter** Students are able to develop a diagram to describe how the transfer of energy drives the cycling of water in a designed system.		each design for use in arid communities. - Students research evaporative cooling technology and compare design features, cost, volume of water required per unit of time, scalability, maintenance needs, etc.
MS-ESS2-6. Develop and use a model to describe how unequal heating and rotation of the Earth cause patterns of atmospheric and oceanic circulation that determine regional climates. *How might California climate zones change in the future?*	**SEP: Develop and Use Models:** Students can map current and projected weather and climate data to identify potential change in future patterns in California regional climates. **DCI**: **ESS2.D: Weather and Climate:** Students can describe how changing climate patterns will effect future weather and water availability in California. **CCC**: **Systems and System Models:** Students can use climate model data to describe how changing weather and climate patterns will effect the cycling of water in California climate regions.	**'Wet Vacation' (Project WET, Portal)** - Students can use Cal-Adapt model data to investigate how temperature and precipitation patterns in their California climate region and along their route maps are expected to change by the end of this century. - Students can revise their regional water cycle diagrams to describe how the predicted changes may affect communities and ecosystems.	**ELA:** RST.6-8.1; SL.8.5; WHST.6-8.2 **MATH:** MP.2 - Students can help add to the body of data to improve the accuracy of current and future weather models by setting up or engaging in a campus CoCoRAHS or GLOBE program.
MS-ESS2-6. Develop and use a model to describe how unequal heating and rotation of the Earth cause patterns of atmospheric and oceanic circulation that determine regional climates. *How do temperature changes affect the ocean?*	**SEP: Develop and Use Models:** Students can demonstrate how temperature and salinity affect the density and movement of water. **DCI**: **ESS2.C: The Roles of Water in Earth's Surface Processes:** Students can describe how variations in temperature and salinity affect the density and global movement of water in the ocean. **CCC**: **Systems and System Models:** Students can describe how the global ocean conveyor belt is driven by variations in density caused by variations in temperature and salinity.	**'Adventures in Density' (Project WET 2.0, p: 3)** - Students conduct investigations to discover how the density of water is affected by heat and salinity, and helps drive the oceanic conveyor belt.	**ELA:** RST.6.8.1; RST.6.8.3; RST.6.8.4; RST.6-8.9, RI.6-8.1, RI.6-8.2, RI.6-8.7, RH.6-8.7, WHST.6-8.2b; SL.8.5 **MATH:** - Students can help people visualize future sea level by participating in the California King Tides Project.