Hypothesized Learning Progression (LP) for Sea Level Rise (SLR)
MADE CLEAR UM Learning Sciences Research Group
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	Level 1 (Lower Anchor)	**Level 2**	**Level 3**	**Level 4** (Upper Anchor)
Potential SLR LP indicator based on Gunckel, Covitt, Salinas & Anderson (2012, p. 854) "SM" stands for scale and mechanisms	SM1: Students explain sea level rise on a macroscopic scale only, focusing on immediately visible structures or phenomena without including mechanisms for phenomena.	SM2: Students explain sea level rise on a broad macroscopic to large-scale focus across familiar and visible dimensions. Students can identify a mechanism, though they rely on actors or agents.	SM3: Students explain sea level rise on the microscopic to the landscape scale, though they may refer to smaller particles such as atoms or molecules. Students are able to put events in order, but do not include driving forces or constraining factors.	SM4: Students explain sea level rise on the atomic-molecular scale. Students use driving forces (e.g. gravity), as well as constraining factors (e.g. topography) to explain changes in sea level.
Potential SLR LP indicator based on Gunckel, Covitt, Salinas & Anderson (2012, p. 854) "R" stands for representations	R1: Students are able to obtain useful information from representations related to sea level rise, though they are not able to connect these representations to the physical world.	R2: Students are able to make limited connections between the physical world and representations related to sea level rise.	R3: Students are able to connect representations of sea level rise to the three-dimensional physical world, but do not infer driving forces or constraining variables.	R4: Students are able to interpret driving forces and constraining factors related to sea level changes based on representations.

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	Level 1 (Lower Anchor)	**Level 2**	**Level 3**	**Level 4** (Upper Anchor)
Potential SLR LP indicator about causes of sea level rise "C" stands for causes	C1: Students identify global warming due to the enhanced greenhouse effect as a cause of sea level rise.	C2: Students recognize that global warming causes sea level rise, but are not able to identify factors such as thermal expansion and ice melt (not distinguishing between terrestrial and see ice). Students are also able to identify a mechanism that relies on actors or agents.	C3: Students understand that sea level rise scenarios are based on thermal expansion and ice melt (not distinguishing between terrestrial and see ice), though they do not consistently relate these factors to atomic-molecular models.	C4: Students understand that sea level rise scenarios are based on thermal expansion and terrestrial ice melt, and they are able to explain these factors using atomic-molecular models consistently.
Potential SLR LP indicator about impacts of sea level rise "I" stands for impacts	I1: Students identify that an impact of sea level rise is that some land in coastal areas and islands will be underwater, though they are not able to elaborate on specific consequences of sea level rise.	I2: Students understand that sea level is projected to rise in the future and are able to identify a limited number of specific consequences, though they do not understand that sea level change will have local effects including those related to storm surge.	I3: Students understand that local impacts of sea level changes can differ, but cannot explain primary factors that can cause this difference. Students are able to elaborate on specific consequences of sea level rise such as loss of habitat, in-land flooding during storms, property loss, and erosion.	I4: Students understand that local sea level changes can differ from global trends based on regional variations in factors such as geographic uplift or subsidence and ocean currents. Students are able to elaborate on specific consequences of local sea level rise. Students recognize that sea level rise projections are based on available data and may be lower or higher than predicted.

References:

Gunckel, K. L., Covitt, B. A., Salinas, I., & Anderson, C. W. (2012). A learning progression for water in socio-ecological systems. *Journal of Research in Science Teaching*, *49*(7), 843-868.

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