The University of Texas at Austin
Environmental Science Institute

Tracking Hurricane Harvey

Lesson Plan for Grades: 7th or 8th grade
Length of Lesson: 45 minutes

Authored by: UT Environmental Science Institute
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Subject area/course:
- Math 7th Grade or 8th Grade

Materials:
- Atlantic Basin Hurricane Tracking Chart, one per student OR pair: https://www.nhc.noaa.gov/pdf/tracking_chart_atlantic.pdf
- Student Handout, one per student OR pair

TEKS/SEs:

§111.27. Grade 7, Adopted 2012.

(1) Mathematical process standards. The student uses mathematical processes to acquire and demonstrate mathematical understanding. The student is expected to:

(A) apply mathematics to problems arising in everyday life, society, and the workplace;

(B) use a problem-solving model that incorporates analyzing given information, formulating a plan or strategy, determining a solution, justifying the solution, and evaluating the problem-solving process and the reasonableness of the solution;

(7) Expressions, equations, and relationships. The student applies mathematical process standards to represent linear relationships using multiple representations. The student is expected to represent linear relationships using verbal descriptions, tables, graphs, and equations that simplify to the form $y = mx + b$.

§111.28. Grade 8, Adopted 2012.

7) Expressions, equations, and relationships. The student applies mathematical process standards to use geometry to solve problems. The student is expected to:

(C) use the Pythagorean Theorem and its converse to solve problems; and

(D) determine the distance between two points on a coordinate plane using the Pythagorean Theorem.

Lesson objective(s):
- Students will be able to graph given coordinates. This is done through mapping Hurricane Harvey on a tropical cyclone tracking map, given latitude and longitude for each of a 17-day period.
- Students will be able to calculate slope given two coordinate points.
- (8th grade) Students will be able to use the Pythagorean Theorem to determine the distance between two points.

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Differentiation strategies to meet diverse learner needs:

- ELL students and students with learning disabilities should have multiple forms of instruction including visual and written instruction sheets as well as a verbal instruction and demonstration.
- ELL students can be provided with sentence stems to assist with communication.

ENGAGEMENT (5 minutes)

1. Watch a news clip or read a news article on Hurricane Harvey and its effects on the Texas gulf coast.
2. This video seems pretty powerful: https://www.youtube.com/watch?v=YzQGgyrxXiI. While students are watching, they should record their observations about before and after the storm.

   TPS (Students think silently for one minute their answers to the below questions, share with their shoulder partner for one minute, then the teacher calls on students to share to the class for one minute)

   Possible questions to ask:

   1. What does it seem like the primary effect of Hurricane Harvey was?
   2. How do you think this affected residents?
   3. How do you think we can minimize the effects of a hurricane? (some students may refer to the flood alert system, which would be a good segue into how the national weather service knows to alert residents based on forecasts.)

Transition: “In this hurricane, the Texas Flood Response System was able to accurately predict where damage would occur before the hurricane landed using a new model that can forecast water flow in streams and rivers. This made it very useful in predicting damage done during Hurricane Harvey, since much of the devastation was caused by flooding. Today, let’s do something similar.”

EXPLORATION (25 minutes)

- Students take real data for latitude and longitude points of Hurricane Harvey and grid them onto a map.
- Partway through, students will predict where the hurricane will make landfall, and thus, for simplicity purposes, where it will “cause the most damage.”
- “Which way does latitude run? Which way does longitude run? How do these compare to x and y values on a coordinate graph?”
- “What are some things you need to consider when you predict where a hurricane will make landfall?
- This can be done either individually or, preferably, in a partner setting and students where must work together in pairs. Making the charts into a poster could be helpful in the absence of a doc cam. Teacher should give students specific roles- one is speaker and one is scribe.

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EXPLANATION (10 minutes)

- 2-3 selected students or pairs should present their work, explaining which direction the hurricane took and when, how they predicted where it would fall, and whether their predictions accurately forecasted where the most damage would occur.
    - 7th- Students should explain their predictions using the equation y = mx + b, and teacher should probe the students for what m, x and y represent.
    - 8th- Students can explain the above, but should also focus on how they determined how far Hurricane Harvey traveled during this time using the Pythagorean Theorem. How was this accomplished using the equation a^2 + b^2 = c^2 and what does each value represent?
- "How did you predict where the hurricane would make landfall?"
- "What use could this information have?"
- "How can you use math to prepare people for natural disasters?"

ELABORATION (5 minutes)

- #3: how far Hurricane Harvey is from its original position is its total **displacement**.
- **Can this knowledge be used in any particular career field? If so, how? –** Civil engineers consider how to build cities to minimize the effects of natural disasters, meteorologists forecast weather including natural disasters, research scientists gather data to understand the earth's natural processes, disaster relief work to provide aid to victims of natural disasters.
- Teacher can also touch on limitations of models- this map is a Mercator Projection, so distance measurements aren't as accurate the further from the equator.

EVALUATION (throughout entire lesson)

- Teacher should formatively assess throughout the class to gauge understanding and adjust the lesson accordingly.
- Student handout can be used as a formative assessment support, as well as a summative assessment at the end of the day.
- Teacher can also devise an exit ticket where students need to come up with an equation for a line given two points (7th grade) or where students need to calculate displacement given two points (8th grade)

SOURCES AND RESOURCES

- **Dr. David Maidment's *Hot Science – Cool Talks #114,* "Hurricane Harvey: Emergency Flood Response",** http://www.esi.utexas.edu/talk/catastrophe-harvey/
- **Teaching and Learning Mathematics through Hurricane,** http://www.cpalms.org/uploads/resources/final/10655/Document/6/fernandez_schoen_2008_mtms_hurr_tracking.pdf
- **National Hurricane Center Tropical Cyclone Report: Hurricane Harvey,** https://www.nhc.noaa.gov/data/tcr/AL092017_Harvey.pdf

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STUDENT HANDOUT:
Name: _____

Hurricane Harvey: My Observations

Watch the video and write down your observations.

Before the Storm	After the Storm

Storm Tracking

Use the data provided below to track Hurricane Harvey on the provided Atlantic Basin Hurricane Tracking Chart.
Best track for Hurricane Harvey, 17 August – 1 September 2017. Adapted from National Hurricane Center Tropical Cyclone Report: Hurricane Harvey (AL092017): https://www.nhc.noaa.gov/data/tcr/AL092017_Harvey.pdf

Date/Time (UTC)	Latitude (degree N)	Longitude (degree W)
17 / 0000	13.6	49.0
18 / 0000	13.0	56.6
19 / 0000	13.4	64.0
20 / 0000	14.0	71.0
21 / 0000	15.1	78.6
22 / 0000	18.0	86.4
23 / 0000	20.5	90.7
24 / 0000	22.0	92.5
Pause here, answer questions 1 & 2		
25 / 0000	25.0	94.4
26 / 0000	27.8	96.8
27 / 0000	29.2	97.4
28 / 0000	28.8	96.8
29 / 0000	28.2	95.4
30 / 0000	28.9	93.8
31 / 0000	31.3	92.6
01 / 0000	34.1	89.6
02 / 0000	37.2	85.6

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1. Where do you predict this storm will make landfall?

2. Come up with an equation in the form of y = mx + b to explain your predicted landfall.

3. From its original position, how many miles did Hurricane Harvey displace? (Assume that degrees latitude and longitude are each 69 miles)

4. Between which two days did Hurricane Harvey travel furthest?

5. According to this data, what day did Hurricane Harvey make landfall?

6. Sources state that Hurricane Harvey made landfall on August 25th, 2017. What could be a reason for this discrepancy?

Challenge Question (8th grade)

7. How would you calculate how quickly Hurricane Harvey traveled between August 17 and September 2, on average?

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TEACHER HANDOUT:

1. Where do you predict this storm will make landfall?

2. Come up with an equation in the form of y = mx + b to explain your predicted landfall.

3. At September 2, 2017, how far is Hurricane Harvey from its original position? (Assume that degrees latitude and longitude are each 69 miles)

7th grade: 1055.7 miles latitude, 3091 miles longitude.
8th grade: ((28.9-13.6)^2+(93.8-49)^2)^(1/2)*(69) = 3266.5 miles.

4. From which day to which day did Hurricane Harvey travel furthest?

Days 5-6, August 21-22

5. What day did Hurricane Harvey make landfall?

Day 11, August 27

6. Sources state that Hurricane Harvey made landfall on August 25th, 2017. What could be a reason for this discrepancy?

The data points mark the eye of the storm, the storm itself spans a much wider range. ~There can be a range of answers to this question.

Challenge Question (8th grade)

7. How would you calculate how quickly did Hurricane Harvey travel between August 17 and September 2, on average?

Range of answers, but something along the lines of: Take the latitude and longitude points of day 1 and 2, find the distance traveled longitudinally and latitudally and calculate using the Pythagorean Theorem what the total distance travelled for that day is. Do this for each data point to find the total distance travelled, then divide by the total number of days.

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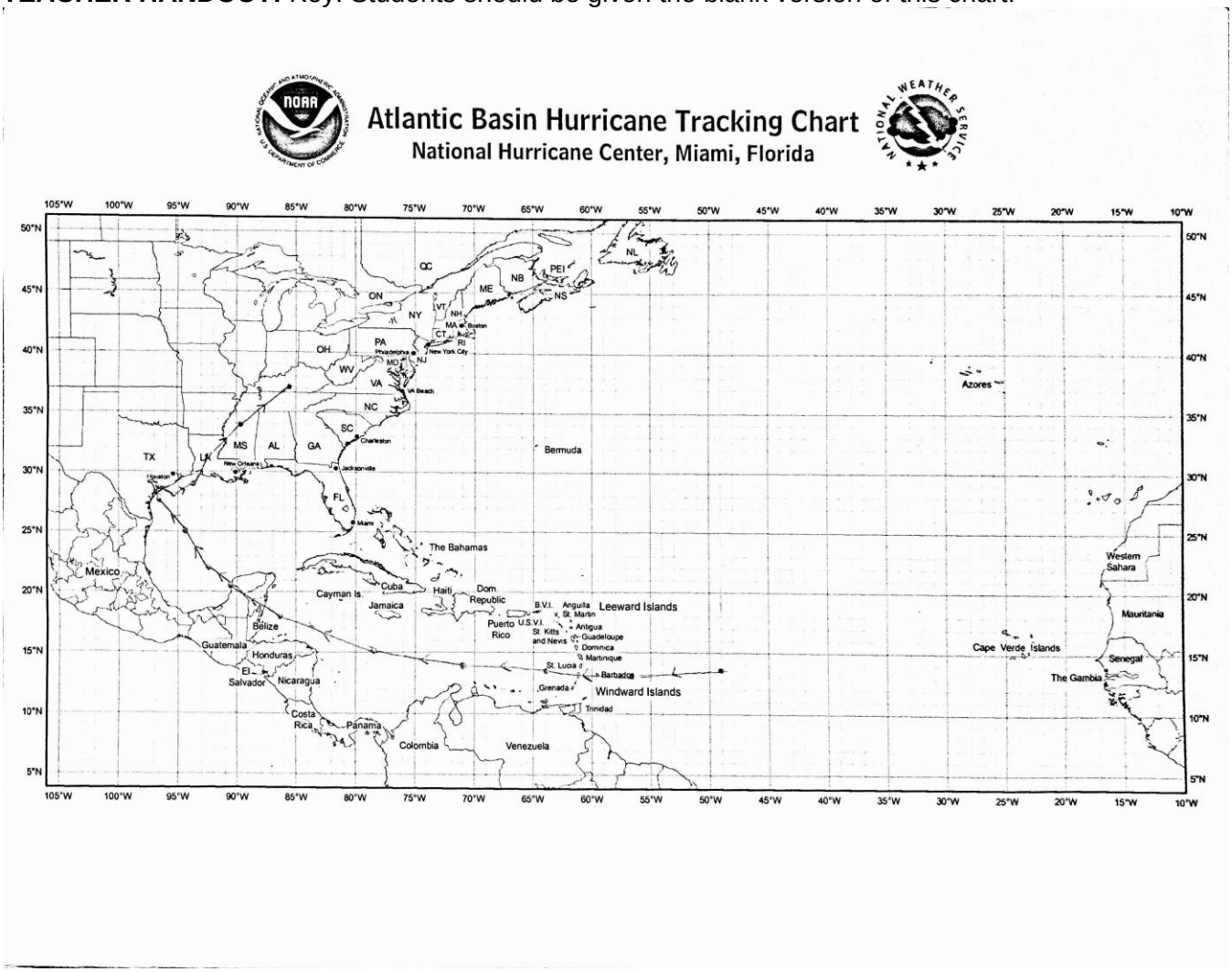
TEACHER HANDOUT: Key. Students should be given the blank version of this chart.



Source: National Hurricane Center, Atlantic Basin Hurricane Tracking Chart, https://www.nhc.noaa.gov/pdf/tracking_chart_atlantic.pdf