**Data and Classroom Activities to Teach the Story of Colorado's 2013 Floods**

*A Workshop for Boulder Valley School District Professional Development*

**Presenters:**

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**Objectives for today’s workshop:**

* You will get to know materials and activities from ***The Flash Floods Teaching Box*** (<http://scied.ucar.edu/flash-floods-teaching-box>), a free online curriculum collection for middle and high school science instruction developed at the UCAR Center for Science Education.
* You will see a preview of ***SOS Explorer***, a new personal classroom version of NOAA’s Science On a Sphere. SOS Explorer is in development and will be released to participating teachers for beta testing very soon!

For links to more information about flash flooding and the 2013 Colorado Flood event, visit: <http://sos.noaa.gov/workshop/spring_2014.html>

**Colorado Flood 2013 - Answering Questions with Data**

Materials:

* SOS Explorer (coming soon!), projector, computer, Internet access
* Bags of beads (each bag with 99 of one color and 1 of another color)
* worksheets (1 for each student)
* laminated maps of Boulder floodplain and dry erase markers (1 for each group of 4)

Duration: 1-1.5 class periods

I. ***Engage:* Drawing on background knowledge with KWL one-year after the flood**. What do you know about it? Are you still curious about it? Fill out the first two columns of your table.

II. ***Explore:* Why did the flood happen?** In order to understand that, we have to go over what normally happens, in other words, how does the atmosphere behave. Now that’s a complicated topic but let’s just look over the basics.

1. Using SOS Explorer - Real-time IR GOES cloud data

* Review/introduce atmospheric general circulation
	+ Where is there more or less wv now? How can you tell?
	+ Which way do the air masses move? What do you think would happen if they didn’t move, if they got stalled?

2. Using Youtube - CO Flood Satellite IR & Weather symbols to view weather conditions: <https://www.youtube.com/watch?v=NKdhfxeZ-ug&feature=youtu.be>

Commentary:

* Tropical Storm Lorena from the Pacific Ocean and Tropical Depression 8 from the Atlantic dissipate over Mexico leaving behind an upper level low pressure.
* The warm core upper level low pressure moves north and parks over Utah.
* As with any low pressure, the air rotates counterclockwise and inward pulling the warm, moist remnants of the tropical systems towards the Front Range of Colorado.
* As with any moist air, as it hits the mountains it rises and forms rain.
* General circulation of air in the mid-latitudes moves air west to east but the high pressure ridge to the east serves as a stalling feature, keeping the low in place for a few days.
* A cold front from Canada moves south to Colorado and reinforces the uplifting motion as cold air is denser and plows under the warmer air causing another couple of days of rain.
* These factors caused 14+” of rain to fall within a week in Boulder and more than 8” of rain over a large area of the Colorado northern foothills, which brought widespread flooding. This water washed out nearly every road in Boulder County that leads to the foothills and ultimately swelled riverbanks in Nebraska.
* This dataset can also be seen on the NOAA Boulder Science On a Sphere® (SOS)

3. Kinesthetic supplemental activity: Have 6 students (a mountain, tropical storm Lorena, tropical depression 8, low, high, & cold front) stand up and act out the weather conditions. i.e. Lorena would turn counterclockwise, the High would block the Low.

4. Record Question #1 - What did the flood happen? Summarize your finding. What resources were used?

**III. *Elaborate & Evaluate:* Was it normal?**

1. Think-pair-share: How exactly do we define normal? Where would we go for answers?

2. As a class, look at the storm totals: <http://www.denverpost.com/2013coloradofloods/ci_24101329/colorado-flooding-2013-precipitation-totals>

3. Then, decide whether the rain is typical by looking at Boulder Monthly Climate data:

<http://www.esrl.noaa.gov/psd/boulder/Boulder.mm.precip.html>

4. Record Question #2 - Was it normal? Summarize your finding. What resource was used?

**IV. What’s the likelihood that it will happen again?**

1. Do the activity: <http://scied.ucar.edu/activity/flood-chances> (without the reading)

2. Record Question #3 - What’s the likelihood it will happen again? Summarize your finding. What resource did was used?

**V. What’s the risk where I live?**

1. Print enough maps for each student group and laminate so you can reuse the maps. If you are able, print them at 11 x 17 in color: <http://scied.ucar.edu/activity/considering-flood-risk-0>

2. Hand out the map and ask the students to find their house, their school, and a favorite place. Mark locations with a dry erase marker.

3. Have students take note of whether any of the locations they have marked is within the 100 year or 500 year floodplain.

4. Record Question #4 - Risk is a combination of vulnerability and likelihood. What’s the risk where you live or work? Summarize your finding. What resource did was used?

5. Note that the City of Boulder is in the process of redrawing the floodplain boundary. The Sept 2013 floods provided new data on which areas are vulnerable to flooding. Take a look at the Boulder 2013 flood data at: <https://bouldercolorado.gov/flood/flood-maps>.

**VI. Is climate change a factor?**

1. In partners, have students read “Inside the Colorado Deluge,” paying particular attention to page 5. <http://www2.ucar.edu/atmosnews/perspective/10250/inside-colorado-deluge>

 2. Discuss it as a class.

3. Record Question #5 - Was climate change a factor in the 2013 storm? Summarize your finding. What resource did was used?

**VII. *Evaluate* Effectiveness: What did you learn?** Complete the final column on the KWL. As an extension, have students also write what they will do with the information that they have learned (especially if they have learned that they live in a floodplain). Have students consider what precautions they will take to keep living in the floodplain.

Colorado Flood of 2013

Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Investigation & Data collection Period: \_\_\_\_\_\_

|  |  |  |
| --- | --- | --- |
| What you know? | What do you want to know? | What did you learn? |
|  |  |  |

**1.**  Question:

Finding:

Resource:

**2.** Question:

Finding:

Resource:

**3.** Question:

Finding:

Resource:

**4.** Question:

Finding:

Resource:

**5.** Question:

Finding:

Resource: