

## ***What are the Chances: A storm surge event activity!***

*Find out how often a big storm surge event might happen throughout a multi-year period.*

### **Introduction:**

*By pulling out small cards from a hat, record the number of times a large, anomalous storm surge event might happen.*

*Each card drawn represents the largest storm surge of a single year. Play a game to get data to analyze what type of storm surges might occur over a multi-year period.*

### **Materials:**

- *Page of numbered squares (see table of colored squares)*
- *Scissors*
- *A hat or other container to hold the cut squares*
- *A group or class of people*



### **Assembly:**

- *Cut out all 100 squares below and place them in a hat.*
  - *There are 37 anomalous events*
    - *1 square represents a 100-year event*
    - *2 squares represent 50-year events*
    - *4 squares represent 25-year events*
    - *10 squares represent 10-year events*
    - *20 squares represent 5-year events*
  - *All remaining white squares (63) represent non-anomalous event years,*

### **To do:**

1. *Organize yourself into groups with your 100 cut squares.*  
*Each group can be considered a different location.*
2. *Playing the odds:*  
*Over 10 years, what are the chances you will experience an anomalous event?*
  - a. *Make sure to scramble or shuffle your squares in the hat.*
  - b. *Without looking, pick a square from the hat.*
  - c. *Each small card represents a year when a frequent or infrequent event might happen.*
  - d. *Record your result in the table below.*
  - e. *Return the square to the hat.\**
  - f. *Repeat 10 times:*
    - i. *Shuffle the squares again..*

- ii. *Pick another square.*
3. *Present your findings to your group or class.*

*Record your group events here:*  
**Ten years of draws**

<i>Year of storms</i>	<i>Storm event</i>
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	

**Storm surge event squares.**  
To be cut into separate pieces.

100									
50	50								
25	25	25	25						
10	10	10	10	10	10	10	10	10	10
5	5	5	5	5	5	5	5	5	5
5	5	5	5	5	5	5	5	5	5

**What's going on:**

Were you surprised by the type of events that came out of the hat? You probably got more large events than you thought. You might have even gotten several anomalous events in a row.

It's all about statistics. These returning events are often referred to as return periods, recurrence intervals, or repeat intervals. The events themselves are often referred to as an "x-year events." This is a misnomer.

A 100-year event does not mean it will happen every 100 years. It means the odds are 1 in 100 that this type of event will happen or a 1% chance in a single year. The same is true of a 50-year event, 1 in 50 or 2% chance. A 25-year, 1 in 25 or 4%. A 10-year event, 1 in 10 or 10%, and a 5-year event has a 1 in 5 or 20% chance of happening in a single year.

**Note:** as your timeframe lengthens, the math gets more complicated.

Roughly speaking, for example, you have a 1% chance of drawing a 100-year event card. If you draw 10 times (and return the card each time), you have a  $1\% \times 10$  or roughly 10% chance of drawing a 100-year event card. A further example would be, for a 25-year event over 10 years, which gets close to a 40% chance of occurring (for more accurate calculations as your timeframe increases, see "Going Further," *Flood Return Calculator* below).

As you can see, your chance of experiencing an anomalous event is larger than you might think.

A *Storm surge* is the abnormal rise in seawater level above the normal predicted astronomical tide. Sometimes these events can be huge, causing a wall of water to rush onshore. Many factors affect storm surge, but its main drivers are winds pushing water onshore.

Severe storm surges are anomalous events that follow a similar pattern of "return periods" (mentioned above).

Sometimes you might hear of this wall of water as a Storm Tide. However, this term actually refers to the combination of the surge and the regularly occurring tide.

**Note:** Storm Surge height does not include the associated wave height. High storm surges can be very dangerous!

**This is important:** What we refer to as a 5, 10, 25, 50, and 100-year event now will change as we get more data. Climate predictions are that severe events will become more frequent. So, for example, what we consider a 100-year event might be reclassified to a 50 or 25-year event.

## Going Further:

Roll a dice!

If there is a question about why you return the square to the hat before drawing the next square, do an activity with dice.

For example:

- What are the odds that a “6” will show up when you roll your dice?
- What are the odds that another “6” will show up when you roll again?

Each time you roll, the odds are 1 in 6 or about 17%.

Not, high odds, but you can get two 6’s in a row. That’s because a dice doesn’t remember it’s last roll!

Storm surge is similar, you can consider each year a new roll! That’s why you put the squares back into the hat. You can have, for example, two, 25-year events in a row.

### Flood Return Calculator

*This calculator uses more sophisticated math to calculate return periods...so, your percentages might be close but not exactly what you expect from the activity above.*

*One thing to note is that the longer the timeframe (number of years) the more the chances of a specific event happening deviates from what you might expect.*

[NOAA Flood Return Period Calculator](#)

### More resources:

- [What’s a storm surge](#)
- What’s a [Storm Tide](#)
- A visual way to apply storm surge predictions - [Bay Area Flood Explorer](#)  
See the image to the right.
- Changing [storm surge risk in CA](#)
- It’s more complicated than you think: [Return event formulas.](#)
- Image in upper corner:  
<https://www.usgs.gov/media/images/image-storm-surge>

