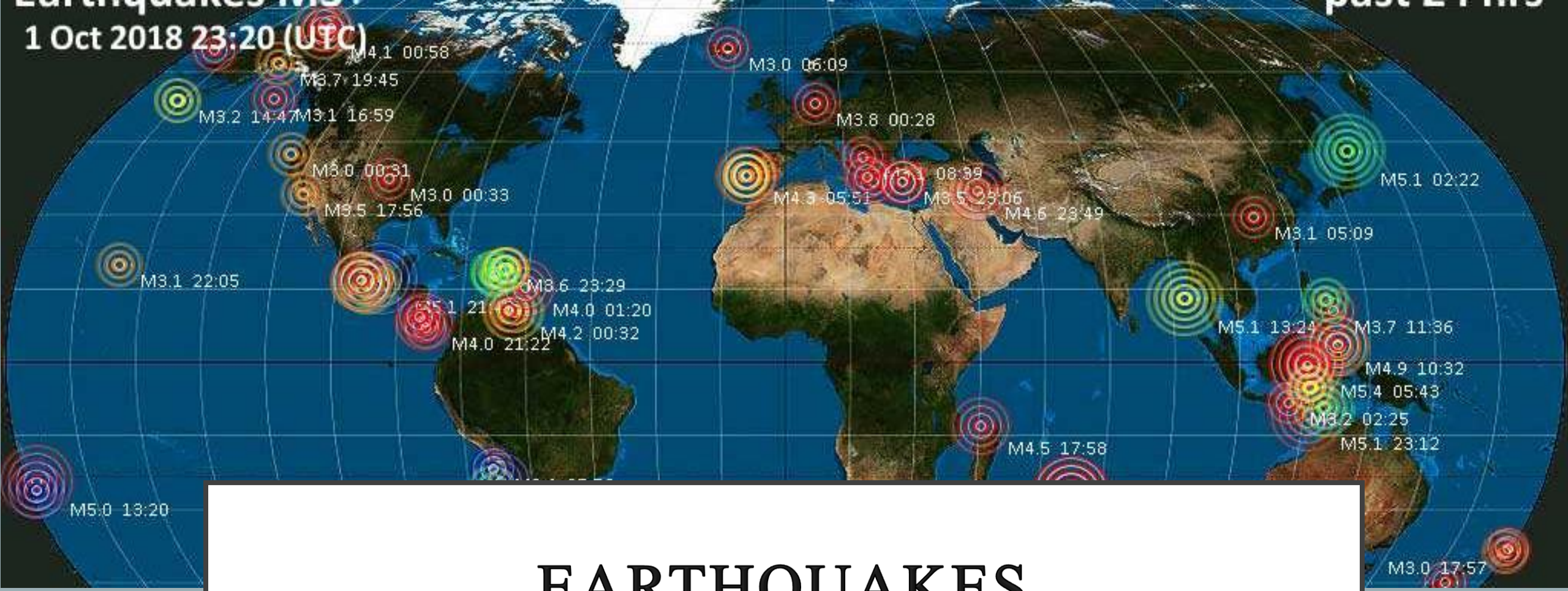
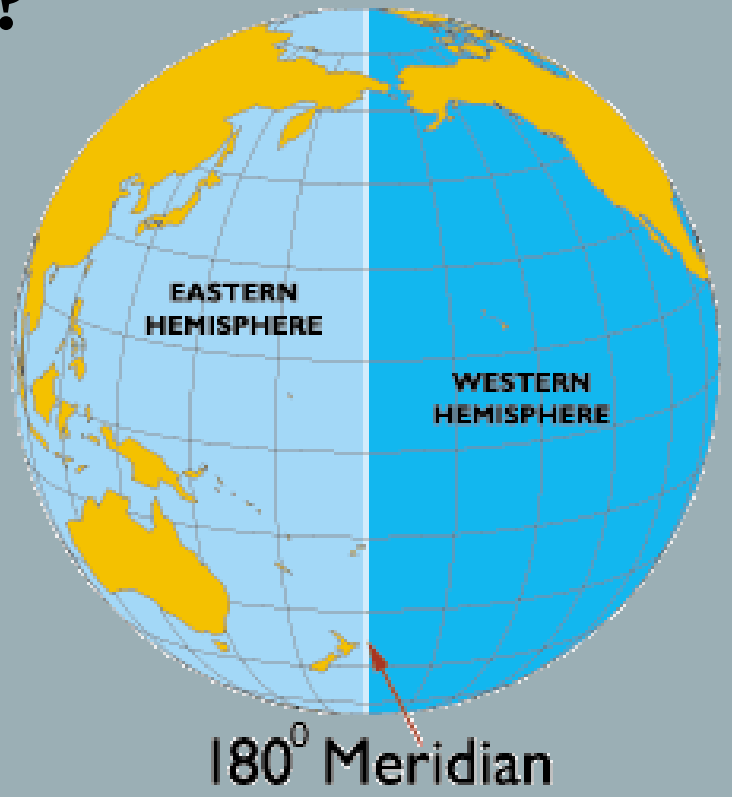


EARTHQUAKES

By: Sofia Romero & Cristina Noriega

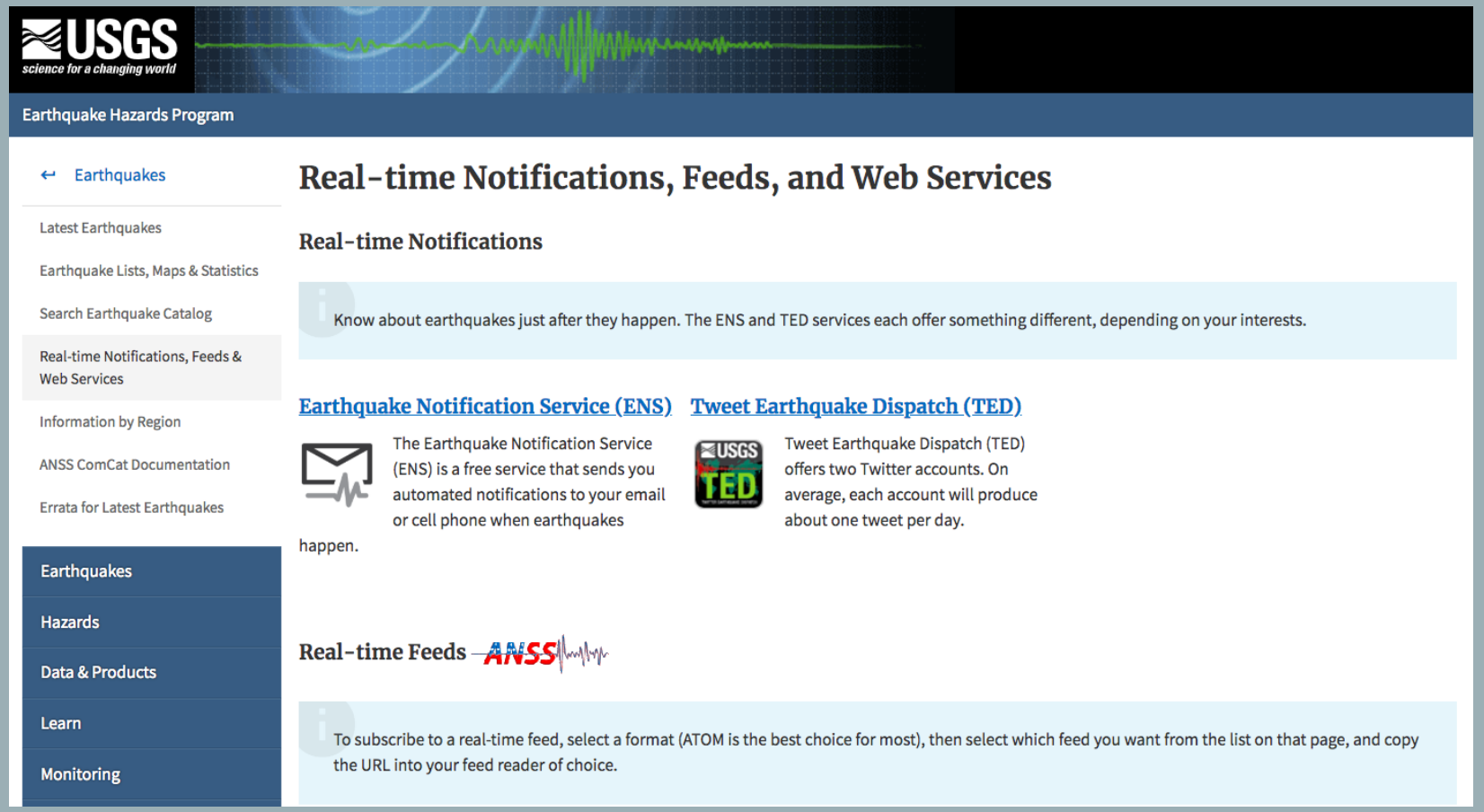
RESEARCH QUESTION

Which hemisphere is affected by larger earthquake magnitudes?



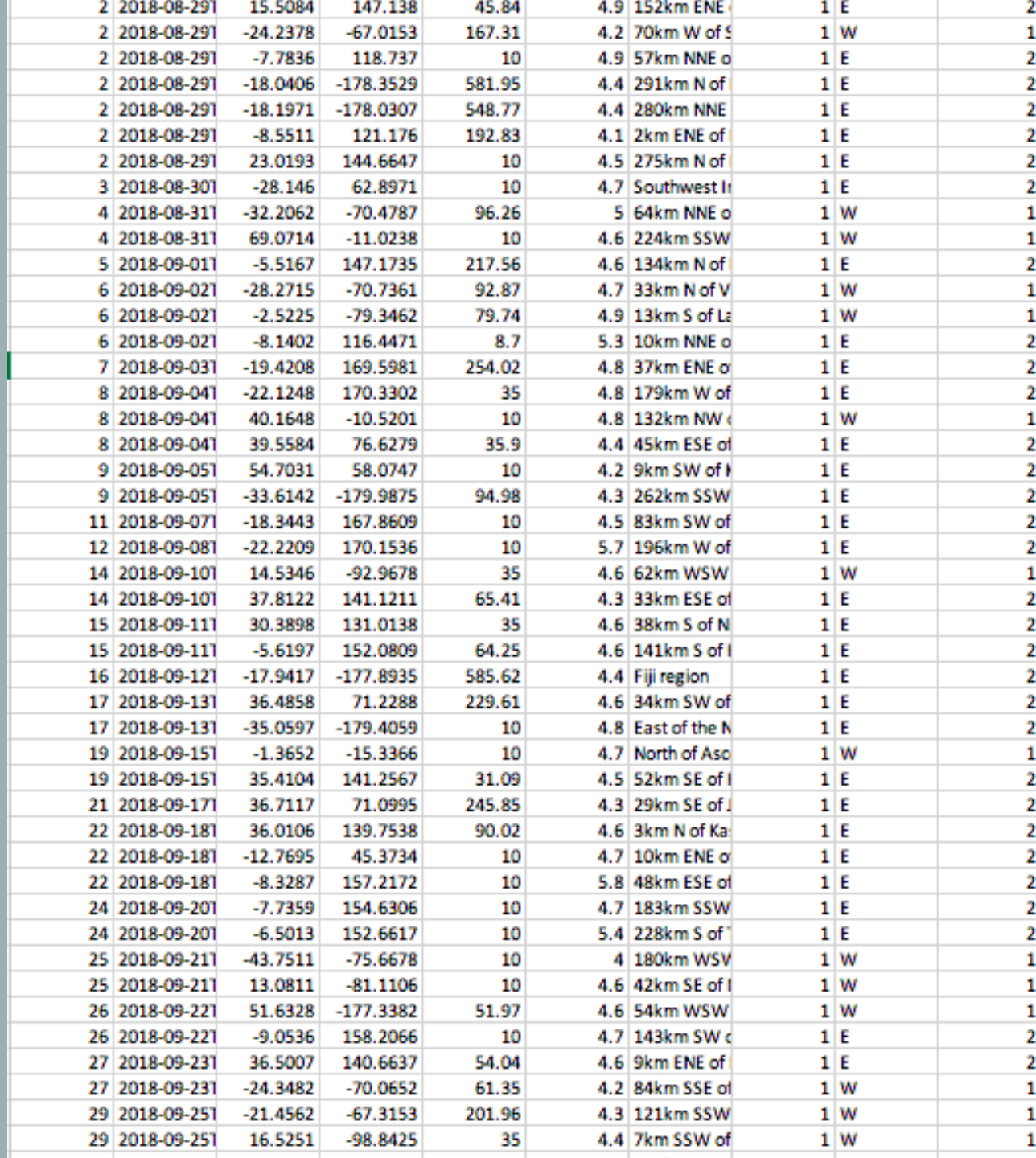
Data

- https://earthquake.usgs.gov/
- Original data from August 28 2018 – September 26 2018 (30days)



SAMPLE DATA

- Simple random sample
- n=50
- **Population:** Earthquakes with a magnitude greater than or equal to 4.0
- **Variables:**
  - Magnitude,
  - Hemisphere
  - Day
  - Date
  - Longitude
  - Latitude
  - Depth
  - Location



2	2018-08-29T	15.5084	147.138	45.84	4.9	152km ENE	1	E	2
2	2018-08-29T	-24.2378	-67.0153	167.31	4.2	70km W of S	1	W	1
2	2018-08-29T	-7.7836	118.737	10	4.9	57km NNE o	1	E	2
2	2018-08-29T	-18.0406	-178.3529	581.95	4.4	291km N of	1	E	2
2	2018-08-29T	-18.1971	-178.0307	548.77	4.4	280km NNE	1	E	2
2	2018-08-29T	-8.5511	121.176	192.83	4.1	2km ENE of	1	E	2
2	2018-08-29T	23.0193	144.6647	10	4.5	275km N of	1	E	2
3	2018-08-30T	-28.146	62.8971	10	4.7	Southwest I	1	E	2
4	2018-08-31T	-32.2062	-70.4787	96.26	5	64km NNE o	1	W	1
4	2018-08-31T	69.0714	-11.0238	10	4.6	224km SSW	1	W	1
5	2018-09-01T	-5.5167	147.1735	217.56	4.6	134km N of	1	E	2
6	2018-09-02T	-28.2715	-70.7361	92.87	4.7	33km N of V	1	W	1
6	2018-09-02T	-2.5225	-79.3462	79.74	4.9	13km S of La	1	W	1
6	2018-09-02T	-8.1402	116.4471	8.7	5.3	10km NNE o	1	E	2
7	2018-09-03T	-19.4208	169.5981	254.02	4.8	37km ENE o	1	E	2
8	2018-09-04T	-22.1248	170.3302	35	4.8	179km W of	1	E	2
8	2018-09-04T	40.1648	-10.5201	10	4.8	132km NW	1	W	1
8	2018-09-04T	39.5584	76.6279	35.9	4.4	45km ESE of	1	E	2
9	2018-09-05T	54.7031	58.0747	10	4.2	9km SW of K	1	E	2
9	2018-09-05T	-33.6142	-179.9875	94.98	4.3	262km SSW	1	E	2
11	2018-09-07T	-18.3443	167.8609	10	4.5	83km SW of	1	E	2
12	2018-09-08T	-22.2209	170.1536	10	5.7	196km W of	1	E	2
14	2018-09-10T	14.5346	-92.9678	35	4.6	62km WSW	1	W	1
14	2018-09-10T	37.8122	141.1211	65.41	4.3	33km ESE of	1	E	2
15	2018-09-11T	30.3898	131.0138	35	4.6	38km S of N	1	E	2
15	2018-09-11T	-5.6197	152.0809	64.25	4.6	141km S of I	1	E	2
16	2018-09-12T	-17.9417	-177.8935	585.62	4.4	Fiji region	1	E	2
17	2018-09-13T	36.4858	71.2288	229.61	4.6	34km SW of	1	E	2
17	2018-09-13T	-35.0597	-179.4059	10	4.8	East of the N	1	E	2
19	2018-09-15T	-1.3652	-15.3366	10	4.7	North of Asc	1	W	1
19	2018-09-15T	35.4104	141.2567	31.09	4.5	52km SE of I	1	E	2
21	2018-09-17T	36.7117	71.0995	245.85	4.3	29km SE of J	1	E	2
22	2018-09-18T	36.0106	139.7538	90.02	4.6	3km N of Ka	1	E	2
22	2018-09-18T	-12.7695	45.3734	10	4.7	10km ENE o	1	E	2
22	2018-09-18T	-8.3287	157.2172	10	5.8	48km ESE of	1	E	2
24	2018-09-20T	-7.7359	154.6306	10	4.7	183km SSW	1	E	2
24	2018-09-20T	-6.5013	152.6617	10	5.4	228km S of T	1	E	2
25	2018-09-21T	-43.7511	-75.6678	10	4	180km WSW	1	W	1
25	2018-09-21T	13.0811	-81.1106	10	4.6	42km SE of I	1	W	1
26	2018-09-22T	51.6328	-177.3382	51.97	4.6	54km WSW	1	W	1
26	2018-09-22T	-9.0536	158.2066	10	4.7	143km SW o	1	E	2
27	2018-09-23T	36.5007	140.6637	54.04	4.6	9km ENE of	1	E	2
27	2018-09-23T	-24.3482	-70.0652	61.35	4.2	84km SSE of	1	W	1
29	2018-09-25T	-21.4562	-67.3153	201.96	4.3	121km SSW	1	W	1
29	2018-09-25T	16.5251	-98.8425	35	4.4	7km SSW of	1	W	1

SAMPLE RESULT

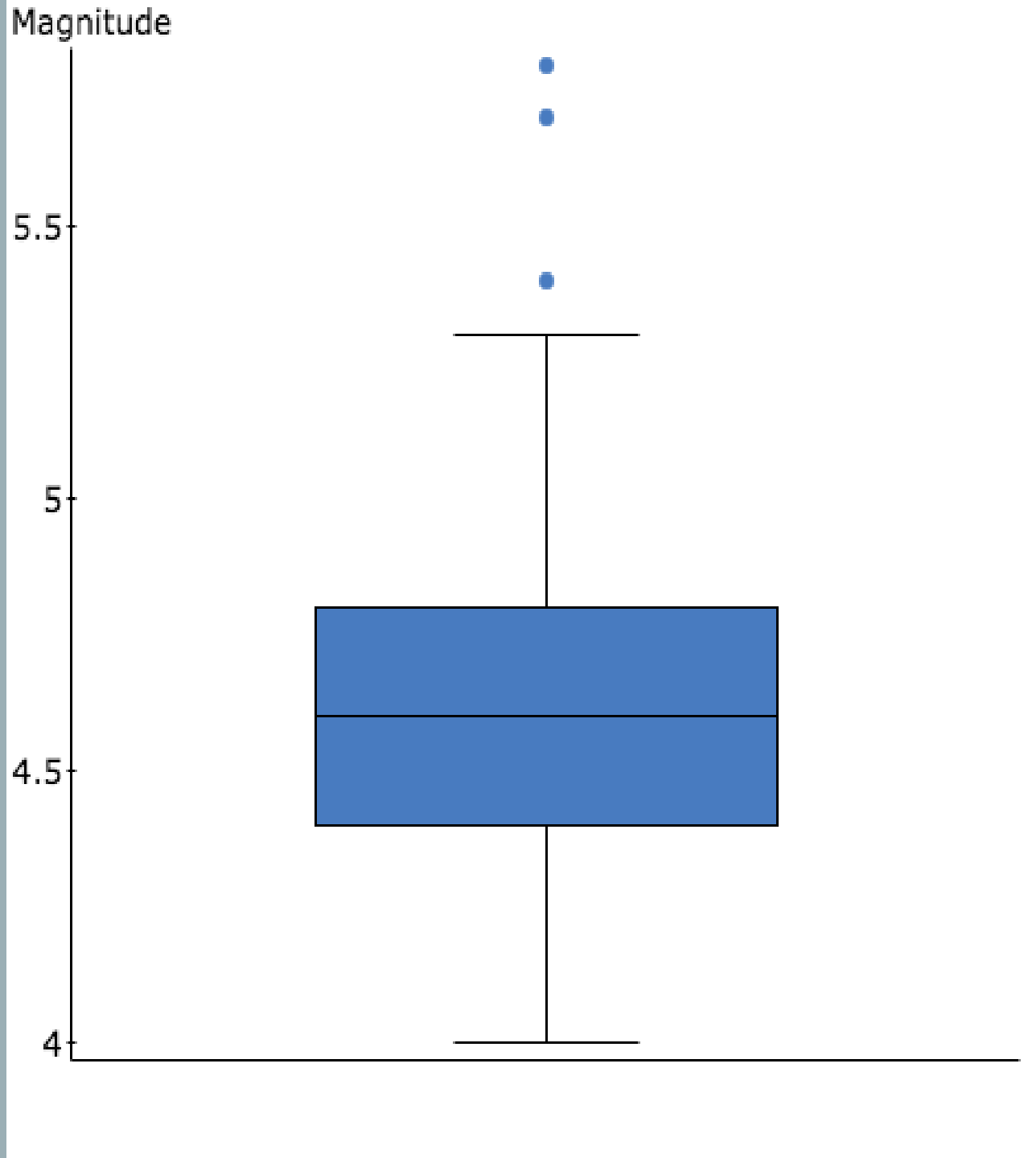
Boxplot

Sample mean: 4.6 magnitude

Skewed right

Outliers: 3 with magnitudes(5.4,5.7,5.8)

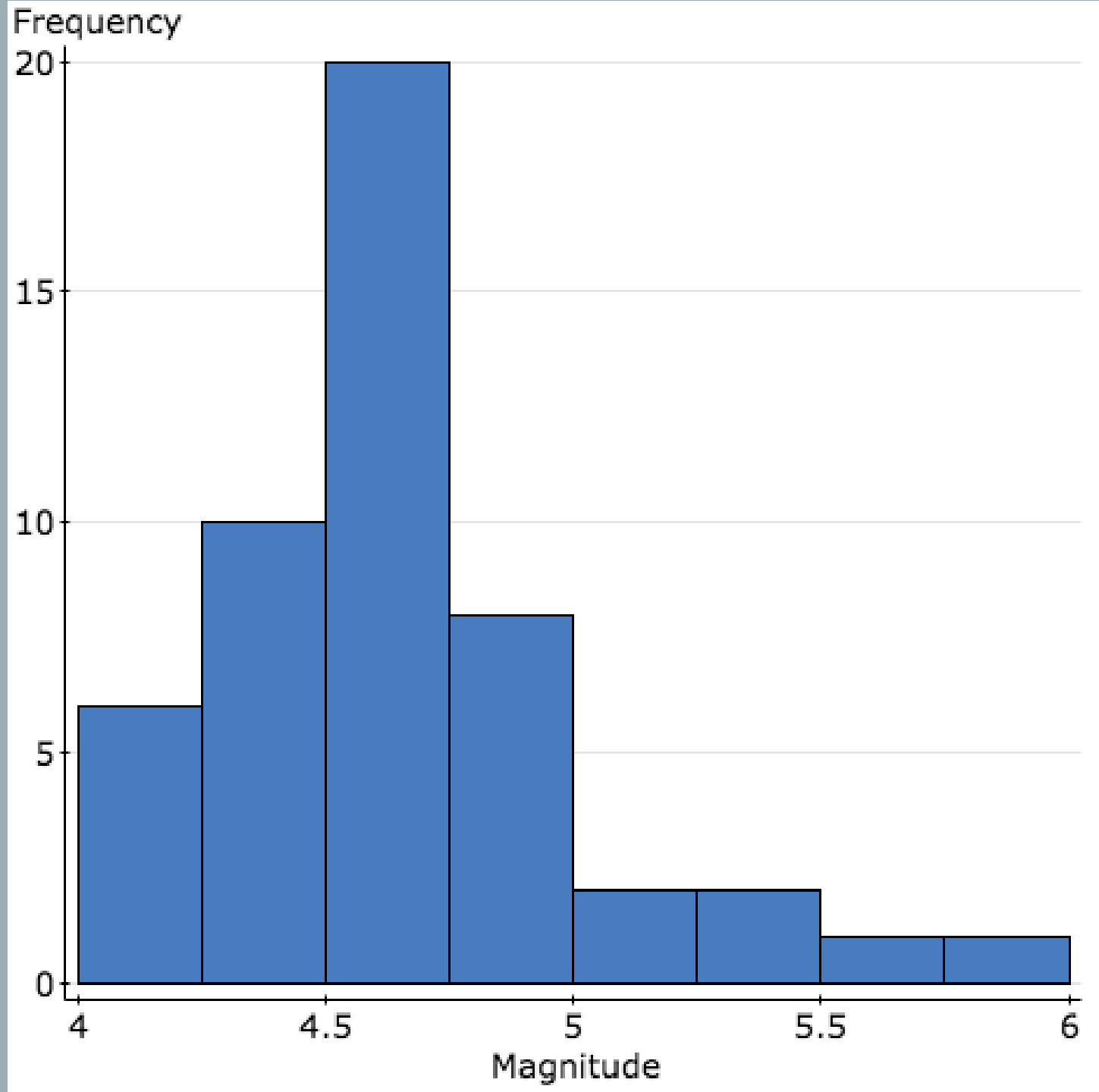
Most earthquakes in East hemisphere 33/50



Magnitude Frequency

Histogram

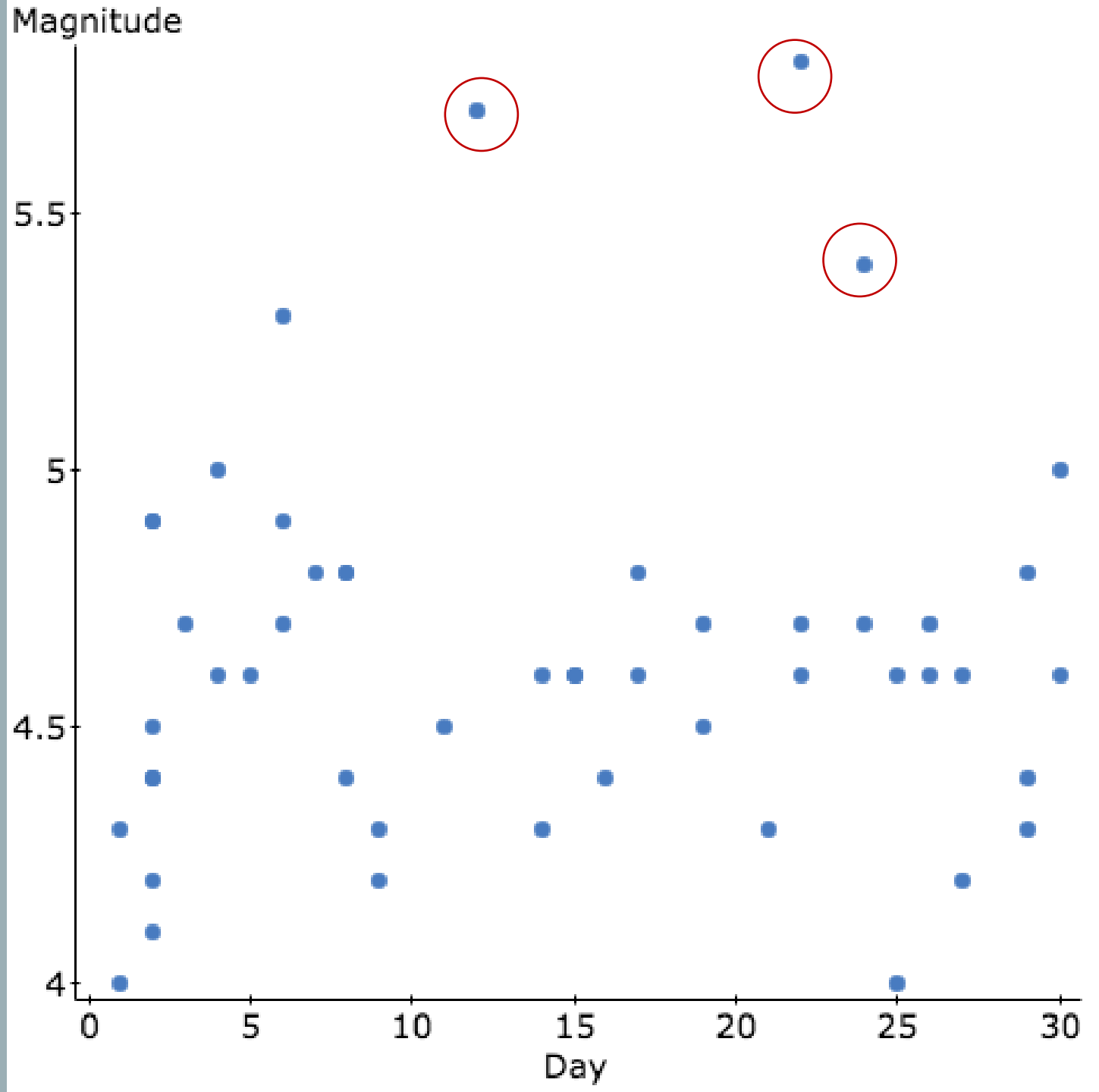
- Skewed right
- Most frequent earthquakes magnitudes greater than 4.5 but less than 4.75



Day vs Magnitude

Scatterplot

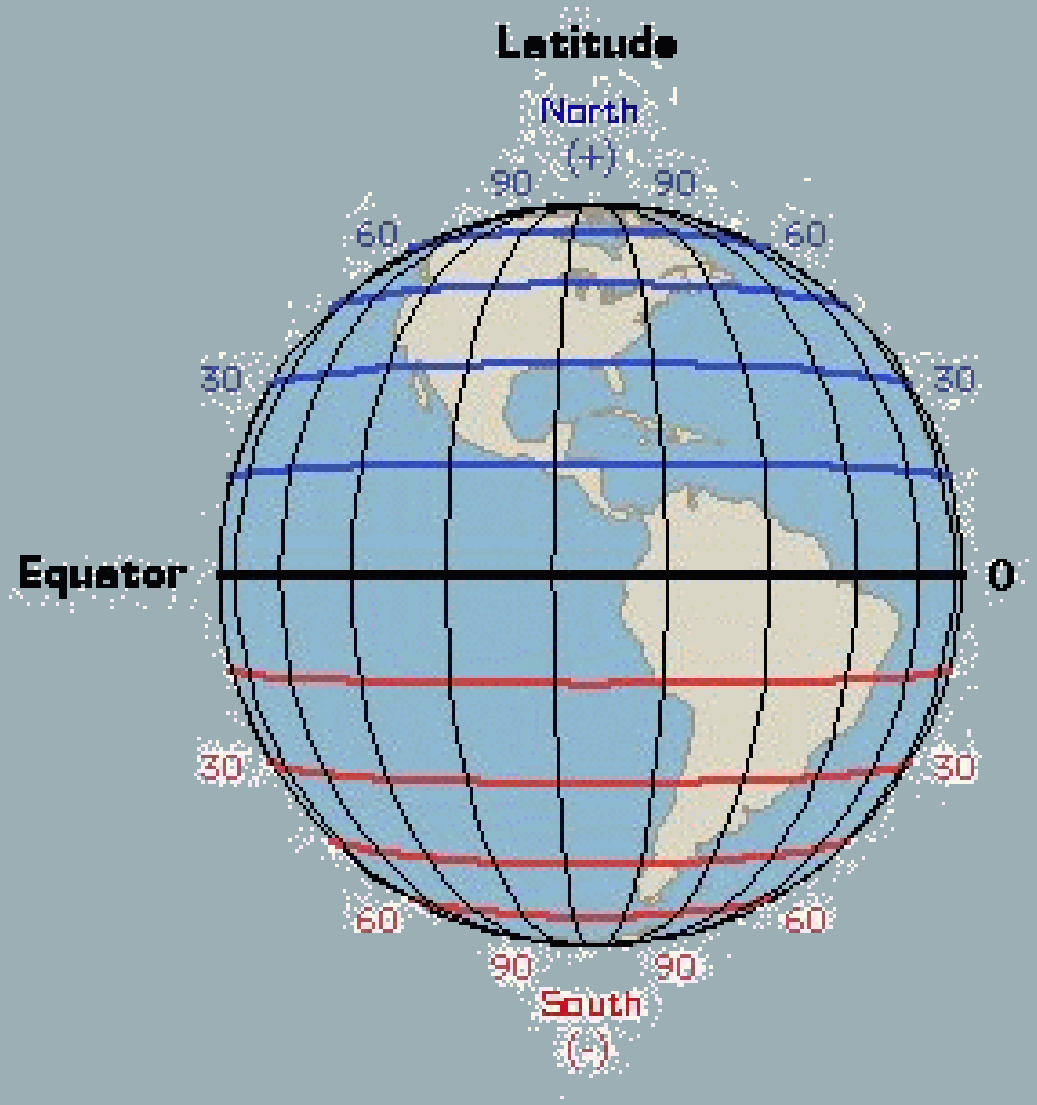
- Outliers circled in red
- Highest magnitudes above 5.5
- Lowest magnitudes 4.0

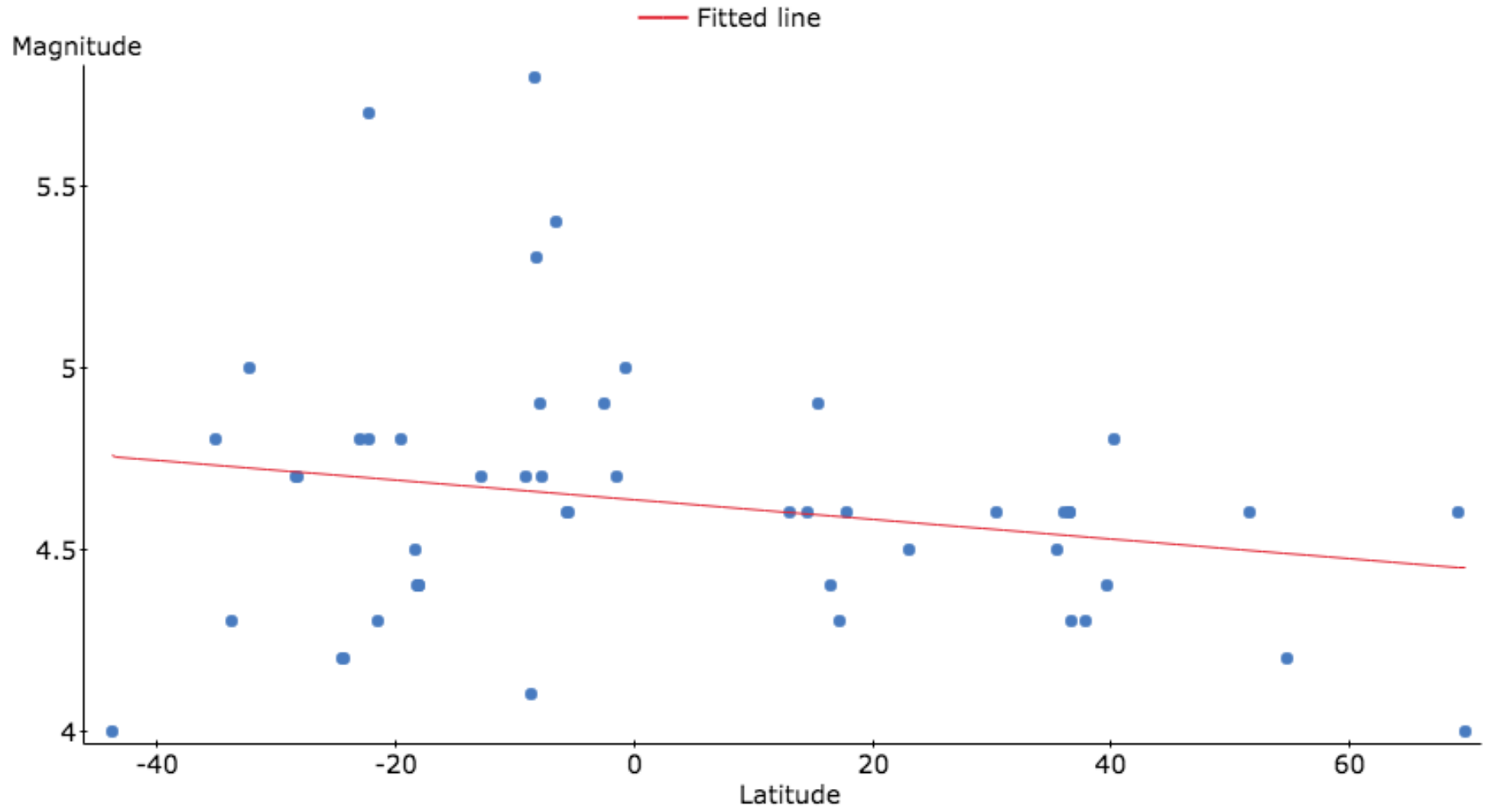


SIMPLE LINEAR REGRESSION

Results:
Dependent Variable: mag
Independent Variable: latitude
mag = 4.6375773 - 0.0027078427 latitude
Sample size: 50
R (correlation coefficient) = -0.21202815
R-sq = 0.044955936
Estimate of error standard deviation: 0.36568031
T-stat: -1.503
P-value: .1394

Conclusion: Weak Negative Correlation





LATITUDE VS. MAGNITUDE

HYPOTHESIS

Does the East hemisphere experience greater earthquake magnitudes than West East hemisphere?

Two sample T test:

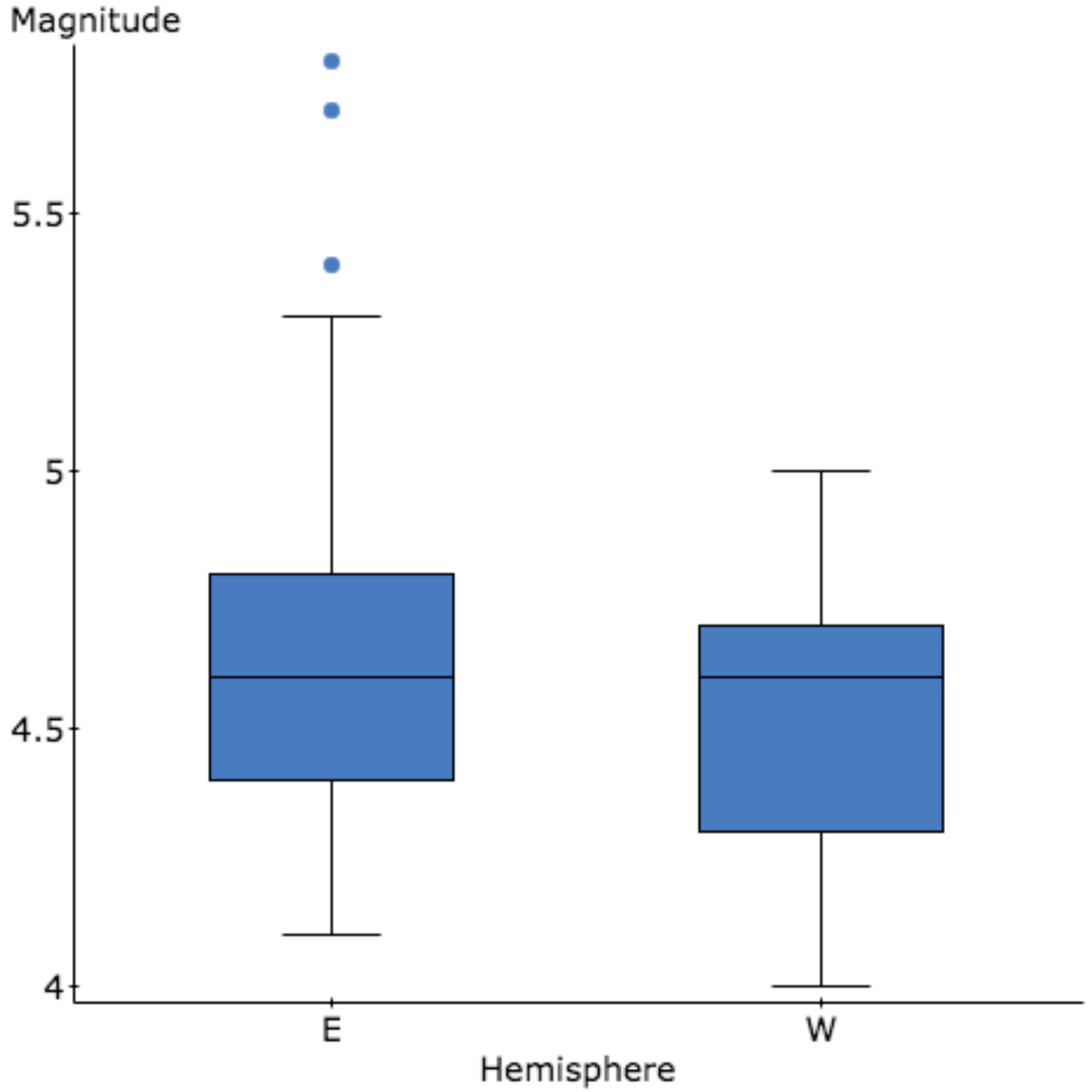
$$t = \frac{(\overline{x_1} - \overline{x_2}) - (\mu_1 - \mu_2)}{\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}}$$

μ_1 : Mean of East
μ_2 : Mean of West

$H_0 : \mu_1 - \mu_2 = 0$
$H_A : \mu_1 - \mu_2 > 0$

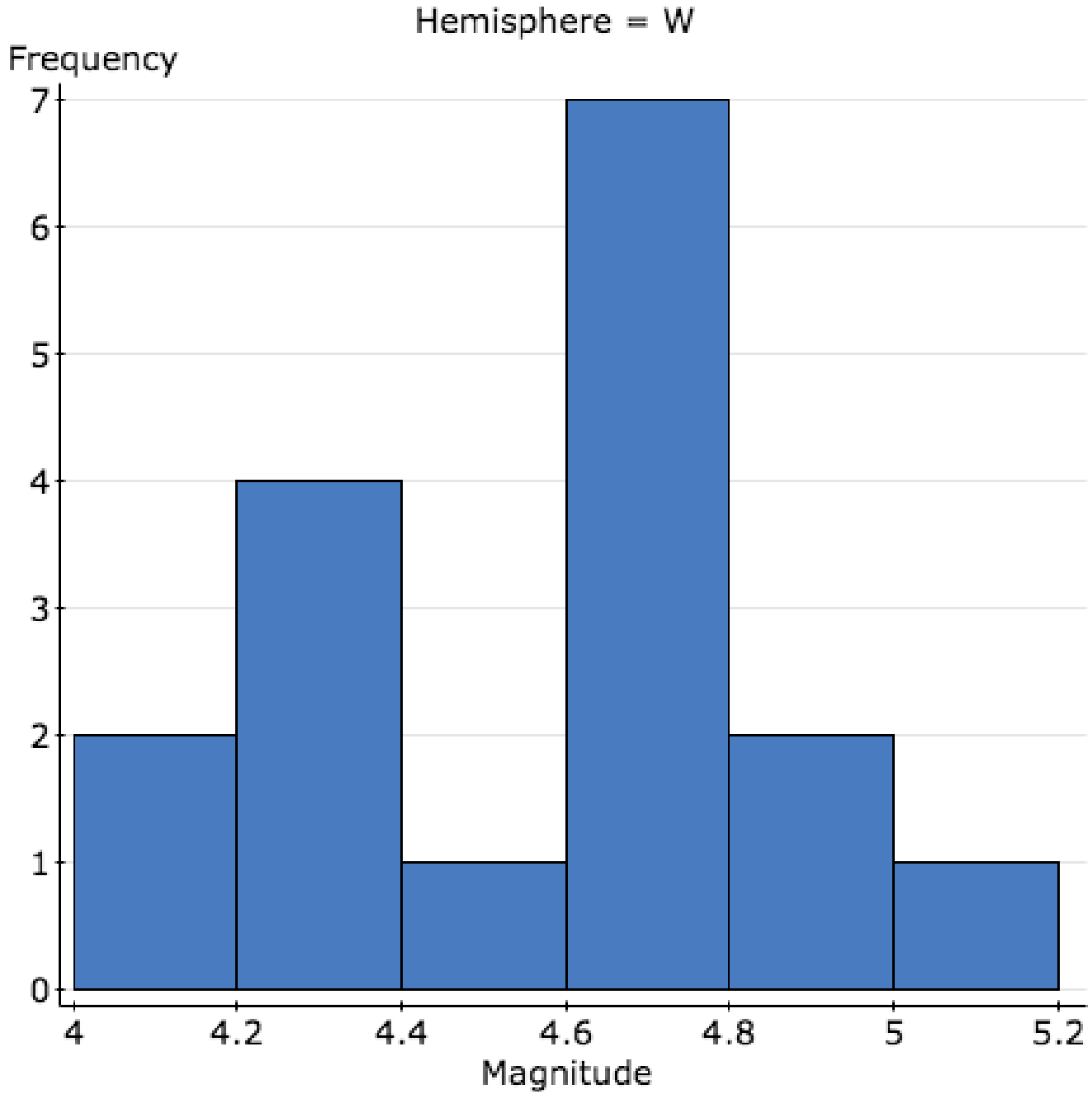
HEMISPHERE VS MAGNITUDE

- East Hemisphere:
  - Skewed right
  - Larger magnitudes
  - Mean: 4.7
- West Hemisphere:
  - Normal distribution
  - Bell shaped
  - Smaller magnitudes
  - Mean: 4.5



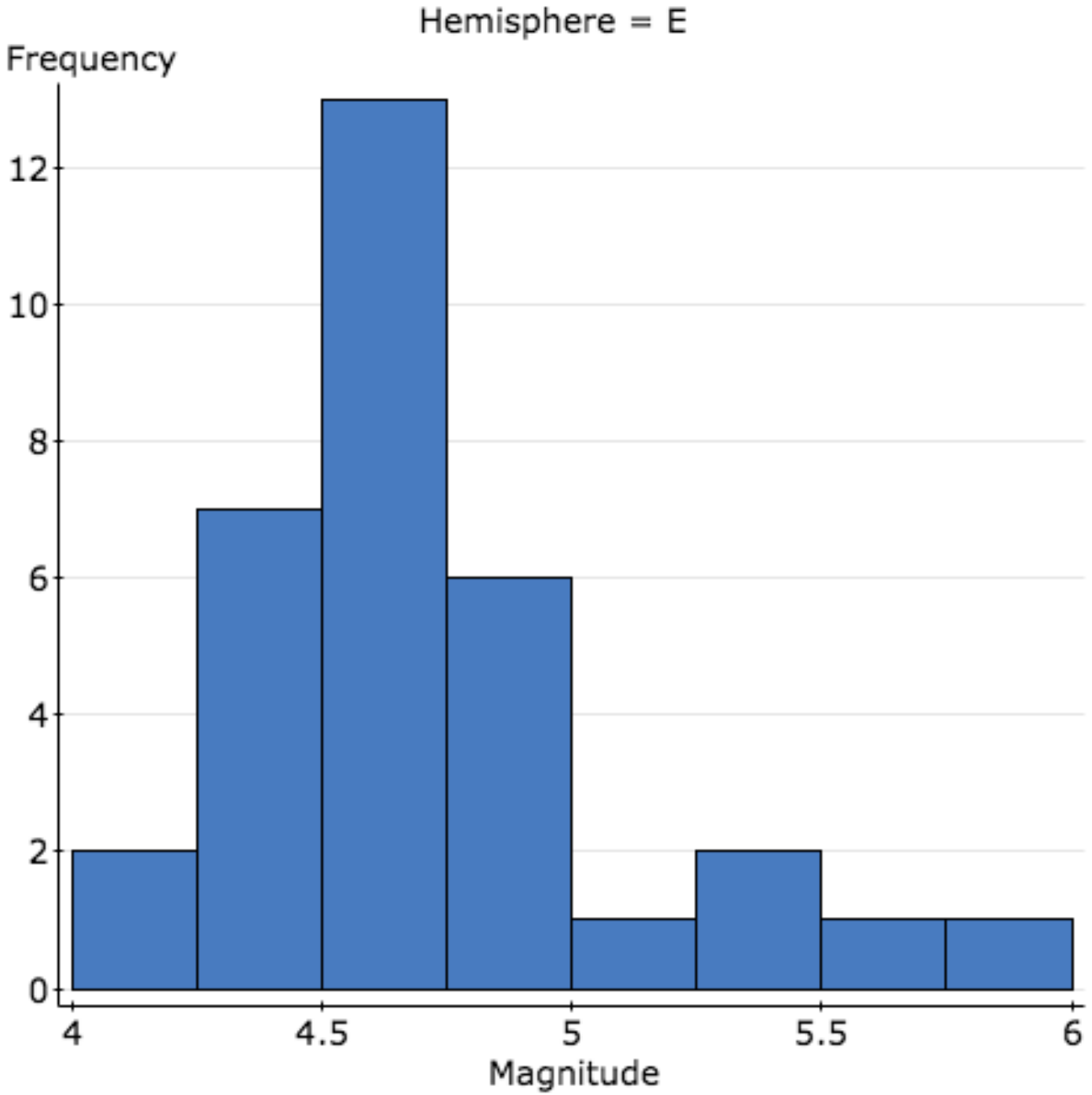
WEST HEMISPHERE: MAGNITUDE VS FREQUENCY

- Most frequent earthquakes magnitudes greater than 4.6 but less than 4.8
- Slightly skewed to right



EAST HEMISPHERE: MAGNITUDE VS FREQUENCY

- Skewed to the right
- Most frequent earthquake magnitudes greater than 4.5 but less than 4.75
- Outliers greater than 5.5

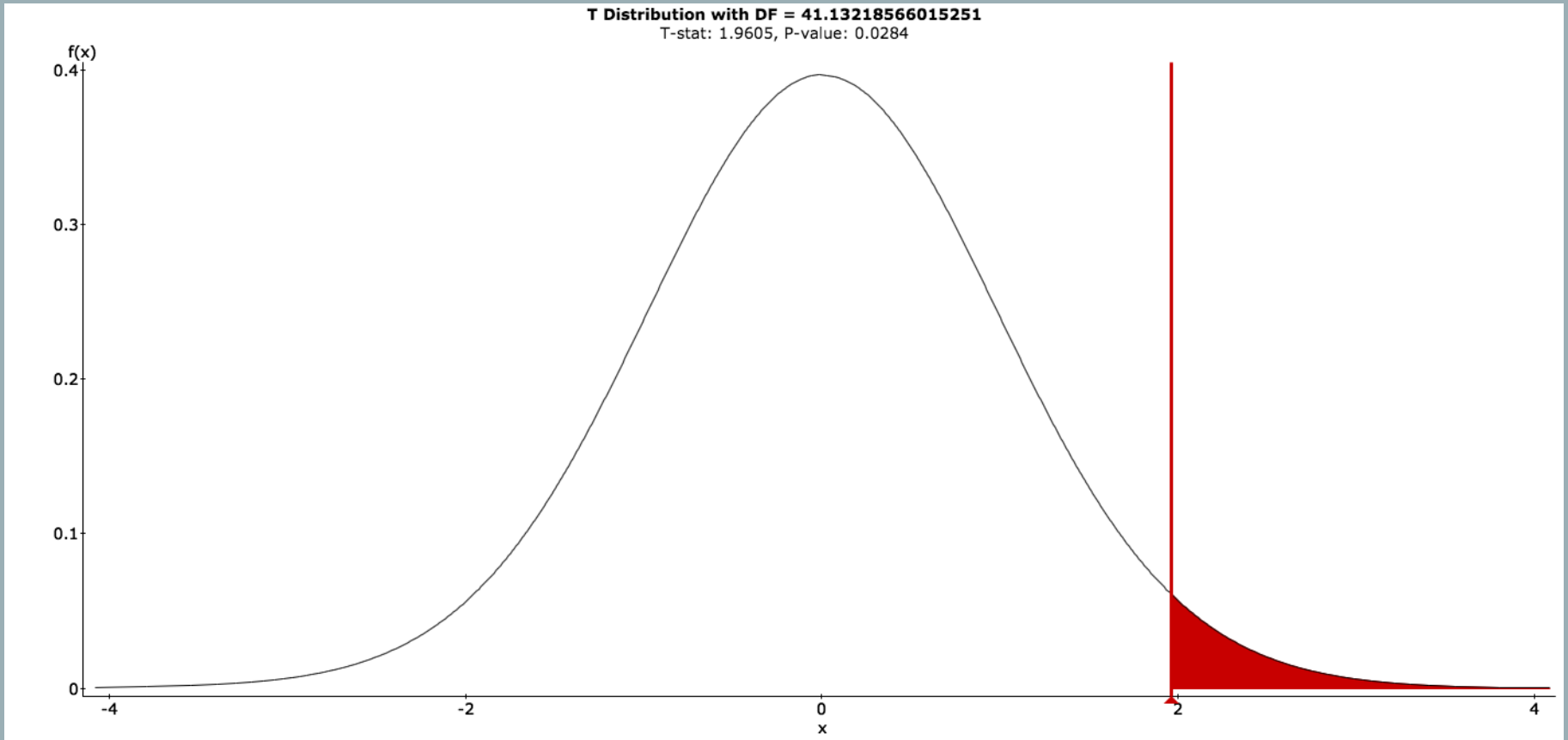


CONCLUSION

t= 1.96.
α = .05
p-value= .0284

.0284 < .05
P-value is less than α

Reject H_0



There is sufficient evidence to warrant rejection of the claim that the mean magnitude for the East hemisphere is greater than the West hemisphere.