Teachers Teaching with Technology™
Professional Development from Texas Instruments

Professional Development Webinars

Using TI technology to explore the emerging field of data science

Fall 2022

education.ti.com/tiwebinars

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Agenda

- Welcome & introductions
- An introduction to data science: Census at School
- What is data science?
  - The data science process
  - Principles for designing activities and engaging students
- The changing climate
- Risk index by states
- Webinar drawing

Expected Outcomes

- Learn what data science is
- Recognize how a framework for the data science process can be implemented using TI technology
- Understand what activities involving large data sets might look like using TI Nspire and TI 84 functionality
- Identify “data moves” necessary to engage in the data science process
- Identify ways in which data driven activities can be incorporated in your classroom

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Census at School (American Statistical Association)

1668090025176_DATA

Country	Region	DataYear	ClassGrade	Gender	Ageyears	Handed	Height_cm	Footlength_cm	Armspan_cm	Languages_spoken	Travel_to_School	Travel_time_to_School	Reaction
USA	NC	2022	10	Male	16	Right-Handed	183	30	183	1	Car	10	C
USA	NY	2022	10	Male	15	Right-Handed	181	396	188	1	Rail (Train/Tram/Subway)	50	
USA	NC	2022	10	Female	15	Right-Handed	157	27	158	1	Car	7	C
USA	NC	2022	10	Male	15	Ambidextrous	175	28	182	1	Car	5	C
USA	NC	2022	10	Male	15	Right-Handed	192	27	200	1	Car	26	C
USA	IN	2022	10	Female	15	Right-Handed	171	27	173	1	Car	15	C
USA	NC	2022	10	Male	16	Right-Handed	5'6	170	168	1	Car	26	C
USA	NY	2022	10	Male	16		181	2t		1	Walk		
USA	NC	2022	10	Female	16	Right-Handed	162	22	152	1	Car	15	C
USA	NC	2022	10	Female	16	Right-Handed	155	24	143	1	Car	10	C
USA	NY	2022	10	Male	1/488	Ambidextrous	14 in	King	Norma	G	Boat	Yello	2
USA	NY	2022	10	Male	15	Right-Handed	186	29	182	2	Bicycle	10	C
USA	IN	2022	10	Male	16	Right-Handed	178	28	165	1	Bus	15-20	
USA	MN	2022	10	Female	16	Right-Handed	164	26.16	170.6	1	Car	7	C
USA	PA	2022	10	Female	15	Right-Handed	62.5	30	165.1	3	Bus	90	C
USA	IN	2022	10	Female	15	Right-Handed	5' 9	26	65	1	Car	12	C
USA	NY	2022	10	Female	16	Right-Handed	160			2	Rail (Train/Tram/Subway)	80	C
USA	NC	2022	10	Female	16	Right-Handed	155	24	143	1	Car	10	C
USA	MN	2022	10	Male	15	Right-Handed	175	27	165	1	Car	20	C
USA	NC	2022	10	Female	15	Right-Handed	166	19.05	159	1	Bus	6	C
USA	IN	2022	10	Male	15	Right-Handed	6,2	12	37	2	Car	10	
USA	NY	2022	10	Female	15	Right-Handed	161	23	161	2	Rail (Train/Tram/Subway)	30	C
USA	NC	2022	10	Female	16	Right-Handed	5'3	7.8	38	1	Car	45	C
USA	NC	2022	10	Female	15	Ambidextrous	165	25	178	2	Car	20	
USA	AK	2022	10	Female	17	Left-Handed	158.7	25	158.7	0	Bus	2	C

Census at School 60 variables

- State, age, year, gender
- Measurements (height, arm span, finger lengths, foot lengths)
- Time spent (video games, friends, homework, family sleeping, computer, texting, social media, tv, paid wk, wk at home)
- Travel (time to school, method)
- Birthmonth
- Favorites (subject, food, season, physical activity, music, beverage)
- Importance of (water, recycling, conserve energy, reduce pollution, own computer, internet access)
- Other (handedness, memory score, reaction time, superhero, educational goal, role model) …

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What do you notice? What are you curious about? What is interesting?

1668090025176_DATA

Country	Region	DataYear	ClassGrade	Gender	Ageyears	Handed	Height_cm	Footlength_cm	Armspan_cm	Languages_spoken	Travel_to_School	Travel_time_to_School	Reaction
USA	NC	2022	10	Male	16	Right-Handed	183	30	183	1	Car	10	C
USA	NY	2022	10	Male	15	Right-Handed	181	396	188	1	Rail (Train/Tram/Subway)	50	
USA	NC	2022	10	Female	15	Right-Handed	157	27	158	1	Car	7	C
USA	NC	2022	10	Male	15	Ambidextrous	175	28	182	1	Car	5	C
USA	NC	2022	10	Male	15	Right-Handed	192	27	200	1	Car	26	C
USA	IN	2022	10	Female	15	Right-Handed	171	27	173	1	Car	15	C
USA	NC	2022	10	Male	16	Right-Handed	5'6	170	168	1	Car	26	C
USA	NY	2022	10	Male	16		181	2t		1	Walk		
USA	NC	2022	10	Female	16	Right-Handed	162	22	152	1	Car	15	C
USA	NC	2022	10	Female	16	Right-Handed	155	24	143	1	Car	10	C
USA	NY	2022	10	Male	1/488	Ambidextrous	14 in	King	Norma	G	Boat	Yello	2
USA	NY	2022	10	Male	15	Right-Handed	186	29	182	2	Bicycle	10	C
USA	IN	2022	10	Male	16	Right-Handed	178	28	165	1	Bus	15-20	
USA	MN	2022	10	Female	16	Right-Handed	164	26.16	170.6	1	Car	7	C
USA	PA	2022	10	Female	15	Right-Handed	62.5	30	165.1	3	Bus	90	C
USA	IN	2022	10	Female	15	Right-Handed	5' 9	26	65	1	Car	12	C
USA	NY	2022	10	Female	16	Right-Handed	160			2	Rail (Train/Tram/Subway)	80	C
USA	NC	2022	10	Female	16	Right-Handed	155	24	143	1	Car	10	C
USA	MN	2022	10	Male	15	Right-Handed	175	27	165	1	Car	20	C
USA	NC	2022	10	Female	15	Right-Handed	166	19.05	159	1	Bus	6	C
USA	IN	2022	10	Male	15	Right-Handed	6,2	12	37	2	Car	10	
USA	NY	2022	10	Female	15	Right-Handed	161	23	161	2	Rail (Train/Tram/Subway)	30	C
USA	NC	2022	10	Female	16	Right-Handed	5'3	7.8	38	1	Car	45	C
USA	NC	2022	10	Female	15	Ambidextrous	165	25	178	2	Car	20	
USA	AK	2022	10	Female	17	Left-Handed	158.7	25	158.7	0	Bus	2	C

Identify a question to investigate

- Worth investigating- answer is not just “yes” or “mean is 69”

- Example: How do males and females compare with respect to
  - Time spent working paid job, texting, computer, and homework
  - Favorite subject
  - The importance of having your own computer

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Messy data

	Texting_Messaging_Hours	Computer_Use_Hours	Watching_TV_Hours	Paid_Work_Hours	We
)	20	70	12	0	
)	0	132	3	0	
5	6	4	10	17	
)	30	120	21	0	
5	5	48	0	0	
4	2	2	0	0	
2	13	12	0	37	
)	3	40	0	20	
7	7	50	11	0	
	W	W	W	W	W
)	9	14	6	0	
)	8	2	0	30	
5	3	28	4	0	
5	5	15	2.5	3	
)	3	10	5	0	
)	3	50	2	0	
7	7	50	11	0	
5	2	15	2	0	
4	6	12	5.25	0	
5	8	7	0	10	
5	7	7	7	0	
)	130	100	100	0	
5	2	15	3	0	
)	4	8	0	14	

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Data Moves

- >> Issues
  - >> Units
  - >> Magnitude
  - >> Blanks
  - >> Outliers
  - >> TI 84 Five letters maximum for label

>> Numerical Codes for categories

- 1 Art
- 2 Computer Science
- 3 English
- 4 Geography
- 5 History
- 6 Language
- 7 Mathematics Statistics
- 8 Music
- 9 Physical Education
- 10 Science
- 11 Social Studies
- 12 Other

>> Scaling importance (0-1000)

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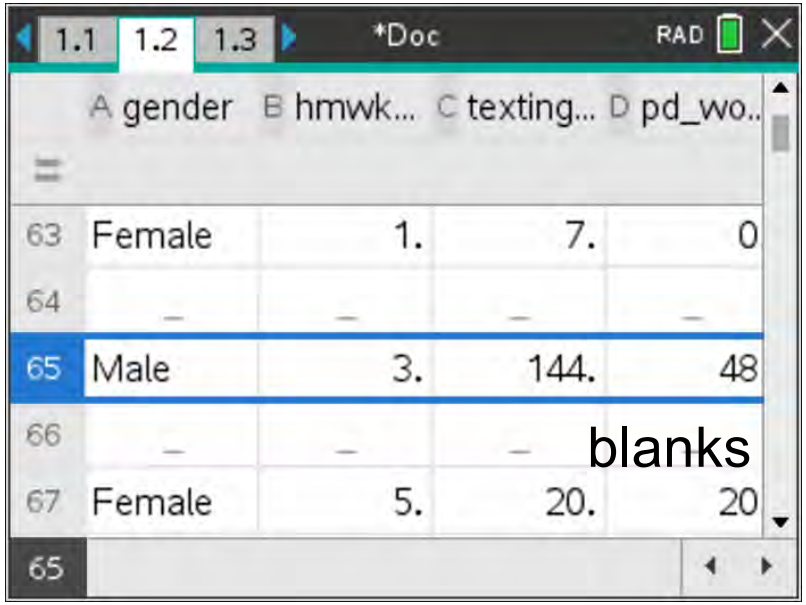
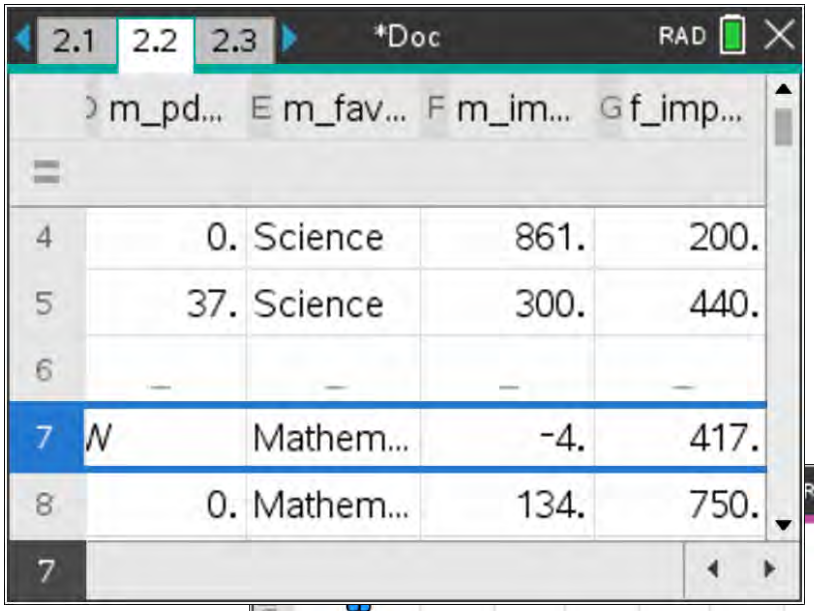
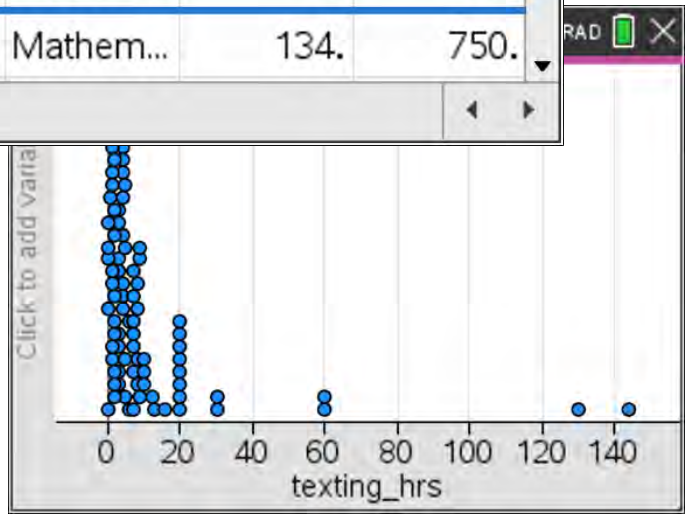
Processing the data

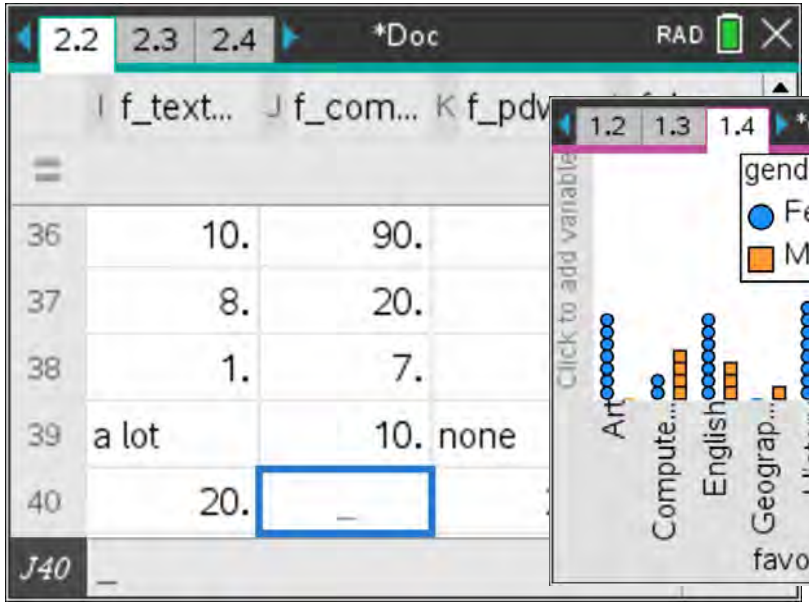


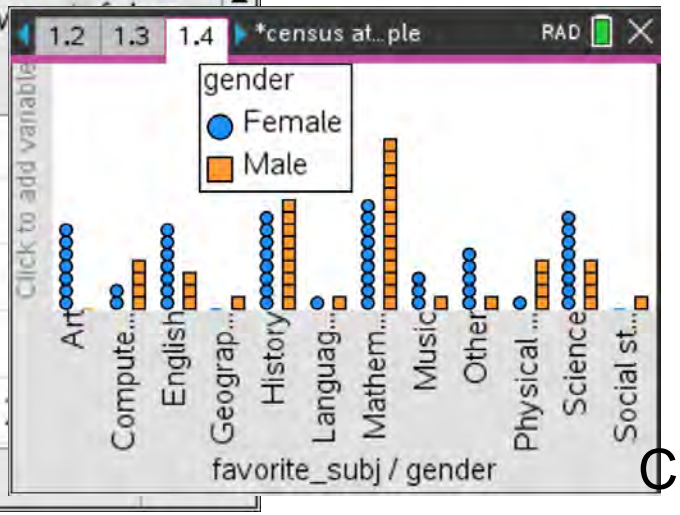
blanks





Magnitude, outliers?





Coding for word data

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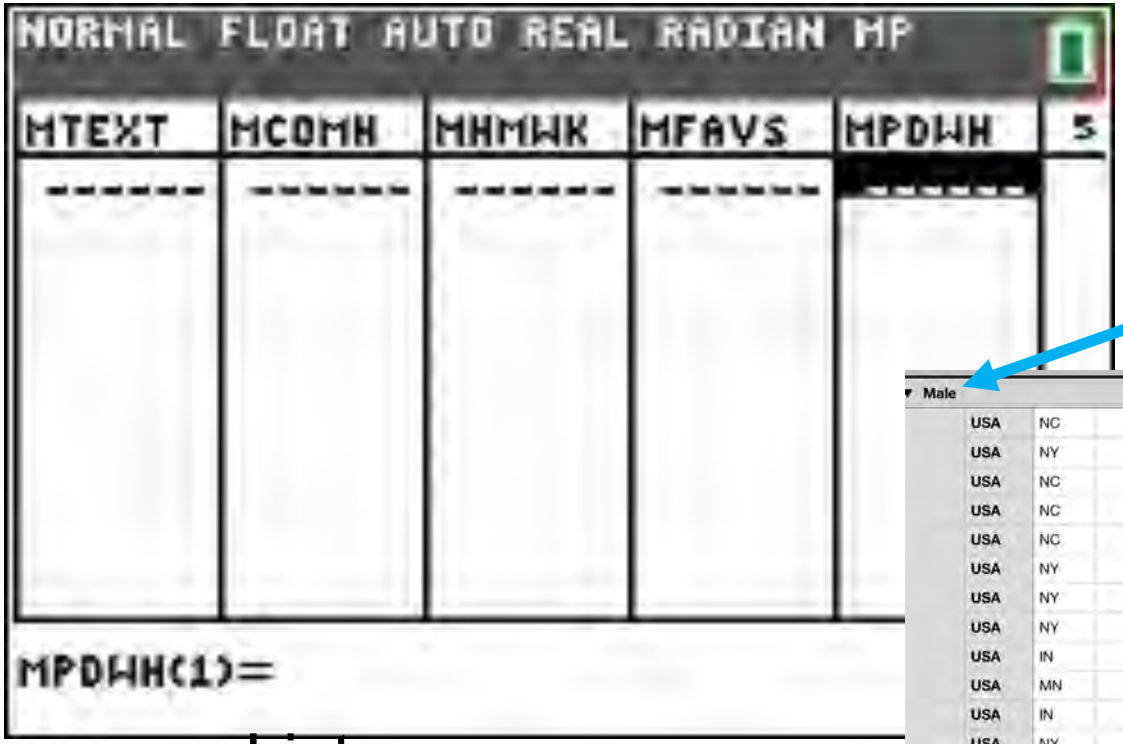
Data Moves: Processing the data



List names

Filter

male, female

Male

USA	NC	2022	10	Male	16	Right-Handed		183	30	183	1	C
USA	NY	2022	10	Male	15	Right-Handed		181	396	188	1	F
USA	NC	2022	10	Male	15	Ambidextrous		175	28	182	1	C
USA	NC	2022	10	Male	15	Right-Handed		192	27	200	1	C
USA	NC	2022	10	Male	16	Right-Handed	5'6		170	168	1	C
USA	NY	2022	10	Male	16			181	2t		1	V
USA	NY	2022	10	Male	1/488	Ambidextrous	14 in		King	Norma	G	E
USA	NY	2022	10	Male	15	Right-Handed		186	29	182	2	E
USA	IN	2022	10	Male	16	Right-Handed		178	28	165	1	E
USA	MN	2022	10	Male	15	Right-Handed		175	27	165	1	C
USA	IN	2022	10	Male	15	Right-Handed	6.2		12	37	2	C
USA	NY	2022	10	Male	15	Right-Handed		175			1	F
USA	MN	2022	10	Male	15	Right-Handed		185	30	189	2	C
USA	NC	2022	10	Male	15	Right-Handed		170	22	170	2	E
USA	NC	2022	10	Male	16	Right-Handed		168	25	164	2	C
USA	NY	2022	10	Male	15	Right-Handed		183			3	F
USA	IN	2022	10	Male	16	Right-Handed		162	28	132	1	C
USA	NY	2022	10	Male	16			181	26	179	2	V
USA	MN	2022	10	Male	15	Right-Handed		170.1	25.5	169	2	E
USA	IN	2022	10	Male	16	Right-Handed		175.6	30.5	152	1	C
USA	NY	2022	10	Male	16	Right-Handed		185			1	F
USA	NC	2022	10	Male	17	Right-Handed		170	26	173	2	C
USA	IN	2022	10	Male	15	Right-Handed		176	27	178	1	E
USA	IN	2022	10	Male	18	Right-Handed	idk		idk	idk	1	C
USA	IN	2022	10	Male	17	Left-Handed		164	26	158	1	C

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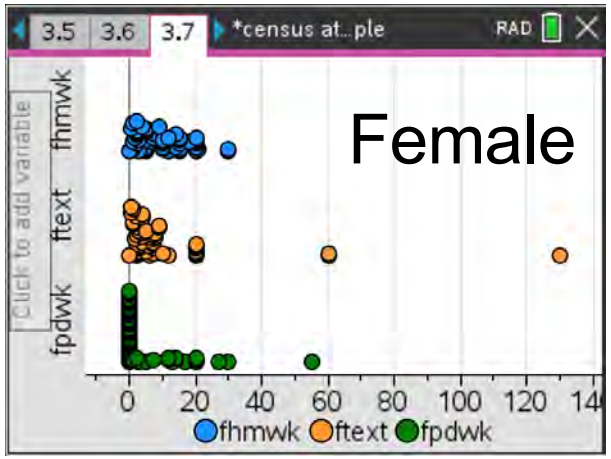
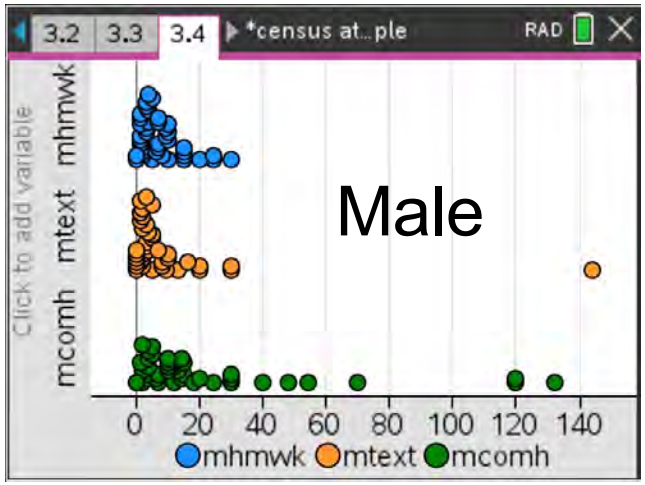
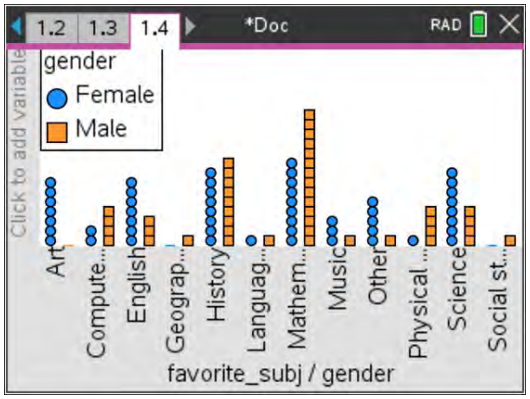
Exploring and visualizing

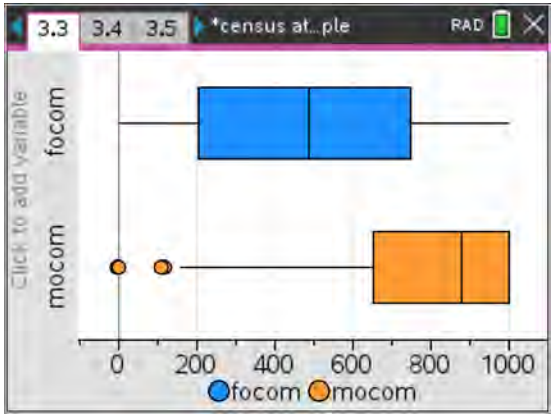


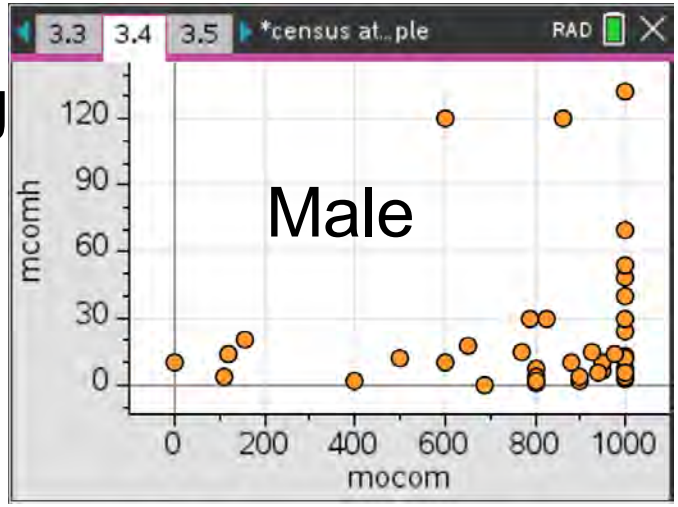


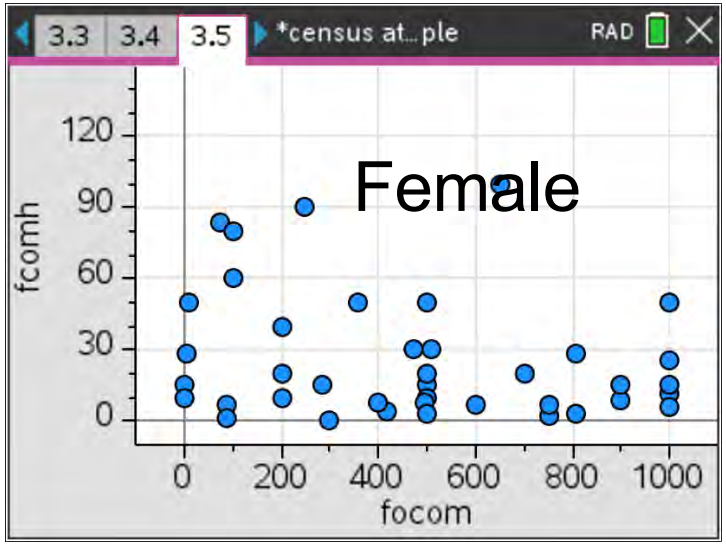


Favorite subject

Hours spent on homework, texting work







>> Association owning and using computer?

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Building a model

- Manage units
- Coding to manage computation

- Find the mean for each numerical category for males/females
- Compute ratio of mean number hours by gender to overall means
- Find weighted sum by judgment about importance, e.g.

Formula = 3HMKH+5PDWK+TEXT +2COMH+OCOM/100

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Communicating/answering the question

- Compare males and female with respect to the variables you choose using graphical representations, categorical data, and a model
- Have students use each other's models to see if they work

Follow up- Compare results to class (google docs, survey monkey, …)

- Gender
- Hours per week spent:
  - Working paid job
  - Texting
  - Working on a computer
  - Doing homework
- Favorite subject
- The importance of having your own computer rated from 0 to 1000 with 1000 very high

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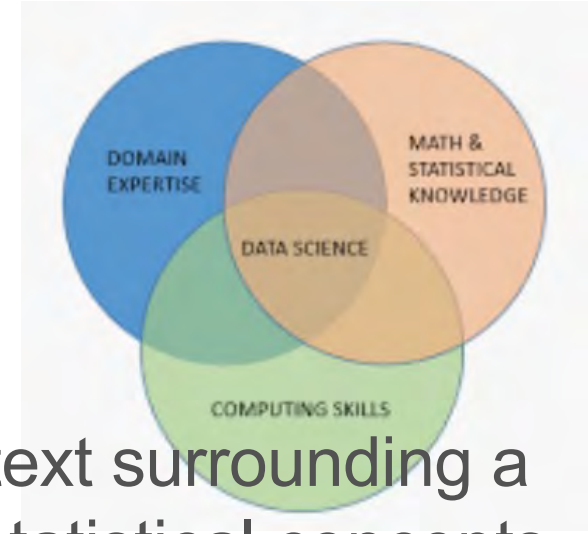
What is data science?



- Data science is "the science of learning from data" (IDSSP, 2019).
- involves knowledge of the disciplinary context surrounding a data set, knowledge of mathematical and statistical concepts, and possession of computer science skills (Conway, 2010; Finzer, 2013).
- "Data Science is the process of uncovering the stories hidden within data. It involves formulating questions, and collecting, cleaning, wrangling, analyzing, and visualizing data (that is often huge and complex) to uncover patterns and trends and communicate them to others." (California Draft Mathematics Framework, 2021)
- Is a synthesis of statistics and computational thinking (Gould, 2022)

Data Science and Statistics

- **Data science** involves the collection, organization, analysis and visualization of large amounts of data.
- **Statistics** uses mathematical models to quantify relationships between variables and outcomes and make predictions based on those relationships. https://www.mastersindatascience.org/resources/what-is-the-difference-between-data-science-and-statistics/
- Traditional statistics education has primarily focused on decontextualized problems and mathematical proofs or small, “clean,” data sets often constructed to illustrate a particular mathematical point.
- “Preparing students to design experiments and understand means and regressions and statistical tests is no longer sufficient” (Gould, 2022)

The Data Science Process

- Identify a problem
- Consider/gather data
  - Begin with tidy data sets, without outliers/missing values, increase complexity– different magnitudes/ units
  - Students notice and wonder, look for patterns
- Process Data: Cleaning, transforming, synthesizing…
- Explore and visualize: What statistical measures might be useful? What kind of displays might reveal patterns/relationships?
  - Introduce the need for coding (filter data, transform data, particular graphic display, …)
- Develop model
- Summarize/communicate with respect to original problem

Burrill & Dick, 2022b

Principles (Burrill & Dick, 2022a)

- Informal before formal (e.g., Gravemeijer, 2004). What do you know about …. , read about, wonder about? What do the numbers tell you?
- Delayed definitions - developed through real contexts (Rumsey, 2002).
- Scaffolded steps to automaticity/formalism (Freudenthal, 1971; Tall & Vinner, 1981): from hands on to simulation with technology
- Reasoning from sampling distributions or visual display (Chance et al., 2004; Saldanha & Thompson, 2002)
- Communicating, connecting and extending, connect to related aspects reported in the media or to the mathematics.

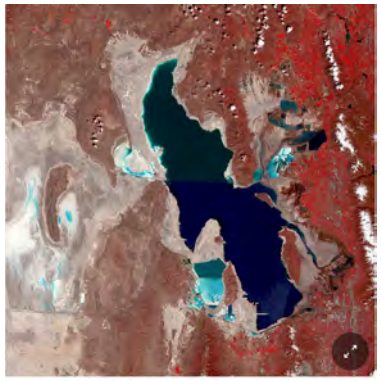
What do students need to know?

Concepts	Content	Where in curriculum
Data Collection (primary)/ consideration (secondary)	Formulating a question to investigate	Across the grades
	Who, Why, When, How, Where	
Data Moves	Organizing data into tables	Grade 6-7 univariate data
	Assigning data to columns/ rows	Grade 6-7 univariate data
	Labeling columns/rows	Grade 6-7 univariate data
	Selecting useful variables	Grade 6-7 univariate data
	Frequency vs relative frequency	Grade 6-7 univariate data
	Missing values, outliers	Grade 6-7 univariate data
	Creating percentages/ratios	Grade 7-8 Ratios and proportions
Transform data with different units/ magnitude	Rank order	Grade 6
	Proportion of best in category	Grade 7 Ratios and Proportions
	Standard deviation	Algebra 2 statistics
	Formulas	Grade 8 Regression
	Choosing and using programs	Grade 7 and up
	Coding	Algebra 2
Statistical concepts	Measures of center and variability	Grade 6, univariate analysis through high school Algebra 2
	Regression	Grade 8 through high school
	Plots	Grade 6 (dot plots, histograms, scatterplots) High school (box plots, segmented bar graphs, maps,…)

Climate

- "Louisiana has lost enough wetlands since the mid-1950s to cover the entire state of Rhode Island." Younger S. (11/8/2022) https://climate.nasa.gov/news/3230/satellites-help-scientists-track-dramatic-wetlands-loss-in-louisiana/

- "Climate Patterns Thousands of Miles Away Affect US Bird Migration"



The Great Salt Lake in May 2021. EROS Center, U.S.G.S.

- ***"As the Great Salt Lake Dries Up, Utah Faces an 'Environmental Nuclear Bomb*** Climate change and rapid population growth are shrinking the lake, creating a bowl of toxic dust that could poison the air around Salt Lake City." https://www.nytimes.com/2022/06/07/climate/salt-lake-city-climate-disaster.html
- "Oregon's mosquito season is now 50 days up from 39." States at Risk. https://statesatrisk.org/oregon/all
- "Climate change is increasingly visible, with record-breaking heat, wildfires, flooding, rainfall, and drought in the news almost every day" Climate Check. https://climatecheck.com/our-methodologies accessed 11/11/2022

Problem: Find a model to compare states with respect to climate change.

The data: Utah, Oregon, Louisiana, Texas, New Jersey

Year	UT max °F	UT avg °F	UT drought	UT precipitation (in.)	OR max °F	OR avg °F	OR drought	OR precipitation (in.)	LA max °F	LA avg °F	LA drought	LA precipitation (in.)
2022	63.2	50.1	-4.61	11.59	59.8	48.3	1.98	32.36	78.9	68.2	-0.67	51.96
2021	63.9	50.4	-5.11	9.84	61.8	49.6	-5.24	24.72	76.5	66.8	4.32	71.90
2020	62.7	49.6	-3.81	9.78	59.3	47.8	-1.60	26.91	78.3	68.3	2.24	62.22
2019	60.2	48.1	-0.69	17.23	58.7	47.4	0.28	30.73	76.9	67.6	3.06	76.03
2018	64.4	51.0	-5.66	9.53	60.1	48.5	-3.15	27.53	78.3	67.8	-2.39	47.88
2017	63.3	50.7	-0.76	16.04	58.9	47.8	-1.72	41.36	79.5	69.6	4.80	66.86
2016	62.6	50.0	-2.15	13.32	60.7	49.2	-2.81	34.48	78.8	68.8	4.46	79.29
2015	63.8	51.2	-2.22	15.15	62.7	51.0	-3.70	28.44	76.9	66.8	-1.59	56.17
2014	61.6	49.0	-2.75	14.24	60.1	48.4	-1.55	29.79	75.3	65.0	2.06	60.71
2013	62.0	49.0	-4.17	11.86	60.2	48.4	-1.73	29.19	77.0	66.4	-0.88	57.69
2012	63.7	50.3	-4.59	10.05	59.8	47.9	1.64	32.47	79.1	68.5	1.76	65.03
2011	60.7	48.1	5.70	18.53	56.8	46.1	-0.16	39.16	79.3	67.9	-5.91	35.91
2010	60.1	47.4	0.82	13.12	57.9	46.7	2.27	31.57	76.0	66.1	-2.23	63.14
2009	62.4	49.2	-1.71	12.50	59.7	47.9	-0.95	28.12	77.6	66.9	-1.85	52.15
2008	61.0	47.7	-1.79	12.24	57.8	46.1	-1.23	31.84	78.3	67.7	0.77	52.75
2007	62.8	49.5	-3.51	12.49	60.4	48.2	-2.42	30.07	77.2	66.6	-0.36	60.16
2006	63.0	49.8	-2.10	12.45	59.2	47.7	-1.19	37.70	79.5	68.2	-3.77	43.98
2005	61.1	49.0	5.23	20.28	59.4	48.0	1.23	27.37	78.1	67.9	-1.83	55.43
2004	62.0	49.3	-3.11	11.82	60.2	48.8	-1.29	31.84	76.9	66.5	2.22	66.21
2003	62.6	49.9	-4.93	12.58	60.8	49.0	-2.96	29.87	76.1	66.3	0.90	66.41
2002	63.3	49.5	-6.60	7.27	59.5	47.7	-3.01	29.98	77.5	66.8	0.01	56.66

https://www.ncei.noaa.gov/access/monitoring/climate-at-a-glance/statewide/time-series/16/tavg/12/8/1895-2022?trend=true&trend_base=100&begtrendyear=1895&endtrendyear=2022

Texas Instruments

Average temp by state

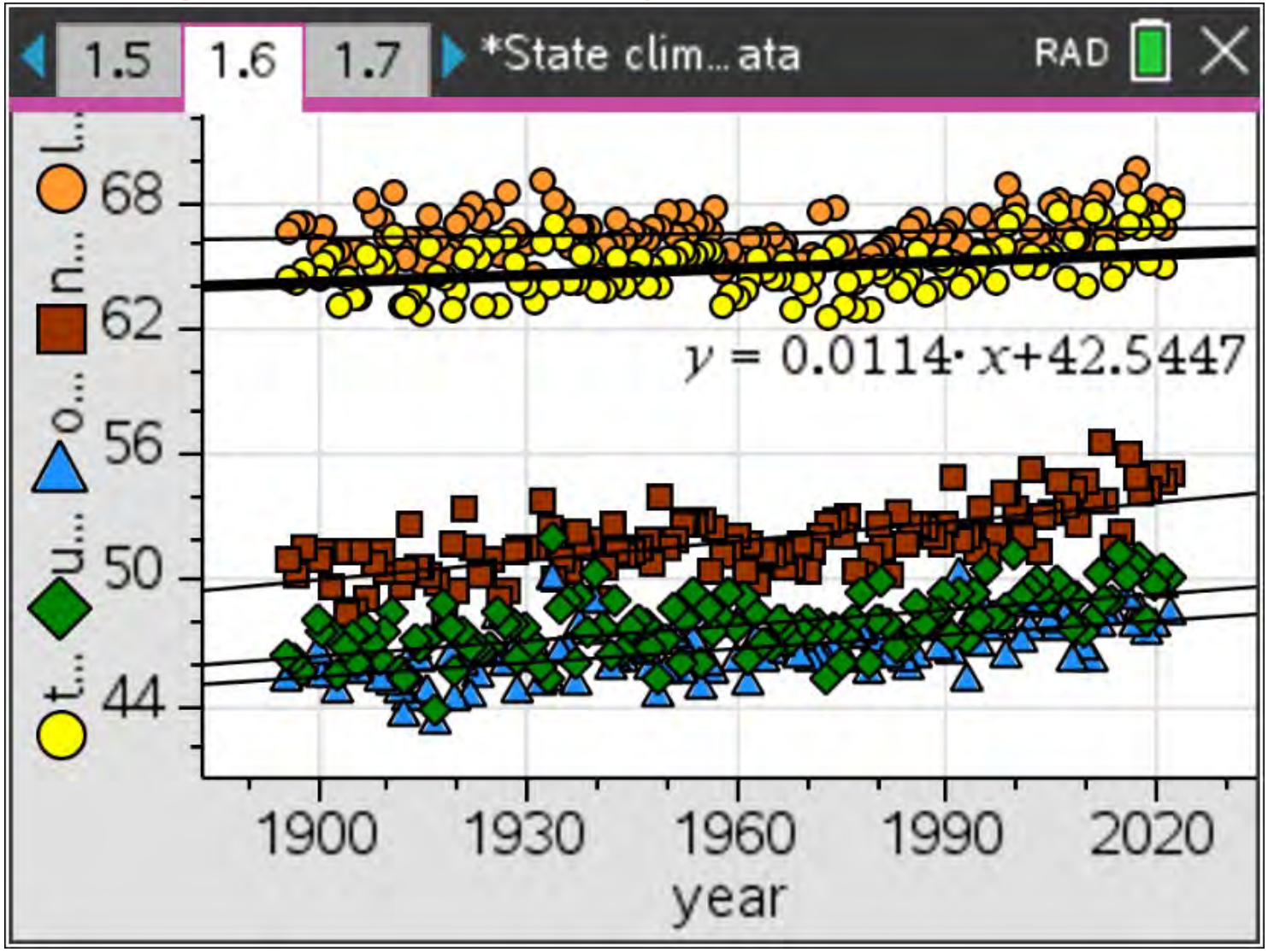
LA

NJ

OR

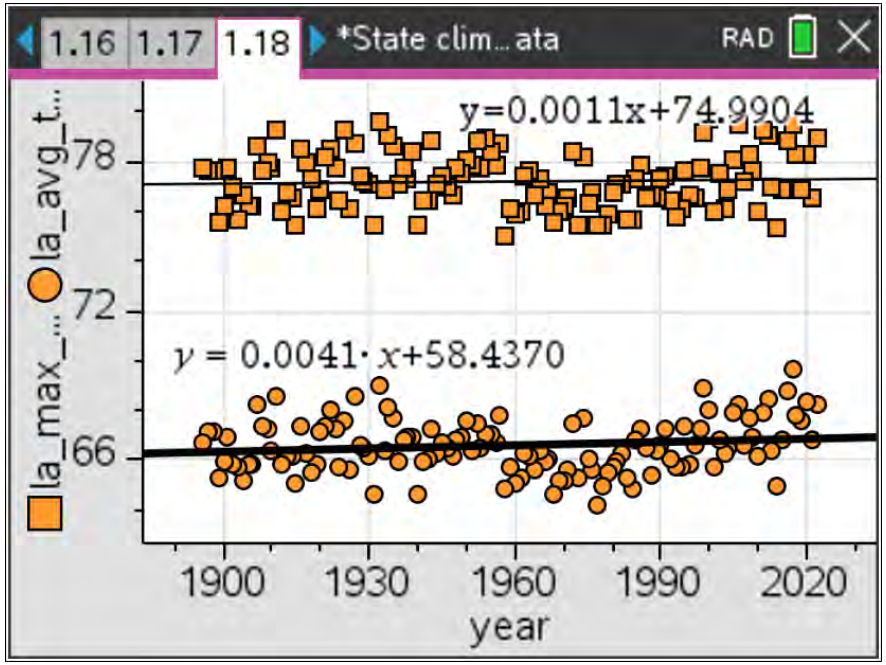
UT

TX

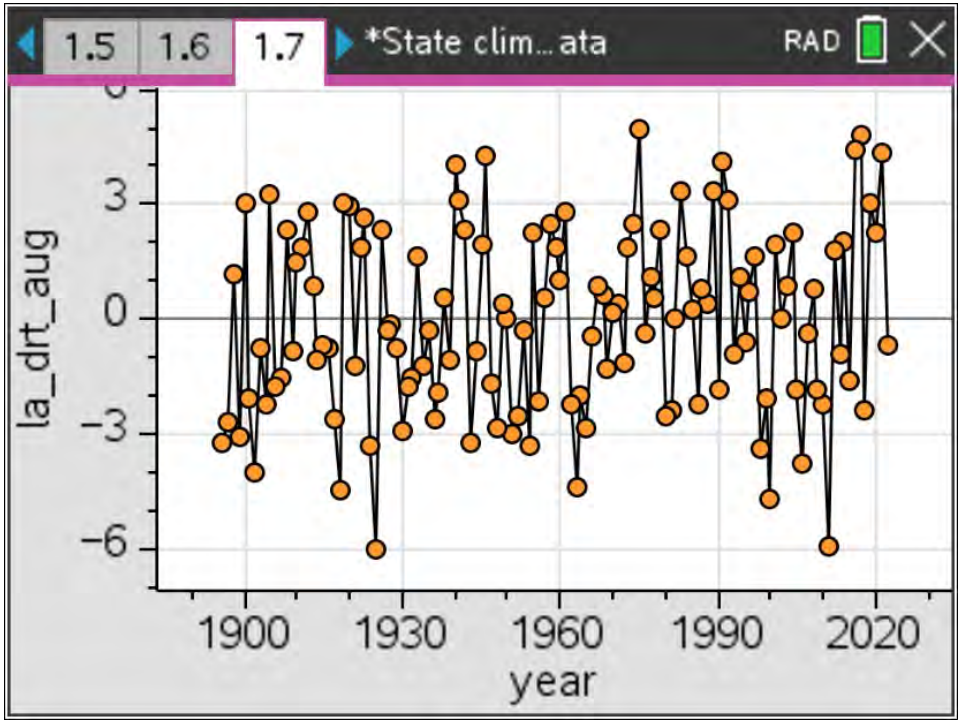


Texas Instruments

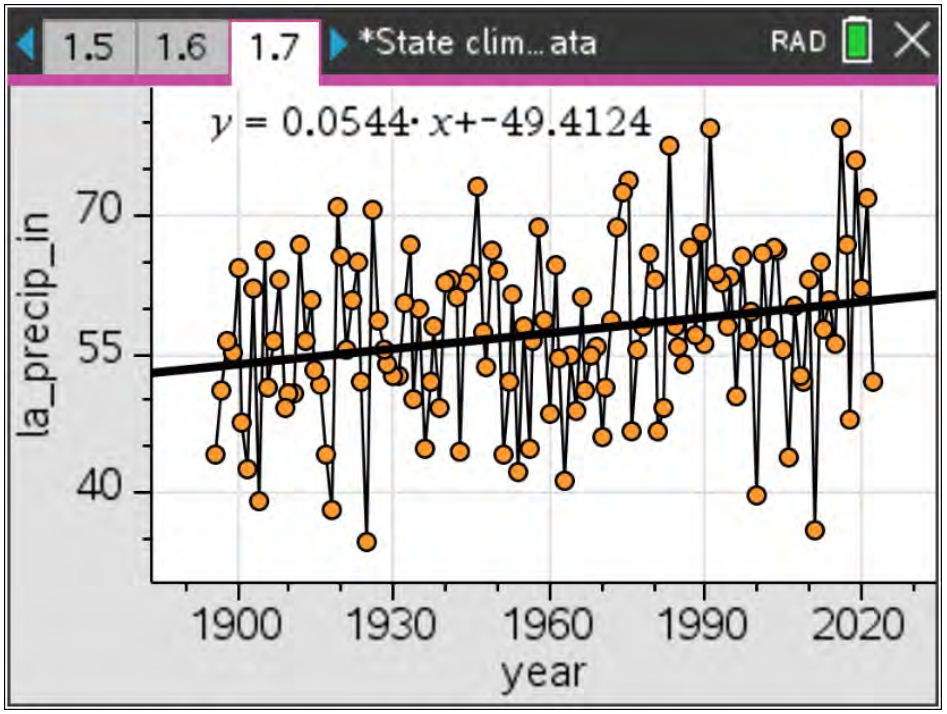
Louisiana



Maximum temperature
Average temperature

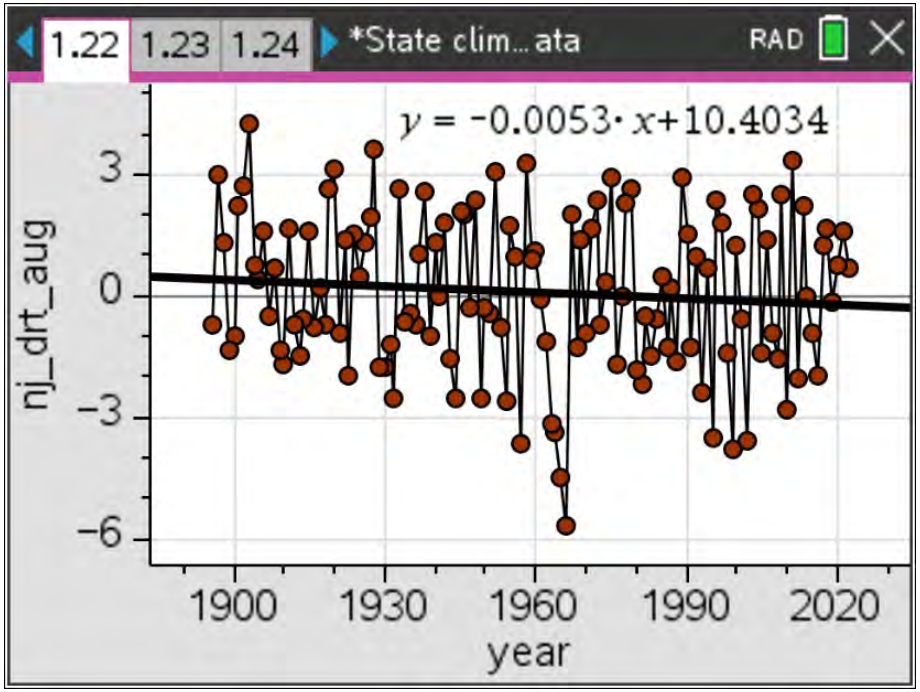


Yearly precipitation (in.)

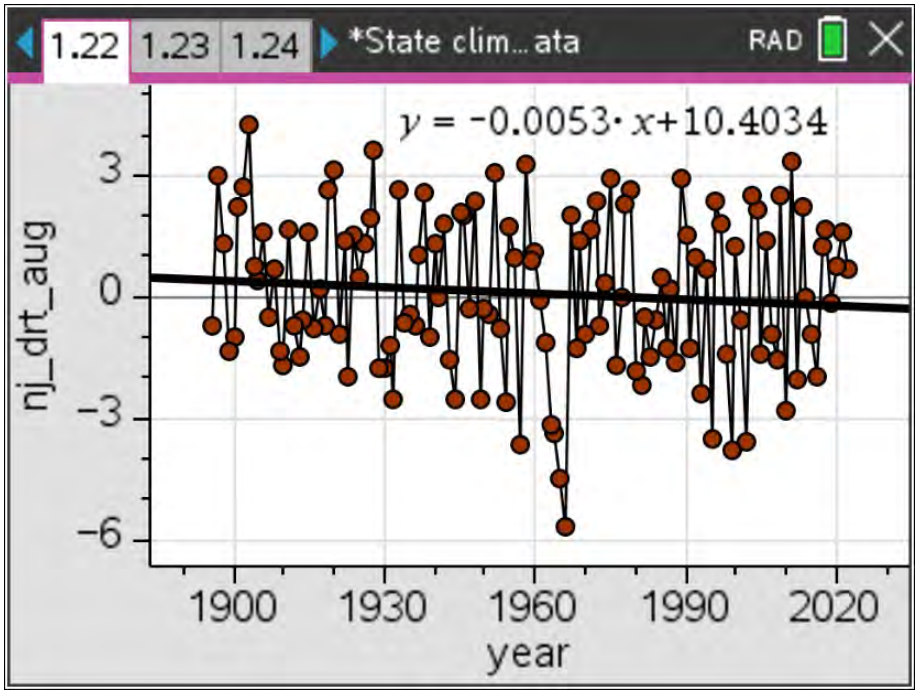


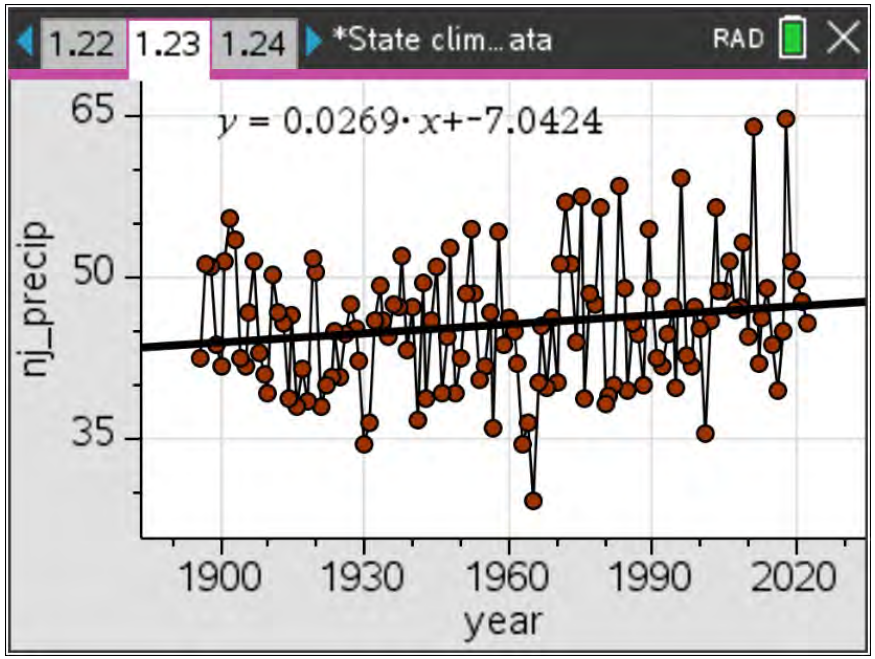
Drought index (<-4 severe)

New Jersey



Maximum temperature
Average temperature



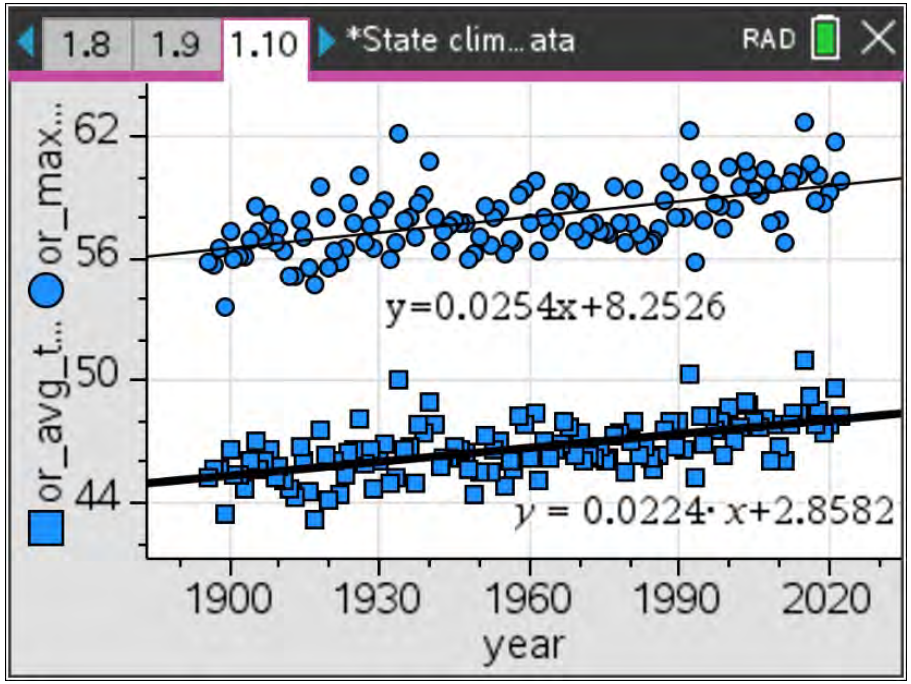


Yearly precipitation (in.)

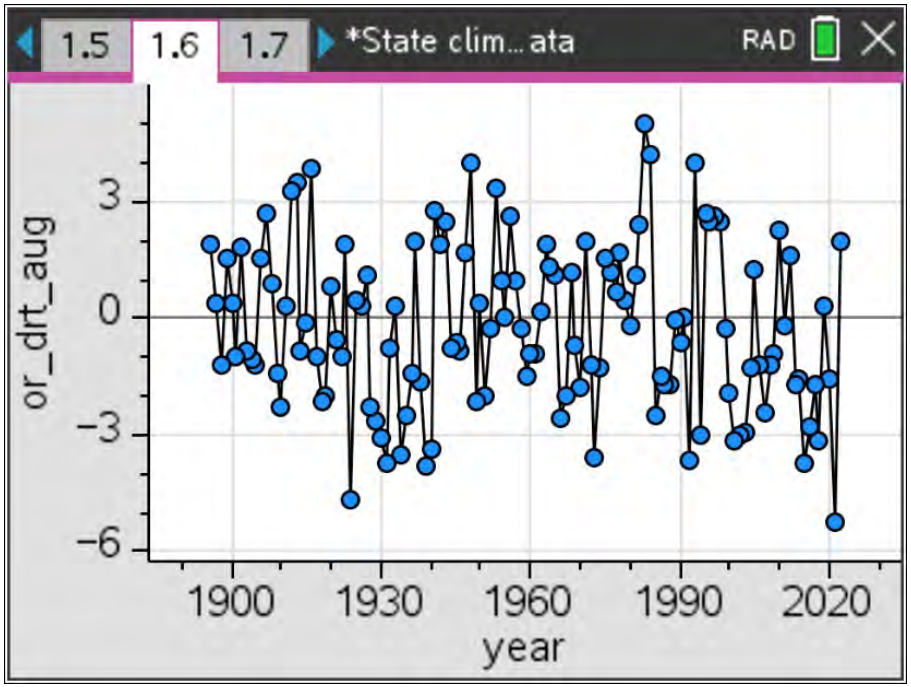
Drought index (<-4 severe)

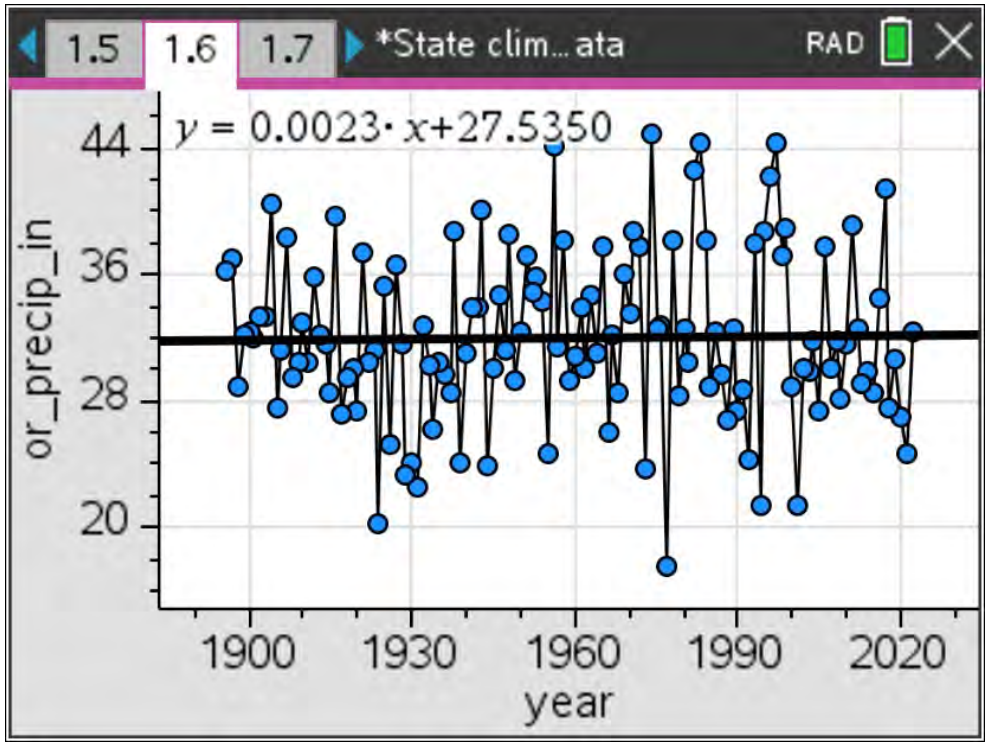
Texas Instruments

Oregon



Maximum temperature
Average temperature

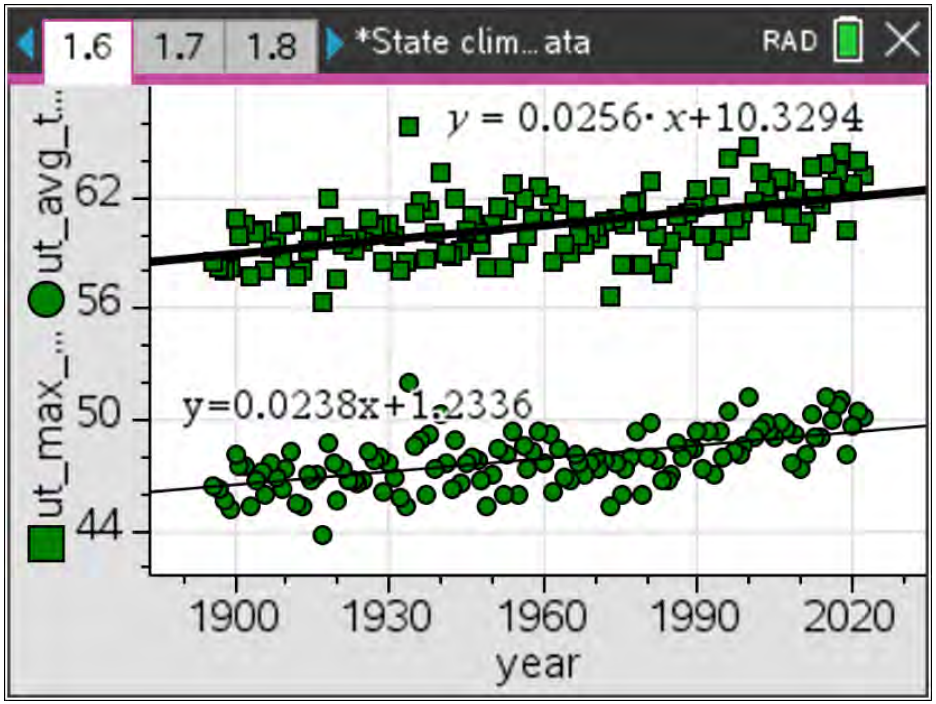




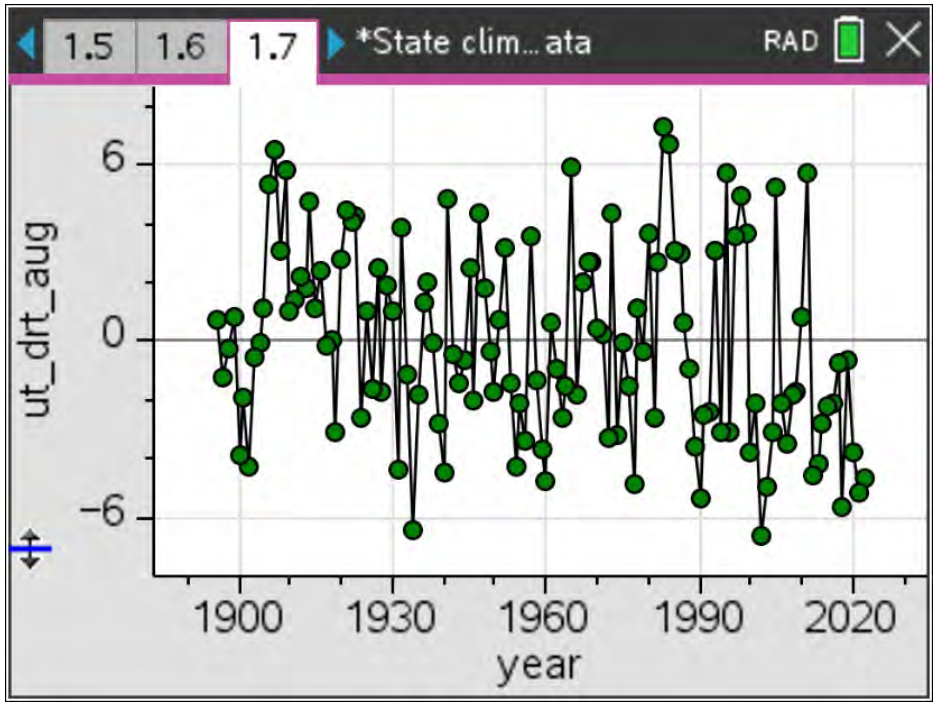
Yearly precipitation (in.)

Drought index (<-4 severe)

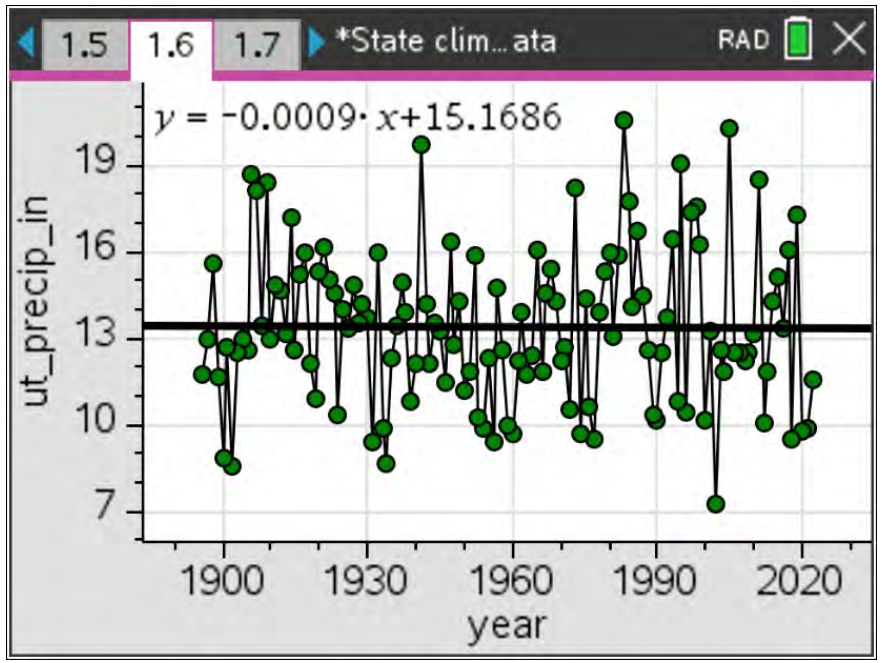
Utah



Maximum temperature
Average temperature

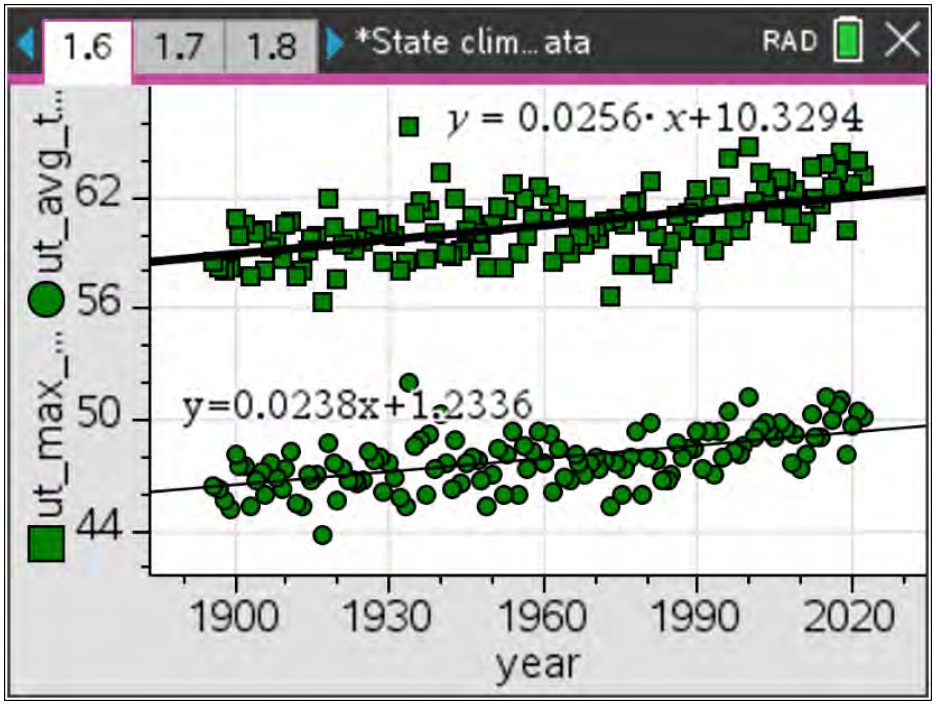


Yearly precipitation (in.)

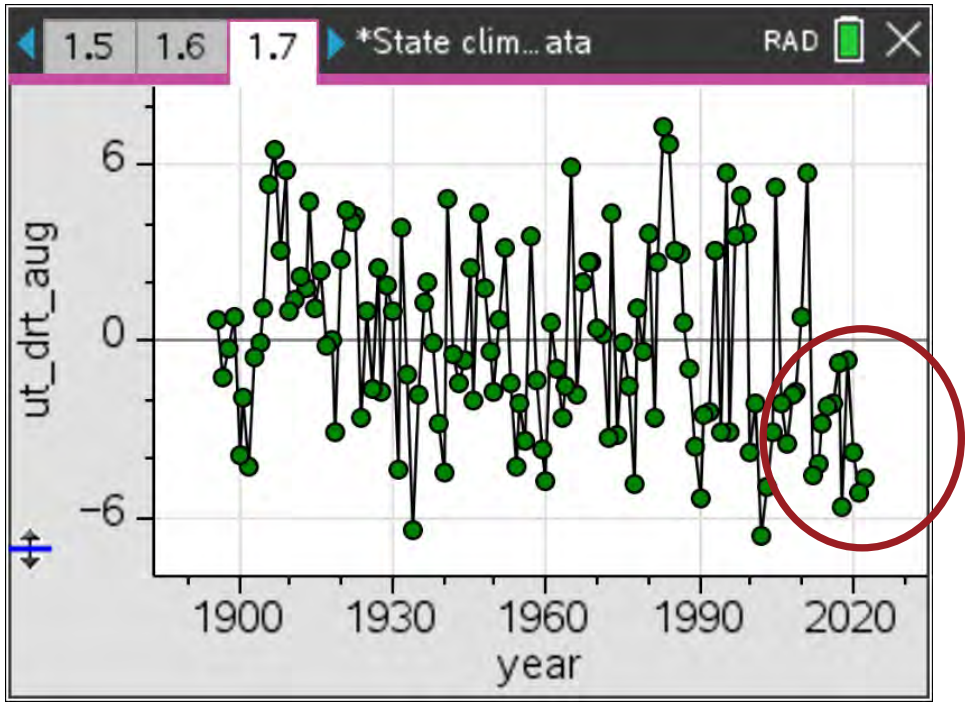


Drought index (<-4 severe)

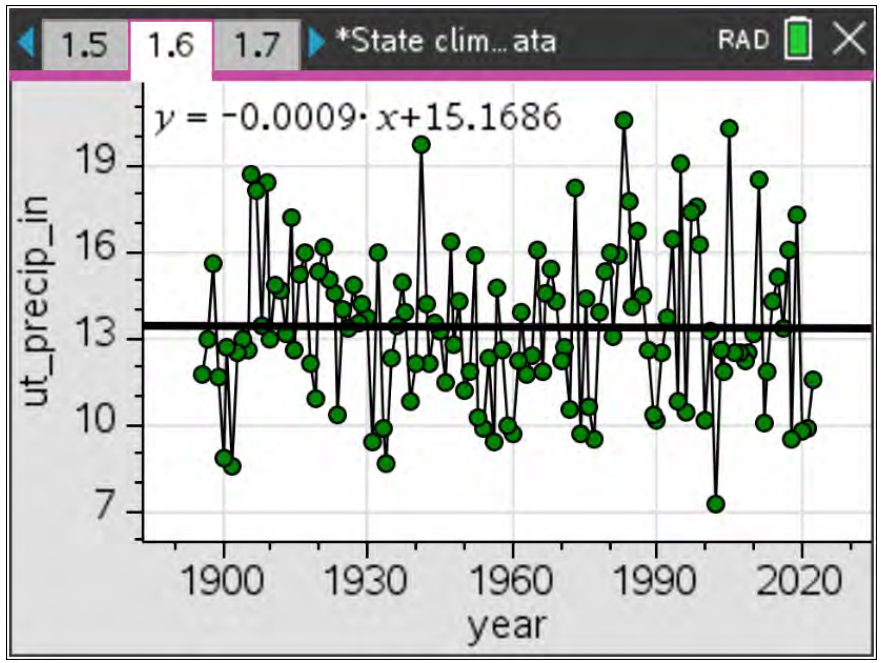
Utah



Maximum temperature
Average temperature

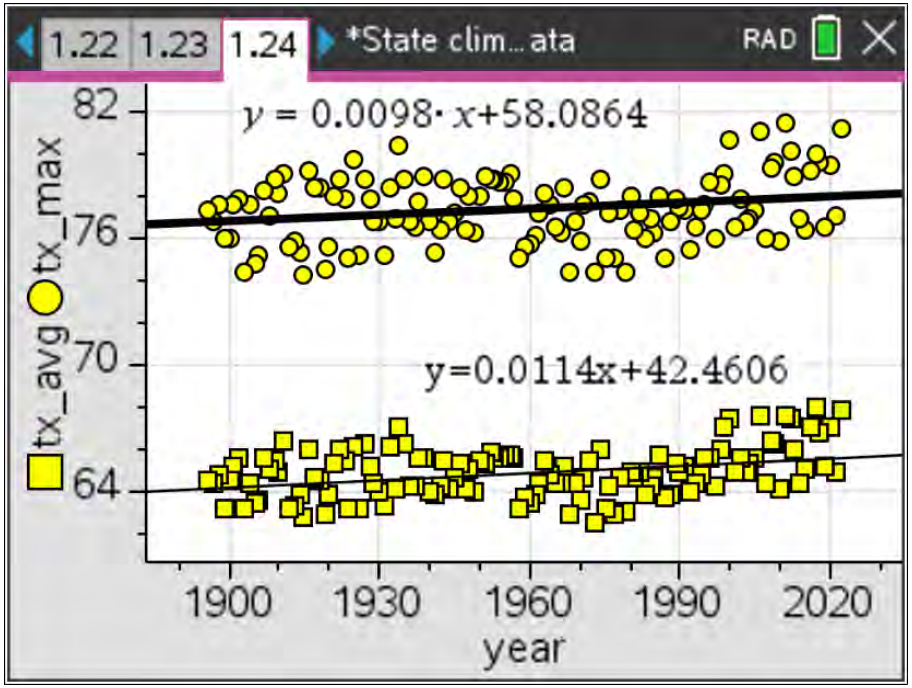


Yearly precipitation (in.)

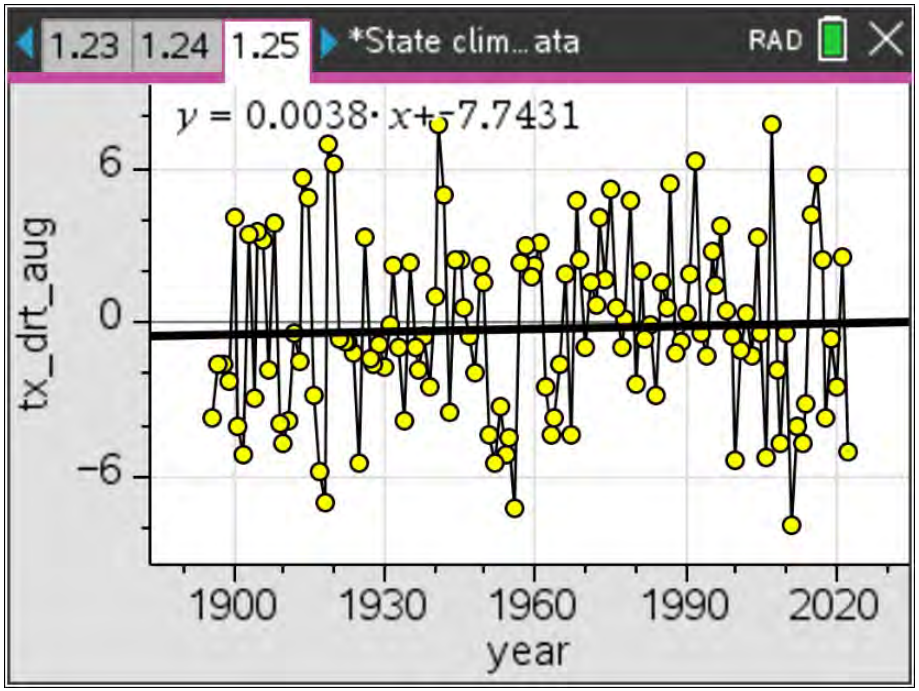


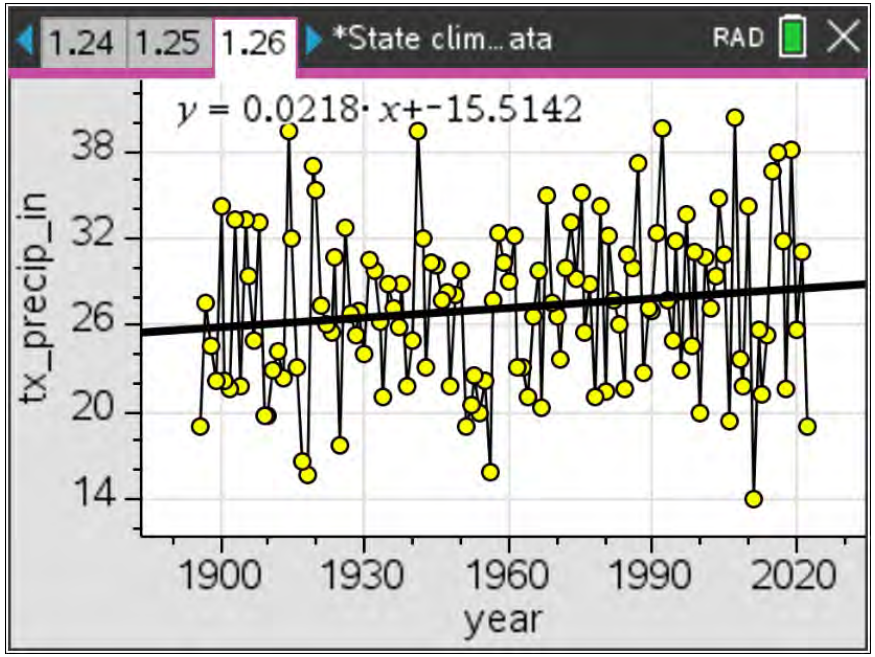
Drought index (<-4 severe)

Texas



Maximum temperature
Average temperature

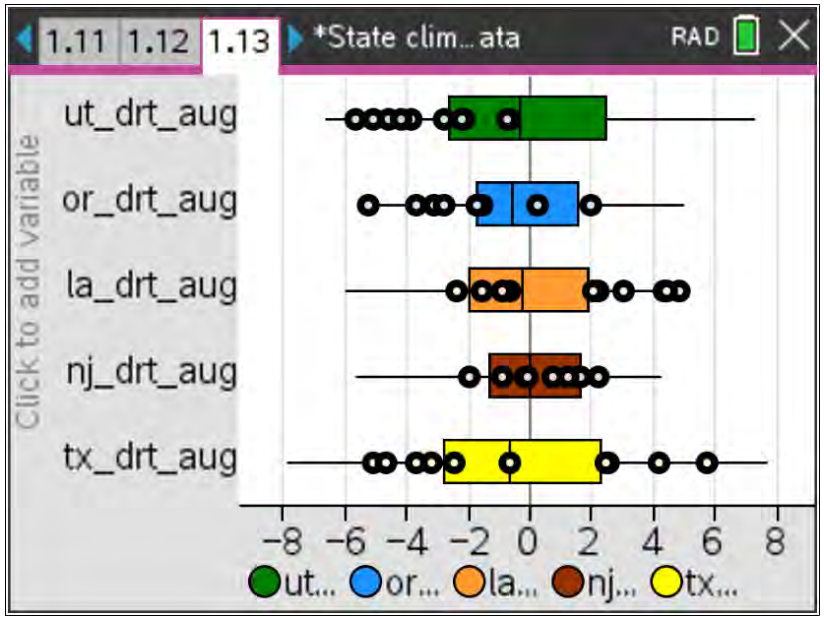




Yearly precipitation (in.)

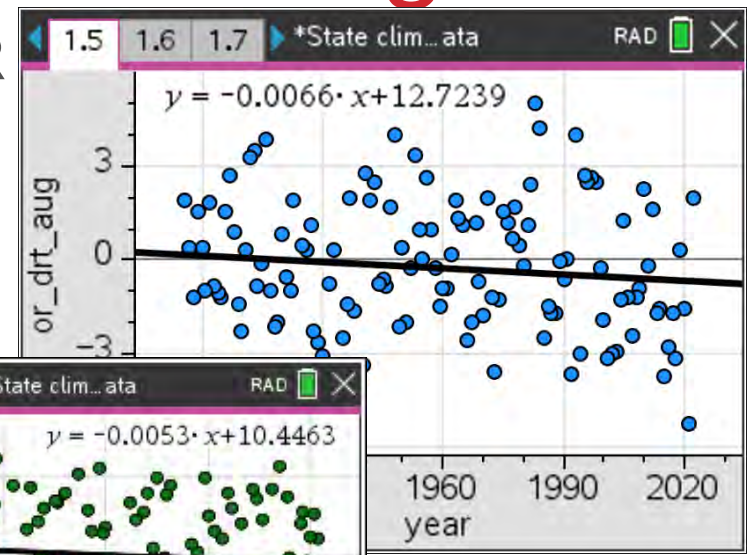
Drought index (<-4 severe)

Severe Drought <-4

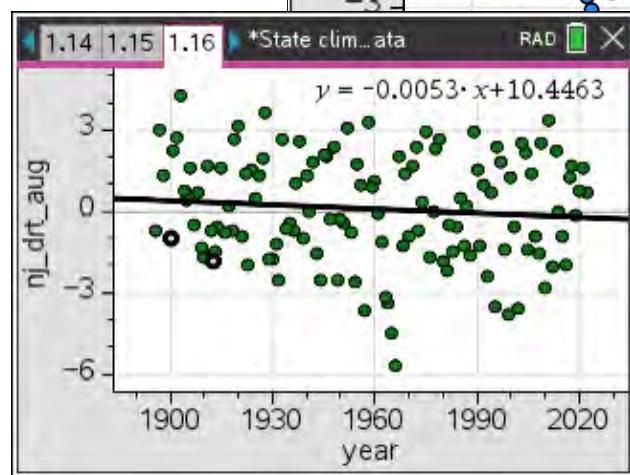


Highlighting drought index 2013-2022

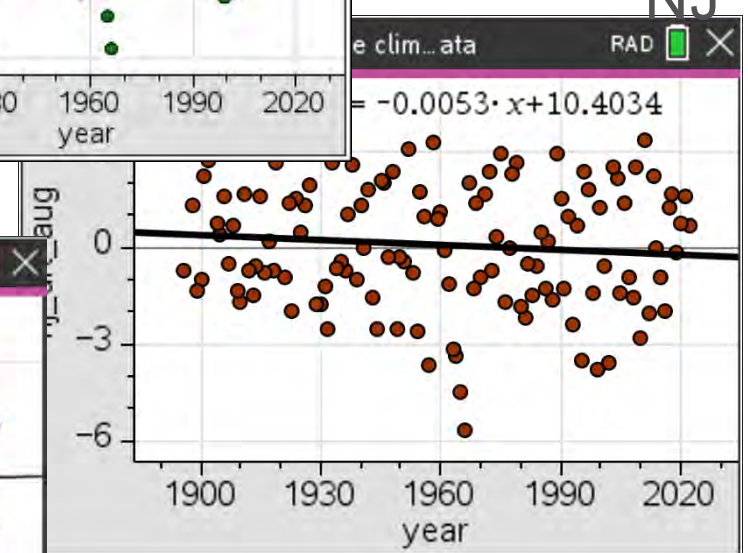
OR



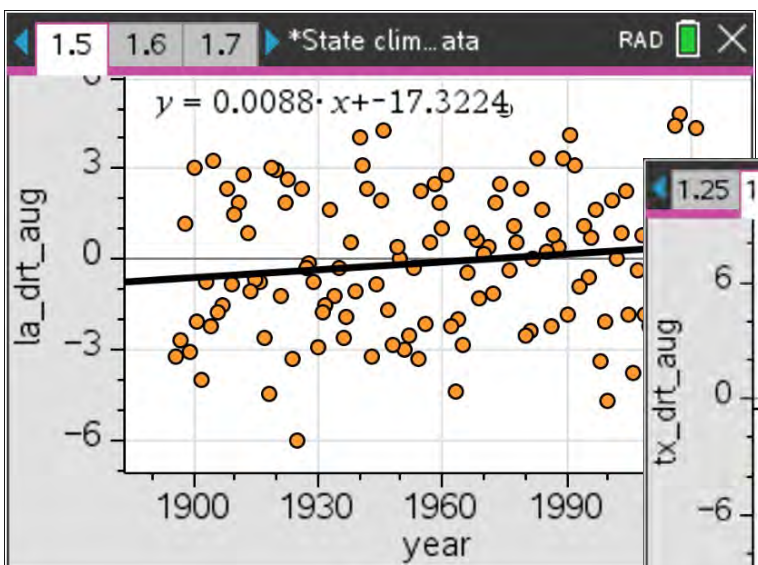
UT



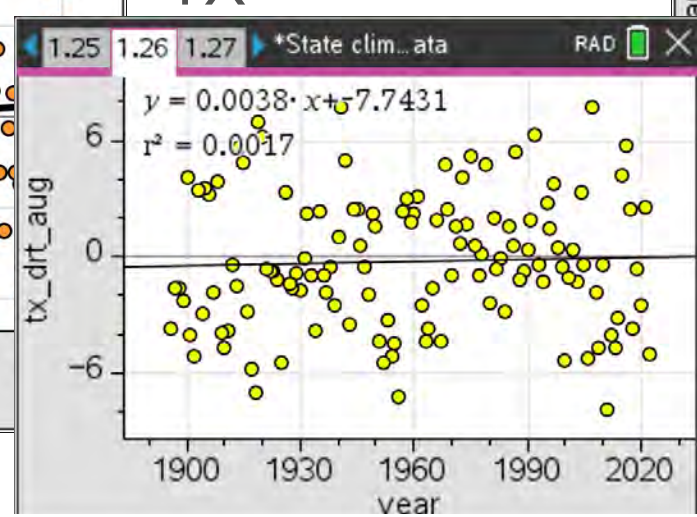
NJ



LA



TX



Texas Instruments

Precipitation

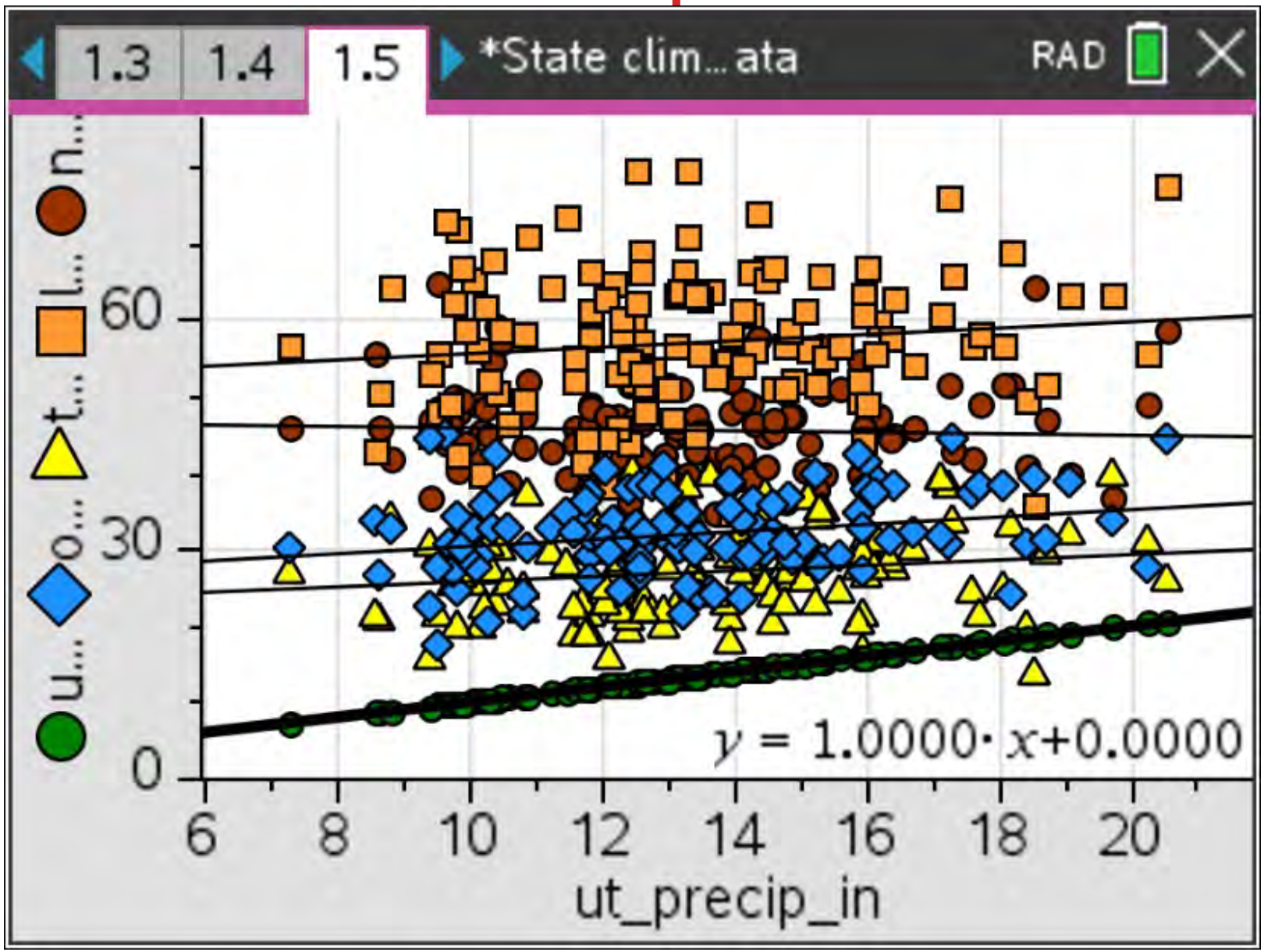
NJ

LA

OR

TX

UT



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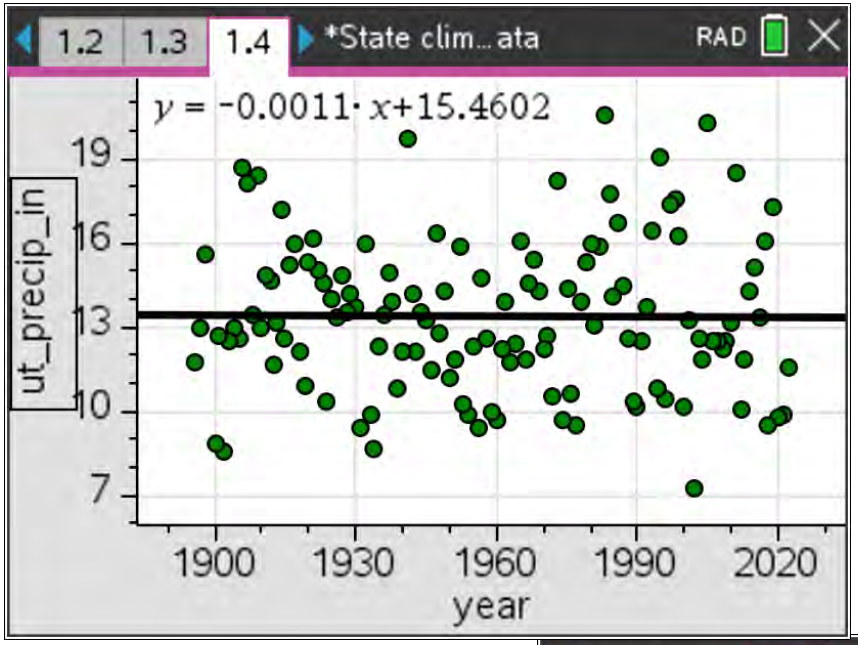
Precipitation

UT



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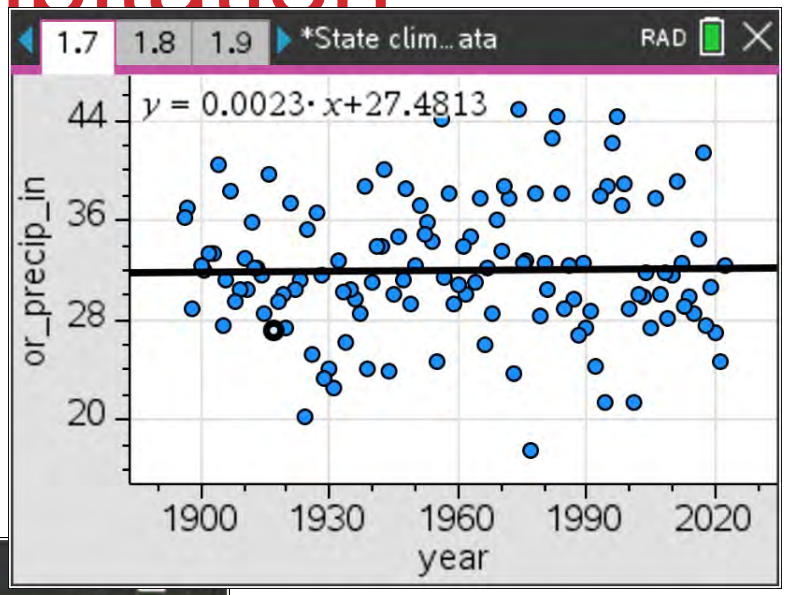

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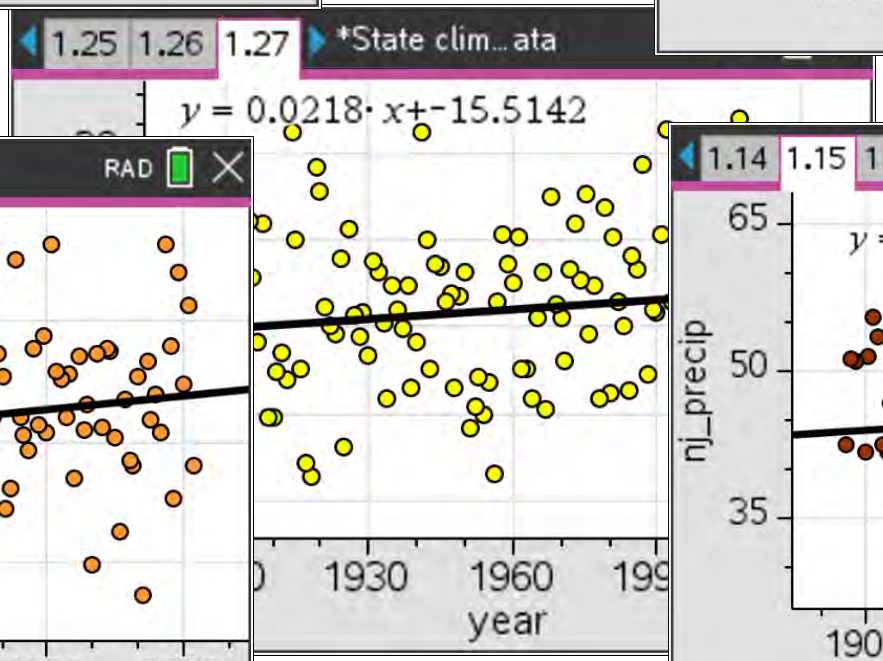

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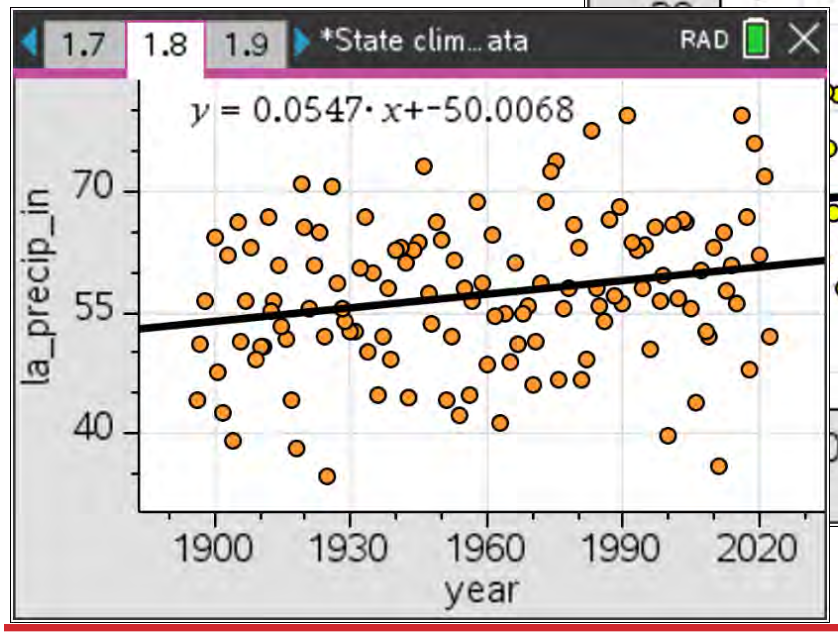

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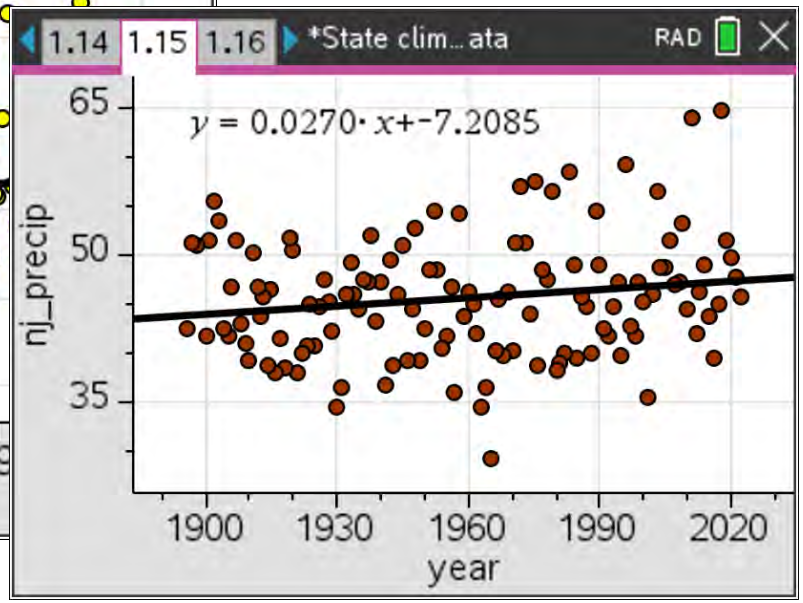

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Creating a model

- Issues:
  - Units (degrees, inches, rating scale)
  - Need to account for where are now as move forward
  - Possibly weighting factors as more or less important
  - Coding to define the formula

- Model 1
  - Ratio of mean of last 10 years to overall mean; rank order per variable with 1 best
- Model 2
  - Set threshold for danger; days to reach that given rate of change; e.g.130 danger heat level; for a slope of 0.05ºF per year and current maximum temperature of 88º, how many years before reach threshold?

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Model 1 (rank)

States/Ratio mean rate of change last 10 yrs to mean total	Average temp	Maximum temp	Precipitation (in)	Drought index	Total ranking: lower is worse
Louisiana	1.01596 (4)	1.00702 (5)	.940728 (5)	19.2648 +1.5/-.08 trend towards too wet (3)	17
New Jersey	0.95068 (5)	1.02455 (3)	1.29119 (2)	6.16001 +.6/.01 no drought or too much (5)	15
Oregon	1.0398 (2)	1.03745 (2)	.958888 (3)	-.241181 -2/-.2 getting more severe (2)	9
Utah	1.044 (1)	1.038 (1)	0.9412 (4)	-3.86 trend to more severe -3.3/-.01 (1)	**7***
Texas	1.02225 (3)	1.0176 (4)	1.05012 (1)	-3.53169 -.5/-.2 not enough (4)	12

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How do states compare with respect to risk from natural events?

- What are natural events?
- Risk can include
  - Loss of human lives
  - Financial losses due to disasters
  - Personal loss
  - Damage to ecosystem
  - Harm to wildlife

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Variables

- Increased mosquito season days, 1980s to today
- Days with heat index at least 105 degrees by 2050 in state or largest city
- Percentage of people vulnerable to extreme heat
- Increase in severity of wide summer drought, 2000-2050
- Percentage of people currently affected by inland flooding
- Increase in days with high wildfire potential, 2000-2050
- Percentage of population at elevated wildfire risk
- Percentage of people currently affected by coastal flooding

https://www.safehome.org/climate-change-statistics/

Risk Data

State	High heat days*	% increase in summer drought*	Increased mosquito season days	% pop risk of wildfire	Increase in wildfire risk days	% pop risk of flooding	% pop vulnerable to extreme heat
AL	113	100	10	57.4		.6	3.28
AK	46		8		90		2.32
AZ	147	200	4	34	34		2.85
AR	63	100	16	43.3	7	7	3.33
CA	29	200	14	28.5	24	3.7	2.53
CO	13	200	5	36.6			1.78
CT	10		29			5.1	1.81
DE	40		25			5.3	2.08
FL	151	120	20	25.3	18	23.8	2.95
GA	105	30	17	44.1	14	6.5	2.97
HI	90						4.57
ID	26	110	2	32.8	15		2.33
IL	39	40	24			3	2.42
IN	39	105	16			4	2.55
IA	43	71	19			4.8	2.23
KS	80	27	8	13.7	23	4.5	2.4
KY	72	95	22	33.7	14	3.6	3.27
LA	120	120	15	42.7	23	20.4	3.42
ME	7	70	32			1.2	2.25
MD	47		37			4.8	1.82
MA	16		23			1.2	2.04
MI	23	230	15			3.4	2.71
MN	6	140	34				1.97
MS	111	140	10	57	21	2.5	4.02
MO	63	70	31	9.6	15	3.6	2.78
MT	3	86	-1	68.7	6		2.38

Risk by State: The Data

(validity of sources?)

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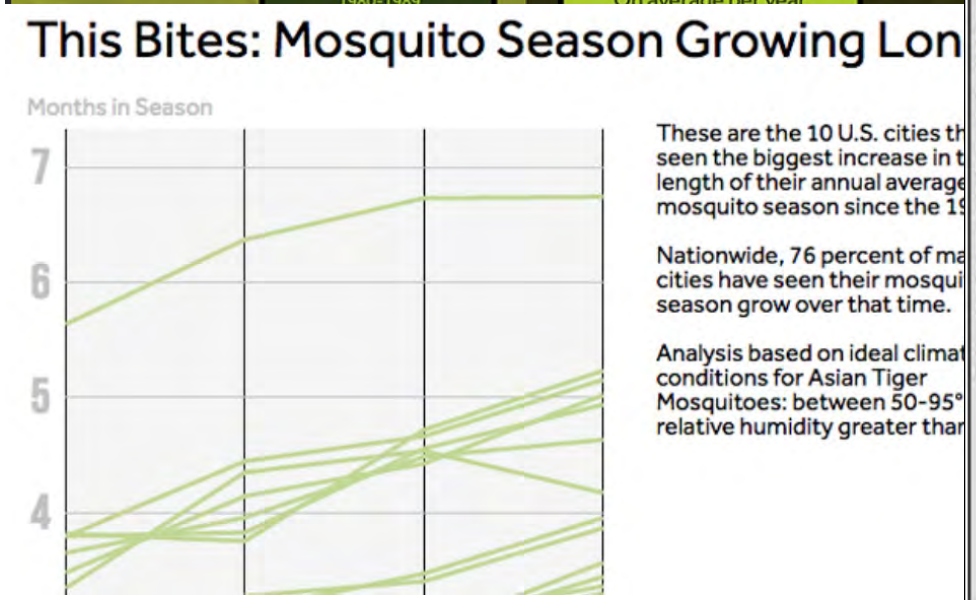
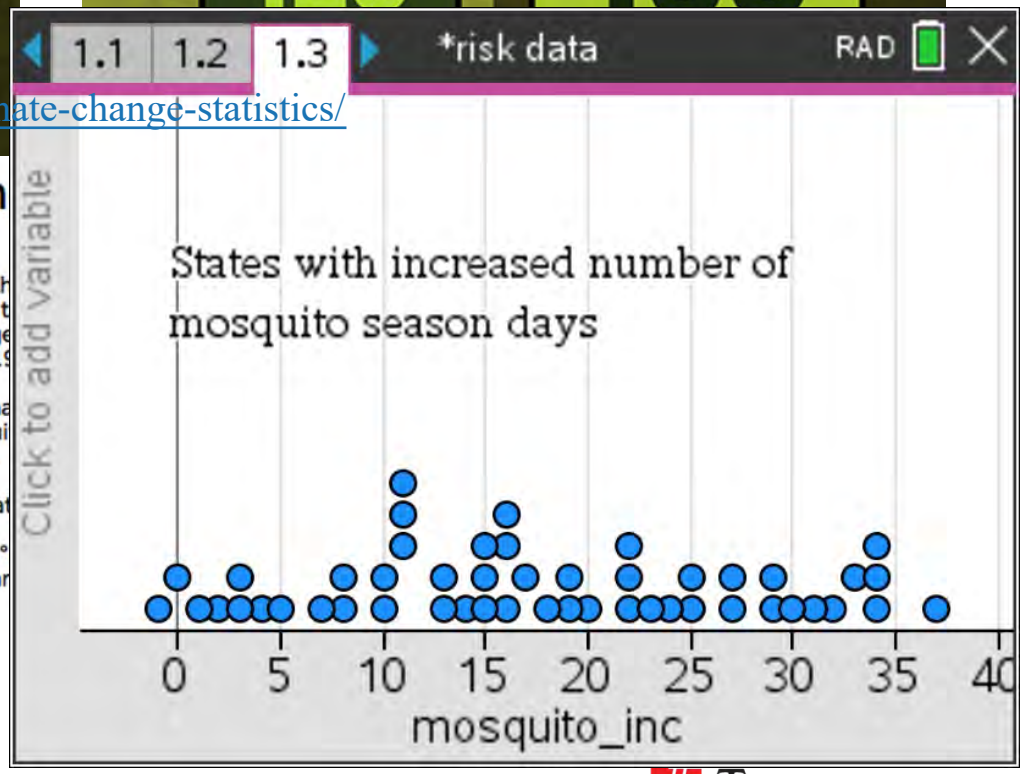
Risk Data by State

State	Heat Map, Risk Index	Choropleth Map, Natural Disasters; top states for each	River floods included as floods	Avg # tornadoes	Total # hurricanes	Acres burned 2020	Acres burned 2021
Alabama	209	Hurricanes	HT	44	23	0	0
Alaska		Earthquakes/F	EF	0		2157965	157716
Arizona	216	drought	D	5		153360	49469
Arkansas	248	Flooding	F	39		0	0
California	237	Earthquakes/drought	DE	11		46102	11830040
Colorado	106	Drought/tornadoes	DT	53		18333	150026
Connecticut	128		HT	2	11	68	381
Delaware	141	Flooding	FHT	1	2	8	8
Florida	308	Flooding/hurricane	FHT	66	120	91285	44765
Georgia	269	Flooding (11)/hurricanes/drought	DFHT	30	21	12113	5770
Hawaii		Earthquakes/Flooding	EFHT	1	5*	16820	5276
Idaho	144	Earthquakes/drought	DET	5		0	0
Illinois	121	Floods river	FT	54		253	995
Indiana	148		N	22		4849	9750
Iowa	140	Floods river	FT	51		3265	6130
Kansas	188	Tornadoes/floods river	FT	96		22795	21546
Kentucky	240		N	21		0	0
Louisiana	281	Flooding/hurricanes	FHT	37	62	5712	3084
Maine	173		N	2	3	151	1047
Maryland	153	Flooding	FHT	10	2	1491	1418
Massachusetts	99	hurricanes	HT	1	12	248	894
Michigan	141	Floods River	FT	16		6163	2899
Minnesota	104	Floods river	FT	45		4626	5209
Mississippi	270	hurricanes	HT	43	14	15657	18118

Exploring: Longer mosquito season

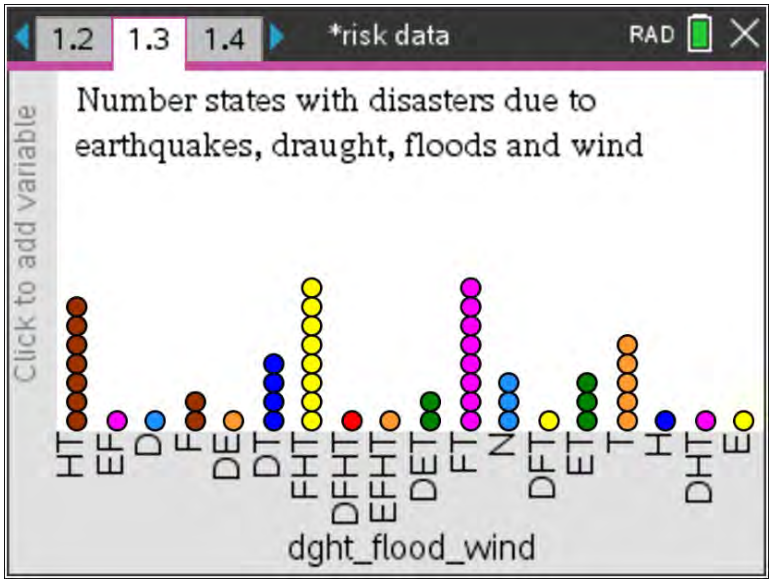
https://www.safehome.org/climate-change-statistics/

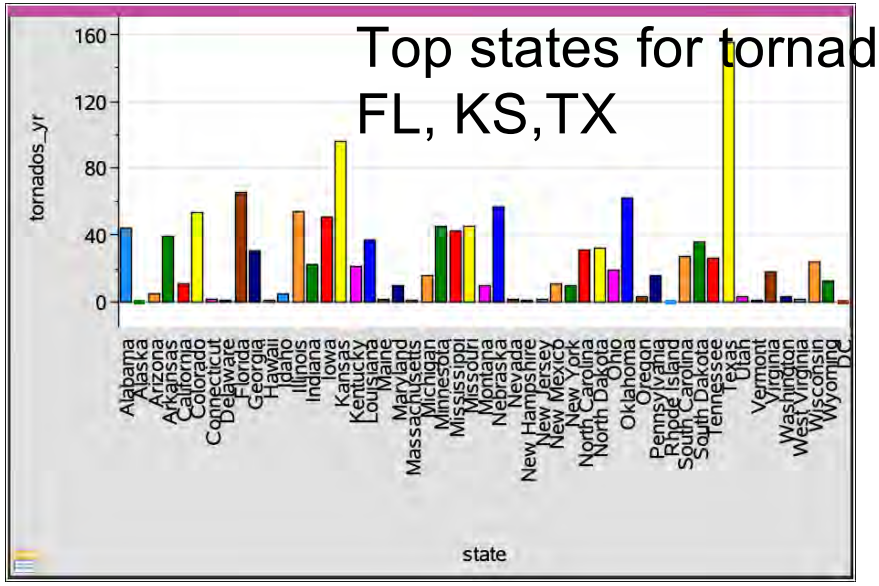


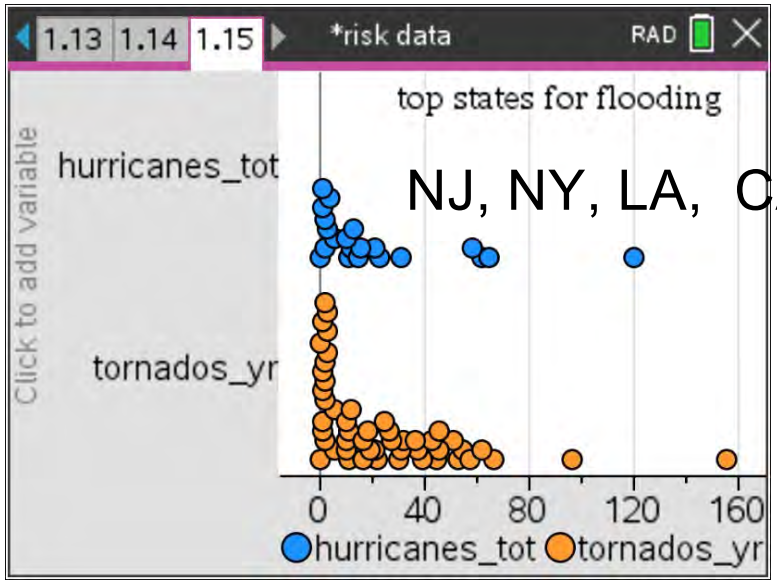


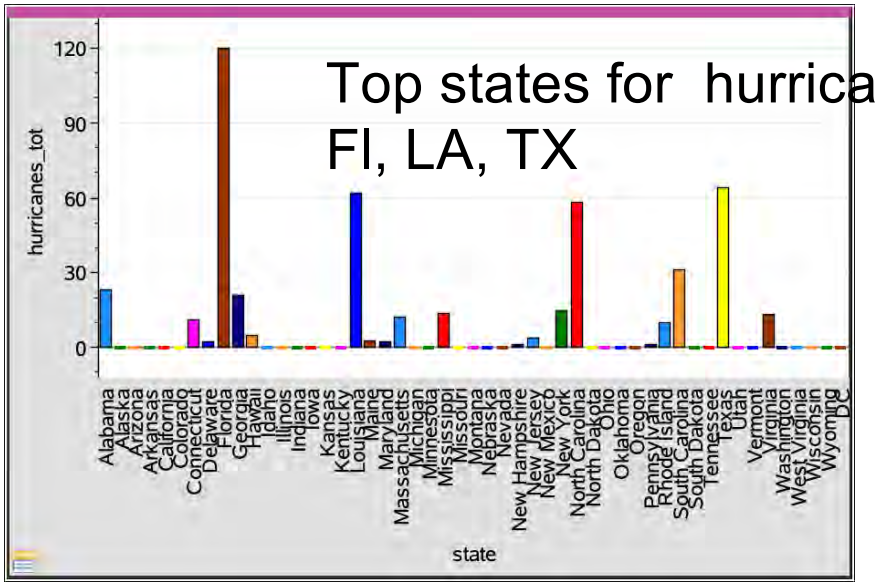
https://statesatrisk.org/mississippi/extreme-heat/

Exploring and visualizing: Winds

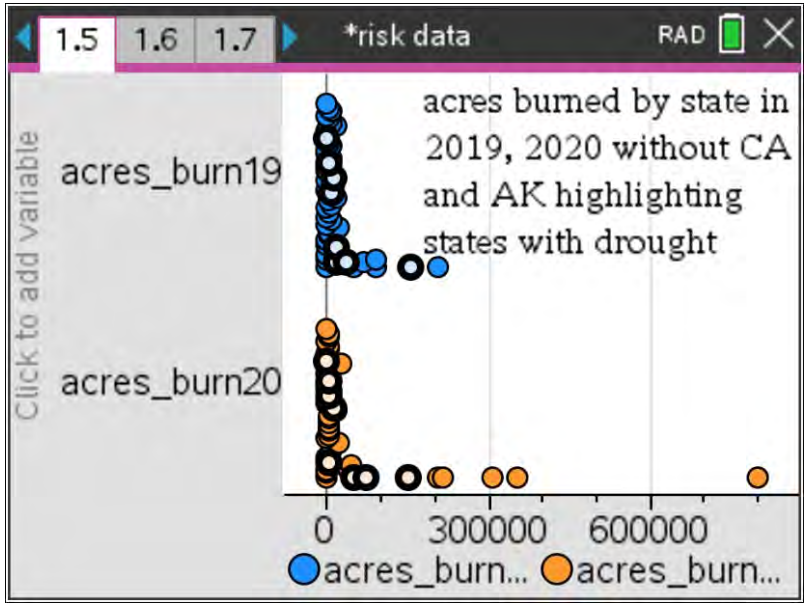






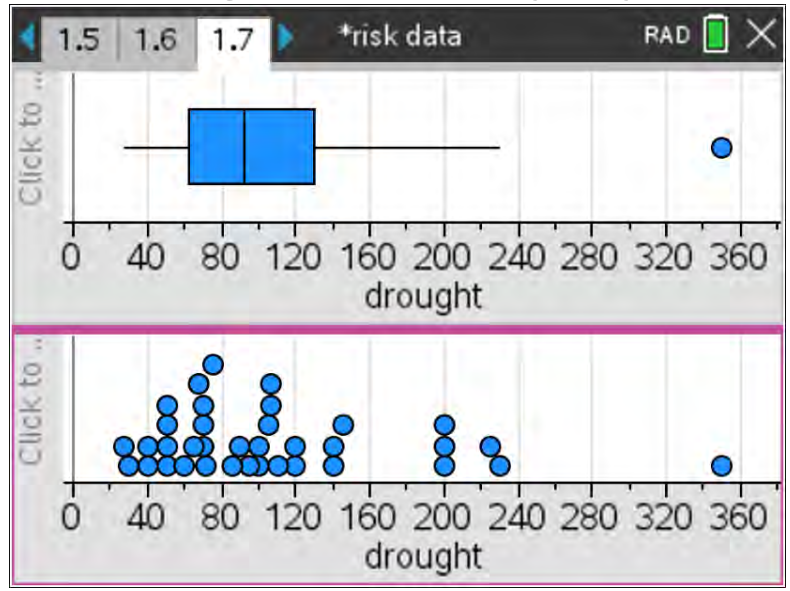


Drought/wildfires

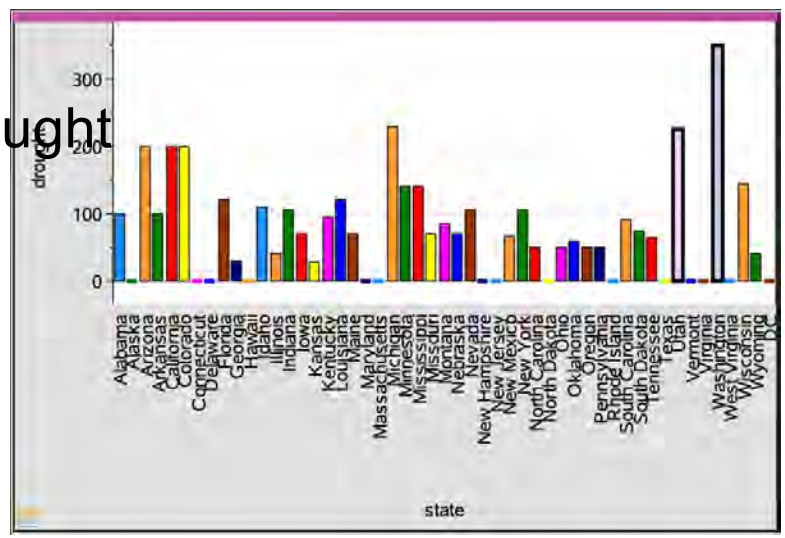


States with the most wildfires
CA, TX, CO, AZ, MT, OK, OR, ID, WA, UT

% Predicted increase in draught severity by 2050

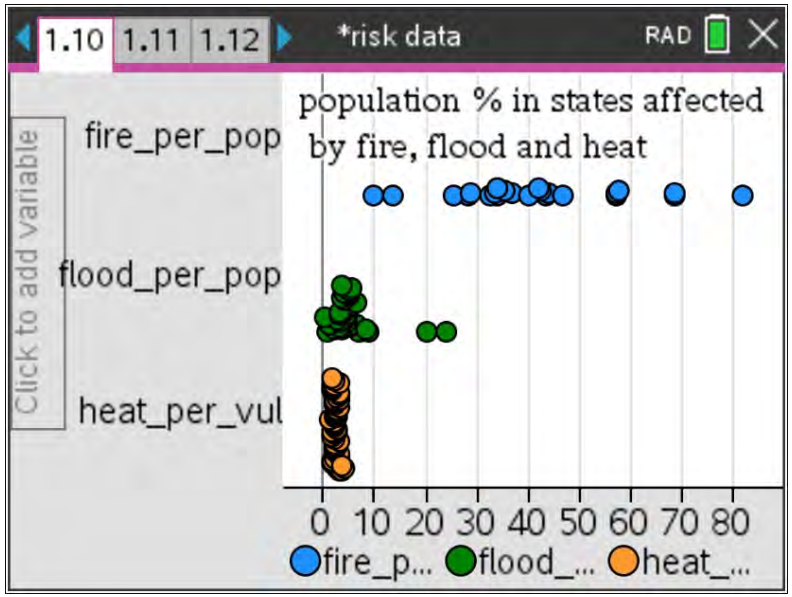


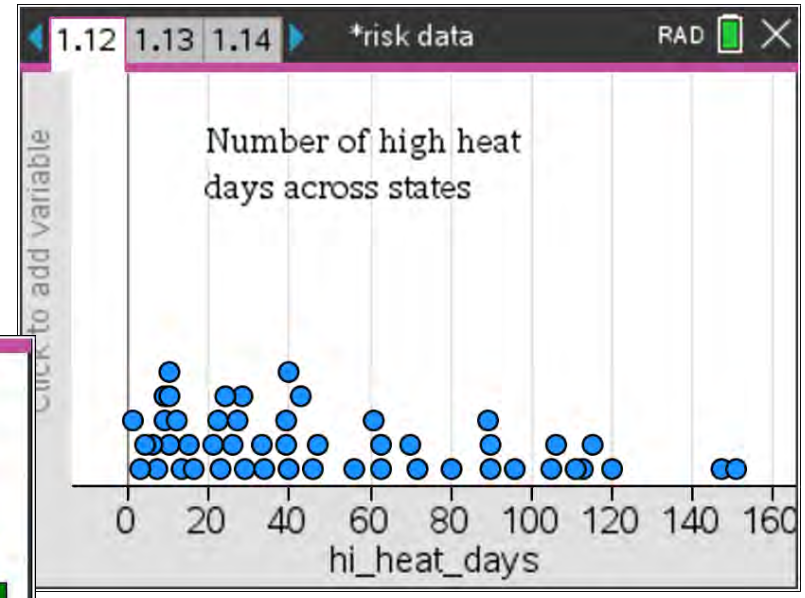
Draught

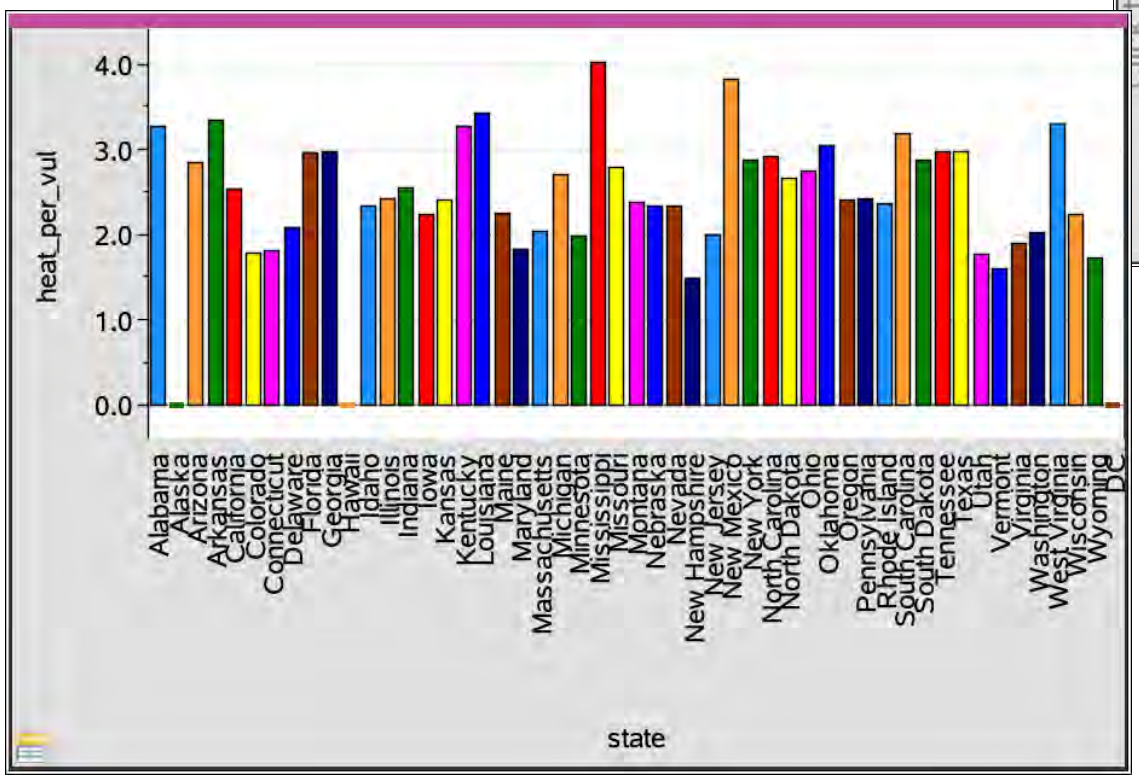


AZ, CA, CO, UT,WA,WI, Mi,

Heat & human costs?







High percentage of population vulnerable to heat: AL, AR, MS, NM, KT,LA

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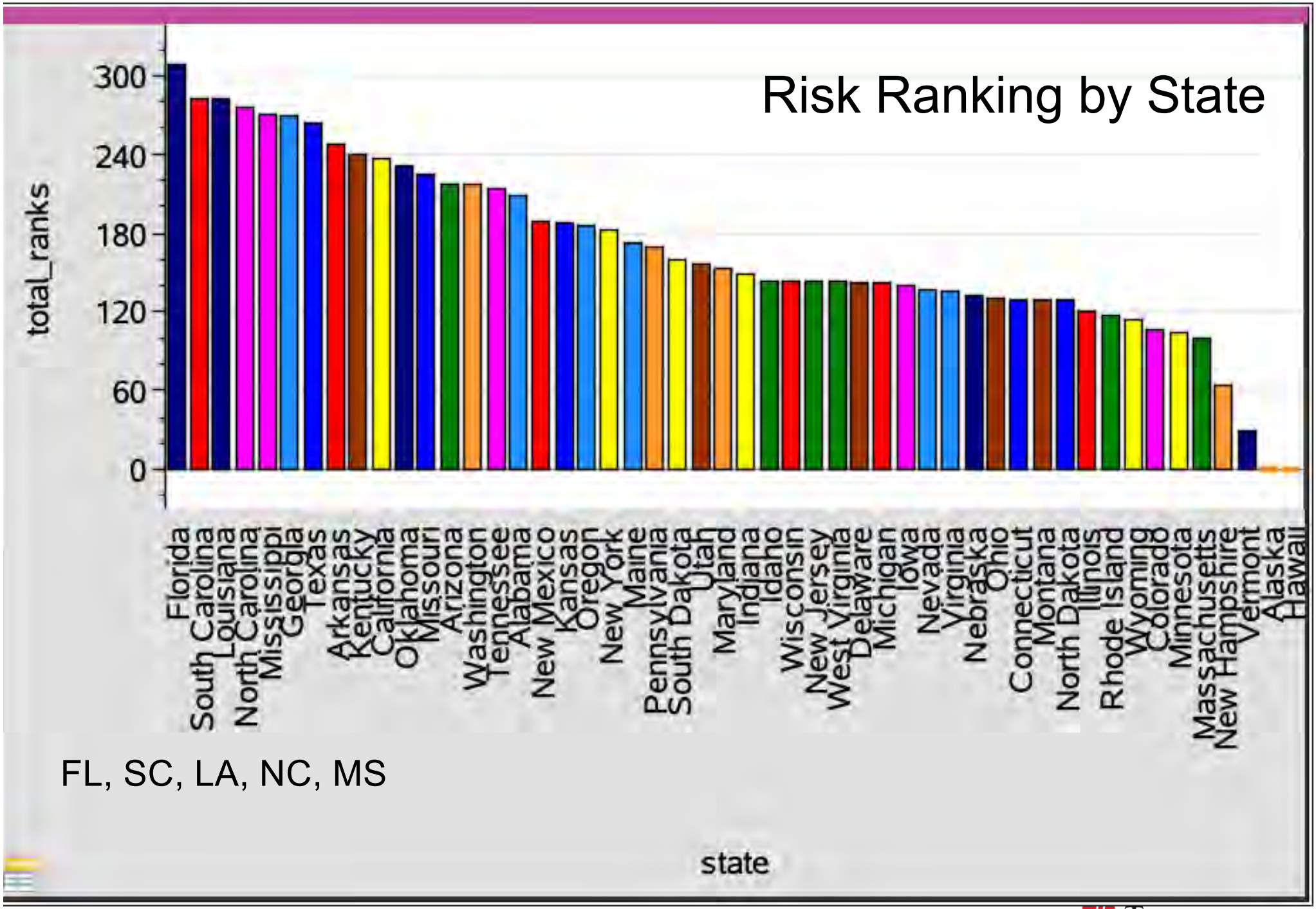
One model

Rank the data for each state from best to worst, and add together each state's rank in all the categories to create an overall ranking - lower scores equate to lower risk from climate change.

https://www.safehome.org/climate-change-statistics/

Risk Ranking by State



FL, SC, LA, NC, MS

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What does this look like across the United States? Which regions are the most at risk with respect to the variables we have been considering?

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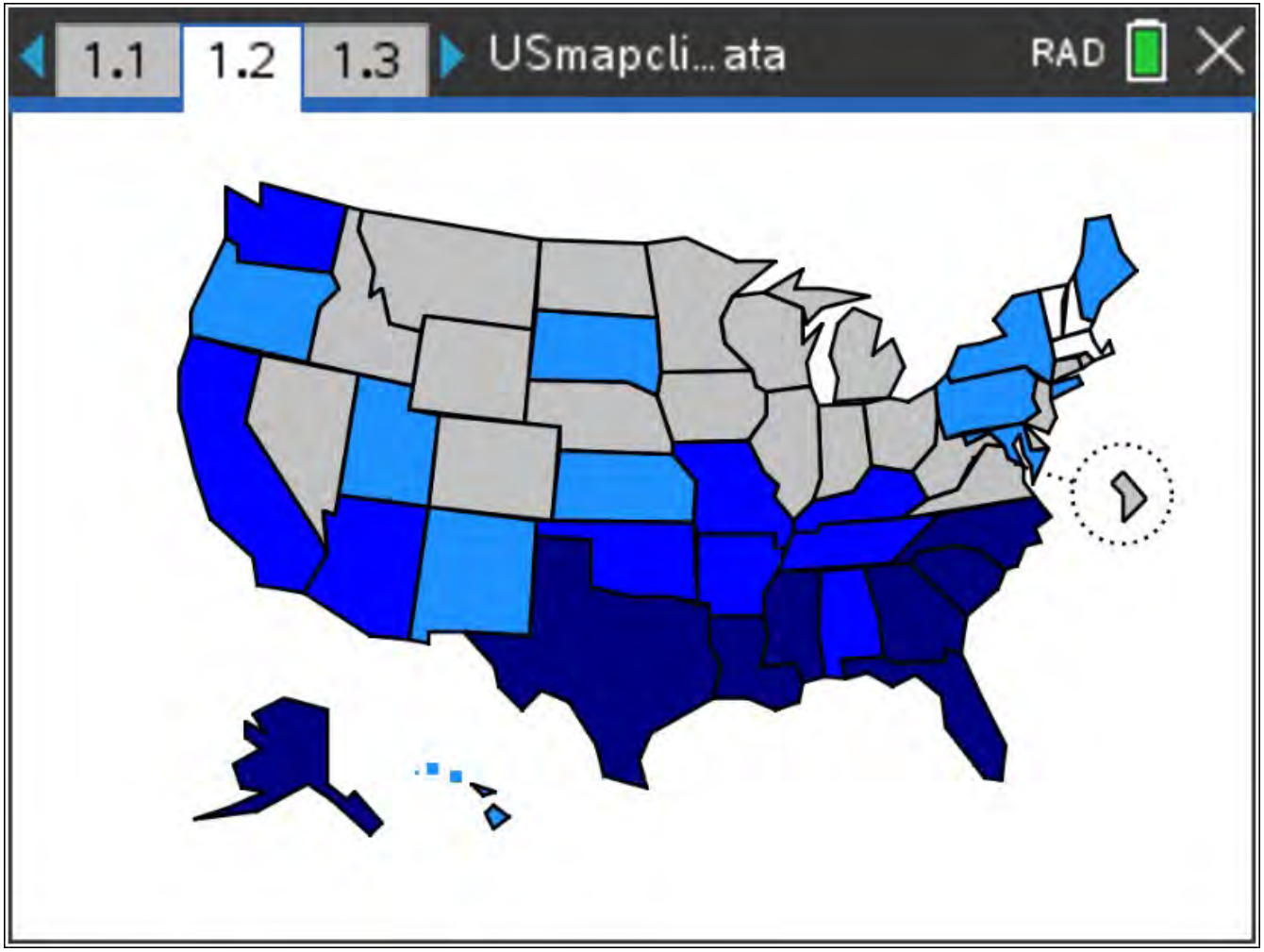
A map: At risk states



Why should data science be incorporated in your class

- provide an opportunity for students to see the relevance of mathematics,
- open doors for students by engaging them in mathematics related to issues they care about,
- have the potential to improve critical thinking (Kerlin et al. 2010; Gould et al. 2014; Holmes et al. 2015),
- support learning to argue from evidence (NRC 2012; NGSS Lead States 2013),
- give students choice in ways they approach a problem and in the problems they choose to do
- engaging students in investigations, reasoning and problem solving will support long term learning rather than teaching for "unproductive success". (Jonsson et al., 2014; Kapur, 2016; Olsson & Granberg, 2019).

How can data driven activities be used?

- As alternate assessments – posters, videos or power points of solutions presented to the class (and/or families/guardians)
- As projects - assign once a chapter or once a quarter
- Incorporate them into units
  - Percent, relative frequency (e.g., herd immunity, analyzing floods, wage gap)
  - Graphical representations and diagrams
  - Rate of change and exponential growth (e.g., constant vs exponential rate of change in yearly mean C02 levels; spread of disease; climate change)
  - Linear equations & correlation (e.g., yearly mean C02 levels, population density vs ethnicity)
  - Statistics (e.g., sampling distributions, measures of center and variability, confidence intervals in screening tests/herd immunity)
  - Calculus (e.g., differential equations and herd immunity)
- Create a semester course as an alternate to calculus – data science; quantitative literacy, modeling, …

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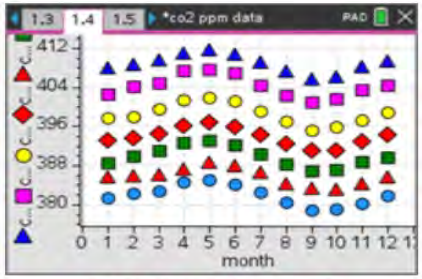
Mathematical Modeling

Find activities that support your lesson plans

Technology tools such as the TI-Nspire™ CX II and other TI graphing calculators can be a powerful support for mathematical modeling activities. It opens up opportunities for student to compare models graphically, to use regression for making and testing predictions, and to simulate processes that would be difficult or impossible to do without technology.

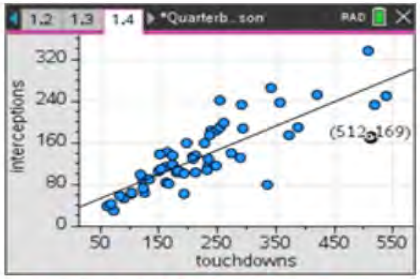
This set of activities seeks to illustrate how the TI-Nspire™ CX family of graphing calculators could be used to effectively support the vision of the GAIMME document. The document "Guidelines for Assessment & Instruction in Mathematical Modeling Education" (GAIMME) was published in 2016 by the Consortium for Mathematics and its Applications (COMAP) and the Society for Industrial and Applied Mathematics (SIAM). GAIMME is a rich resource for teachers at all levels K–16, and it provides valuable advice for making modeling an integral part of mathematics instruction.

Featured Activities



Modeling CO2 Levels

This lesson provides an opportunity to engage students with data that is relevant to contemporary discussions of climate change. Students will compare multiple box plots of the data across years, analyze scatter plots, and fit models to the data.



Modeling QB Passing Rates

This lesson involves using the measures commonly collected for football quarterbacks and provides an opportunity for students to create their own quarterback rating models. As a result, students will model a contextual situation mathematically and use the model to answer a question.

Thank you!

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