



TEXAS ADVANCED COMPUTING CENTER

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TEXAS

The University of Texas at Austin

Data Visualization

PRESENTED BY:

Joao Barbosa

Dave Semeraro

Roberto Ribeiro

Today's agenda

- Introduction to Data Visualization
 - Joao Barbosa
- Introduction to Scientific Visualization
 - Dave Semeraro
- Paraview lab
 - Joao Barbosa
- Visit Lab
 - Dave Semeraro





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Introduction to Data Visualization

PRESENTED BY:

Joao Barbosa

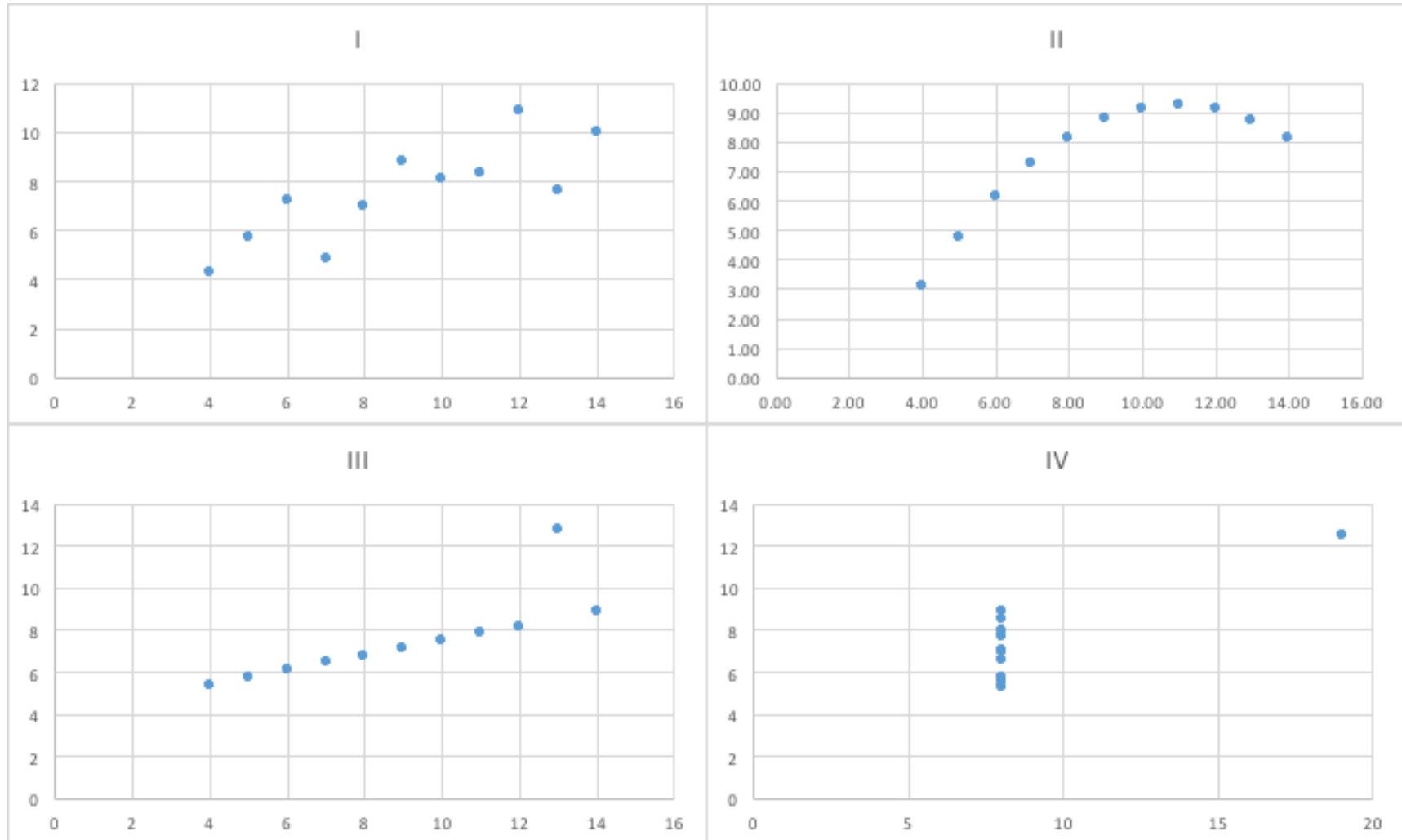
“A picture is worth a thousand words”

- Falsely attributed to a Chinese proverb
- Seems to be from an advertising journal extolling the use of pictures in streetcar ads
- Valid, nonetheless.
- Why ?
 - *Digression on millions of years of evolution, bandwidth into the brain, etc. etc.*
 - Bottom line is that it really works.

Anscombe's Quartet

	I		II		III		IV	
	x	y	x	y	x	y	x	y
	10.00	8.04	10.00	9.14	10.00	7.46	8.00	6.58
	8.00	6.95	8.00	8.14	8.00	6.77	8.00	5.76
	13.00	7.58	13.00	8.74	13.00	12.74	8.00	7.71
	9.00	8.81	9.00	8.77	9.00	7.11	8.00	8.84
	11.00	8.33	11.00	9.26	11.00	7.81	8.00	8.47
	14.00	9.96	14.00	8.10	14.00	8.84	8.00	7.04
	6.00	7.24	6.00	6.13	6.00	6.08	8.00	5.25
	4.00	4.26	4.00	3.10	4.00	5.39	19.00	12.50
	12.00	10.84	12.00	9.13	12.00	8.15	8.00	5.56
	7.00	4.82	7.00	7.26	7.00	6.42	8.00	7.91
5.00	5.68	5.00	4.74	5.00	5.73	8.00	6.89	
Mean	9.00	7.50	9.00	7.50	9.00	7.50	9.00	7.50
Variance	11.00	4.13	11.00	4.13	11.00	4.13	11.00	4.13
Correlation	0.82		0.82		0.82		0.82	
Regression	y= 3 + 0.5 x		y= 3 + 0.5 x		y= 3 + 0.5 x		y= 3 + 0.5 x	

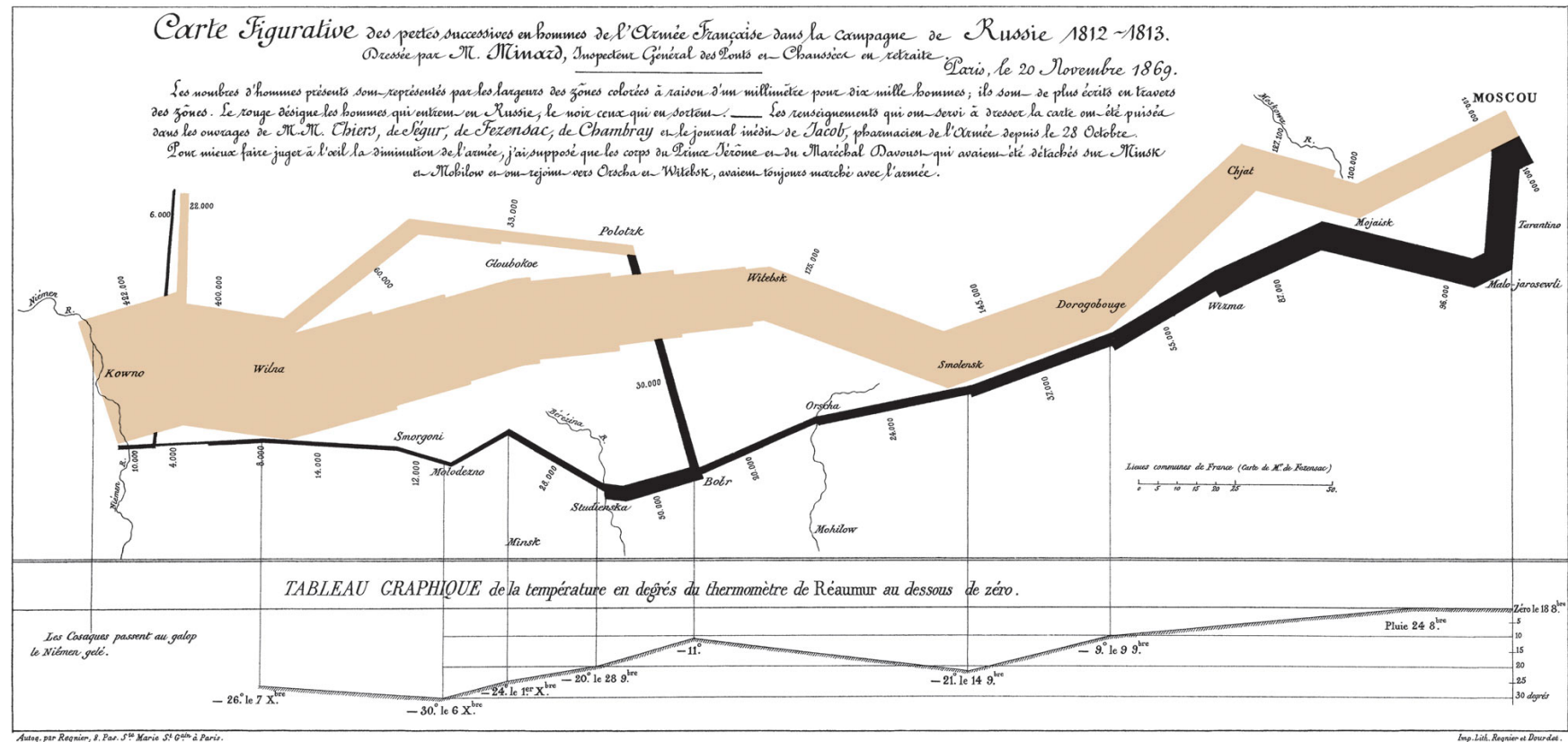
Anscombe's Quartet



Napoleon's Invasion of Russia 1812-1813

Long.	Lat.	Survivors	D	G	Long.	Temp	Date
24	54.9	340000 A	1		37.6	0	10/18/12
24.5	55	340000 A	1		36	0	10/24/12
25.5	54.5	340000 A	1		33.2	-9	11/9/12
26	54.7	320000 A	1		32	-21	11/14/12
27	54.8	300000 A	1		29.2	-11	11/24/12
28	54.9	280000 A	1		28.5	-20	11/28/12
28.5	55	240000 A	1		27.2	-24	12/1/12
29	55.1	210000 A	1		26.7	-30	12/6/12
30	55.2	180000 A	1		25.3	-26	12/7/12
30.3	55.3	175000 A	1				
32	54.8	145000 A	1		long	lat	city
33.2	54.9	140000 A	1		24	55	Kowno
34.4	55.5	127100 A	1		25.3	54.7	Wilna
35.5	55.4	100000 A	1		26.4	54.4	Smorgoni
36	55.5	100000 A	1		26.8	54.3	Miodexno
37.6	55.8	100000 A	1		27.7	55.2	Globokoe
37.7	55.7	100000 R	1		27.6	53.9	Minsk
37.5	55.7	98000 R	1		28.5	54.3	Studienska
37	55	97000 R	1		28.7	55.5	Polotzk
36.8	55	96000 R	1		29.2	54.4	Bobr
35.4	55.3	87000 R	1		30.2	55.3	Witebsk
34.3	55.2	55000 R	1		30.4	54.5	Orscha
33.3	54.8	37000 R	1		30.4	53.9	Mohilow
32	54.6	24000 R	1		32	54.8	Smolensk
30.4	54.4	20000 R	1		33.2	54.9	Dorogobouge
29.2	54.3	20000 R	1		34.3	55.2	Wixma
28.5	54.2	20000 R	1		34.4	55.5	Chjat
28.3	54.3	20000 R	1		36	55.5	Mojaisk
27.5	54.5	20000 R	1		37.6	55.8	Moscou
26.8	54.3	12000 R	1		36.6	55.3	Tarantino
26.4	54.4	14000 R	1		36.5	55	Malo-Jarosewii
25	54.4	8000 R	1				
24.4	54.4	4000 R	1				
24.2	54.4	4000 R	1				
24.1	54.4	4000 R	1				
24	55.1	60000 A	2				
24.5	55.2	60000 A	2				
25.5	54.7	60000 A	2				
26.6	55.7	40000 A	2				
27.4	55.6	33000 A	2				
28.7	55.5	33000 A	2				
28.7	55.5	33000 R	2				
29.2	54.2	30000 R	2				
28.5	54.1	30000 R	2				
28.3	54.2	28000 R	2				
24	55.2	22000 A	3				
24.5	55.3	22000 A	3				
24.6	55.8	6000 A	3				
24.6	55.8	6000 R	3				
24.2	54.4	6000 R	3				
24.1	54.4	6000 R	3				

Napoleon's Invasion of Russia 1812-1813



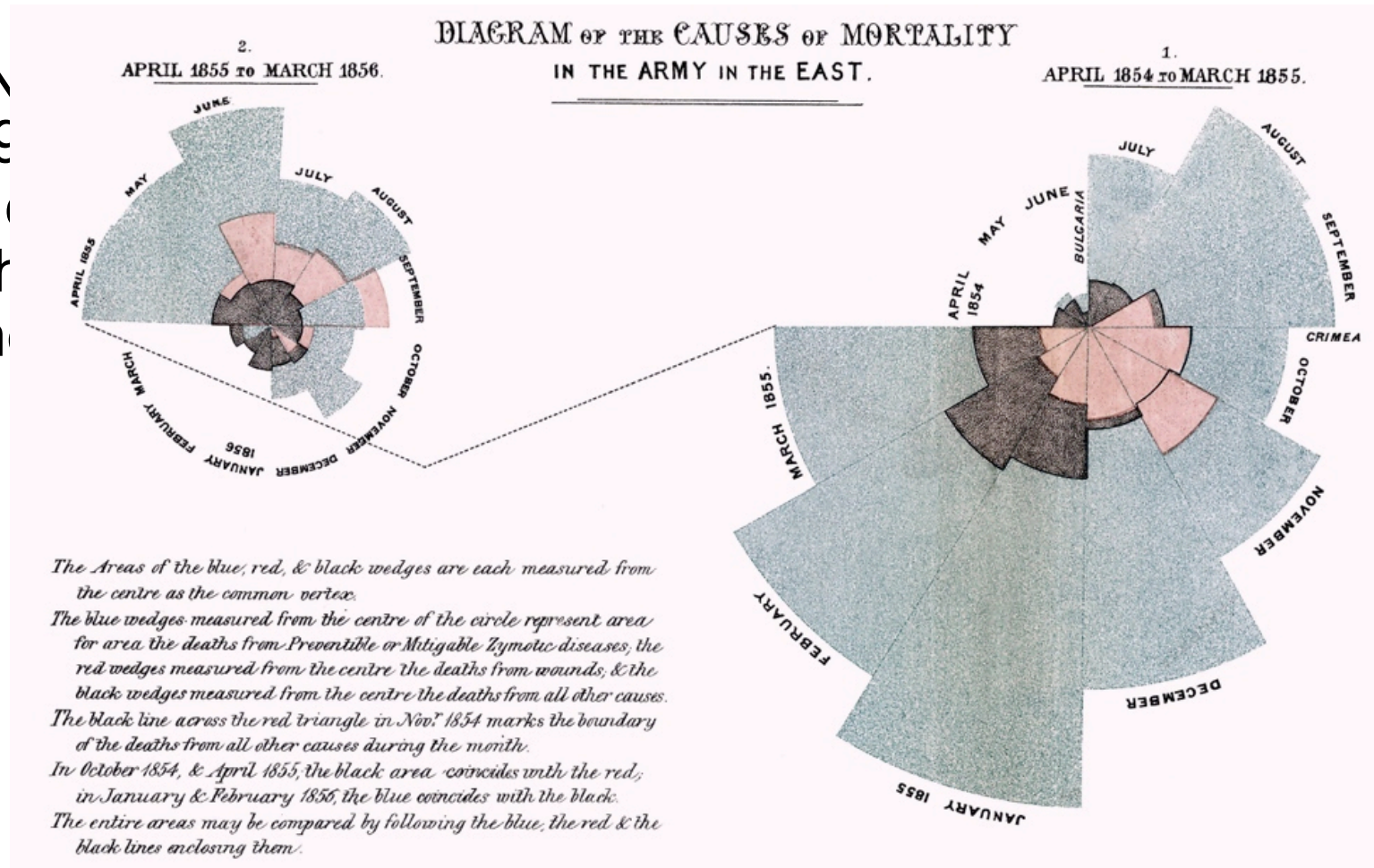
Minard, 1869

Casualties in the Crimean War 1855/6

	A	B	C	D	E	F	G	H	I	J	K
1		Date	Month	Year	Army	Disease	Wounds	Other	Disease.rate	Wounds.rate	Other.rate
2	1	1854-04-01	Apr	1854	8571	1	0	5	1.4	0	7
3	2	1854-05-01	May	1854	23333	12	0	9	6.2	0	4.6
4	3	1854-06-01	Jun	1854	28333	11	0	6	4.7	0	2.5
5	4	1854-07-01	Jul	1854	28722	359	0	23	150	0	9.6
6	5	1854-08-01	Aug	1854	30246	828	1	30	328.5	0.4	11.9
7	6	1854-09-01	Sep	1854	30290	788	81	70	312.2	32.1	27.7
8	7	1854-10-01	Oct	1854	30643	503	132	128	197	51.7	50.1
9	8	1854-11-01	Nov	1854	29736	844	287	106	340.6	115.8	42.8
10	9	1854-12-01	Dec	1854	32779	1725	114	131	631.5	41.7	48
11	10	1855-01-01	Jan	1855	32393	2761	83	324	1022.8	30.7	120
12	11	1855-02-01	Feb	1855	30919	2120	42	361	822.8	16.3	140.1
13	12	1855-03-01	Mar	1855	30107	1205	32	172	480.3	12.8	68.6
14	13	1855-04-01	Apr	1855	32252	477	48	57	177.5	17.9	21.2
15	14	1855-05-01	May	1855	35473	508	49	37	171.8	16.6	12.5
16	15	1855-06-01	Jun	1855	38863	802	209	31	247.6	64.5	9.6
17	16	1855-07-01	Jul	1855	42647	382	134	33	107.5	37.7	9.3
18	17	1855-08-01	Aug	1855	44614	483	164	25	129.9	44.1	6.7
19	18	1855-09-01	Sep	1855	47751	189	276	20	47.5	69.4	5
20	19	1855-10-01	Oct	1855	46852	128	53	18	32.8	13.6	4.6
21	20	1855-11-01	Nov	1855	37853	178	33	32	56.4	10.5	10.1
22	21	1855-12-01	Dec	1855	43217	91	18	28	25.3	5	7.8
23	22	1856-01-01	Jan	1856	44212	42	2	48	11.4	0.5	13
24	23	1856-02-01	Feb	1856	43485	24	0	19	6.6	0	5.2
25	24	1856-03-01	Mar	1856	46140	15	0	35	3.9	0	9.1

Casualties in the Crimean War 1855/6

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Types of Data (with apologies)

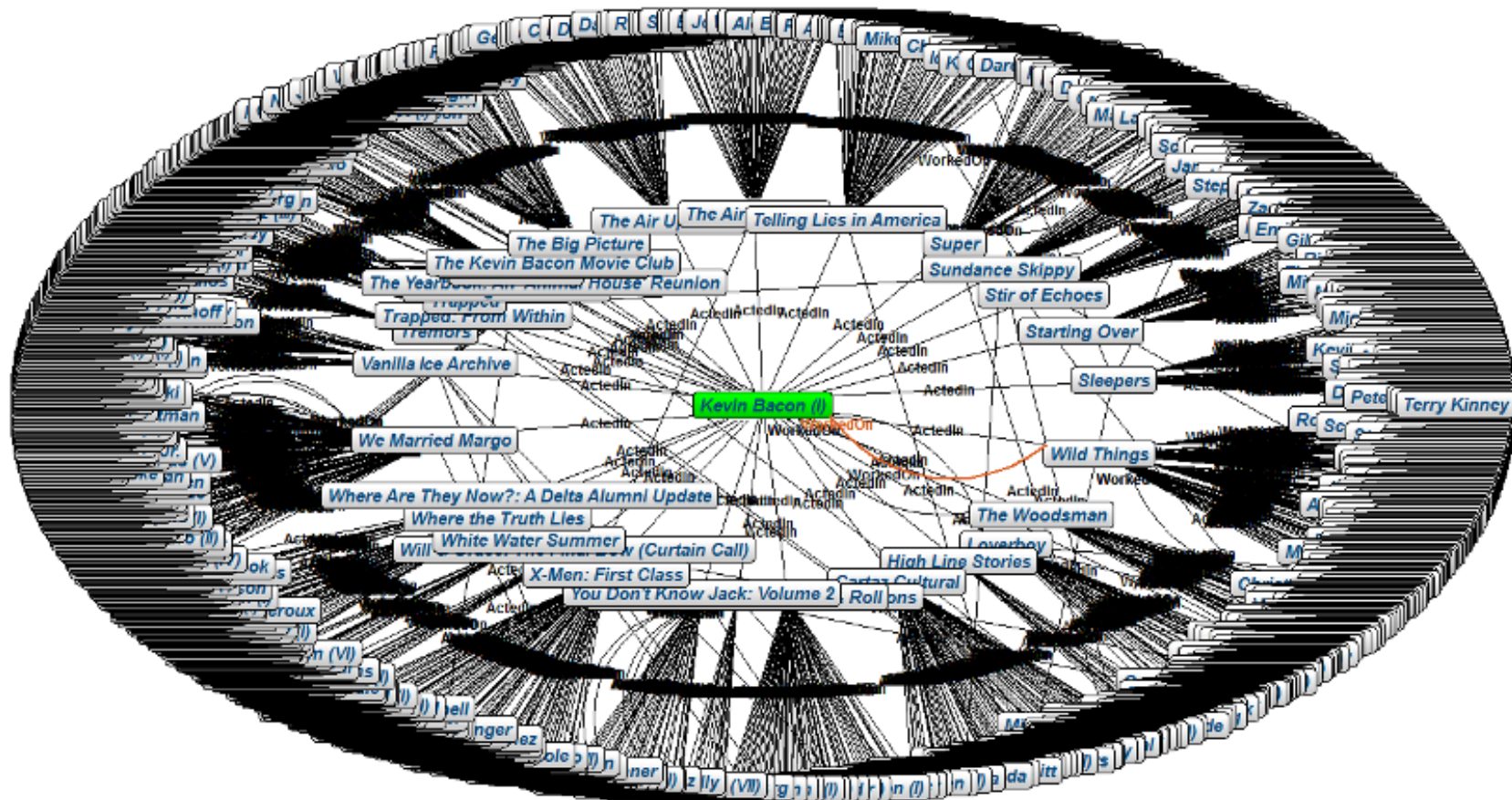
- Infovis data generally represents sets of facts
 - A list of movies, with attributes of each
- SciVis data represents physical properties defined over physical spaces
 - An ocean, with temperature and currents
- All sorts of other stuff
 - Molecular structures have a spatial component
 - Genomic data have an ordering component
 -

Information Visualization

- Information vis data are abstract facts, each a collection of *attributes*
 - Numeric, categorical/nominal, ...
- Overall goal is to convey relationships between facts
- For example, a list of movies, their directors and actors leads to...

Kevin Bacon Data

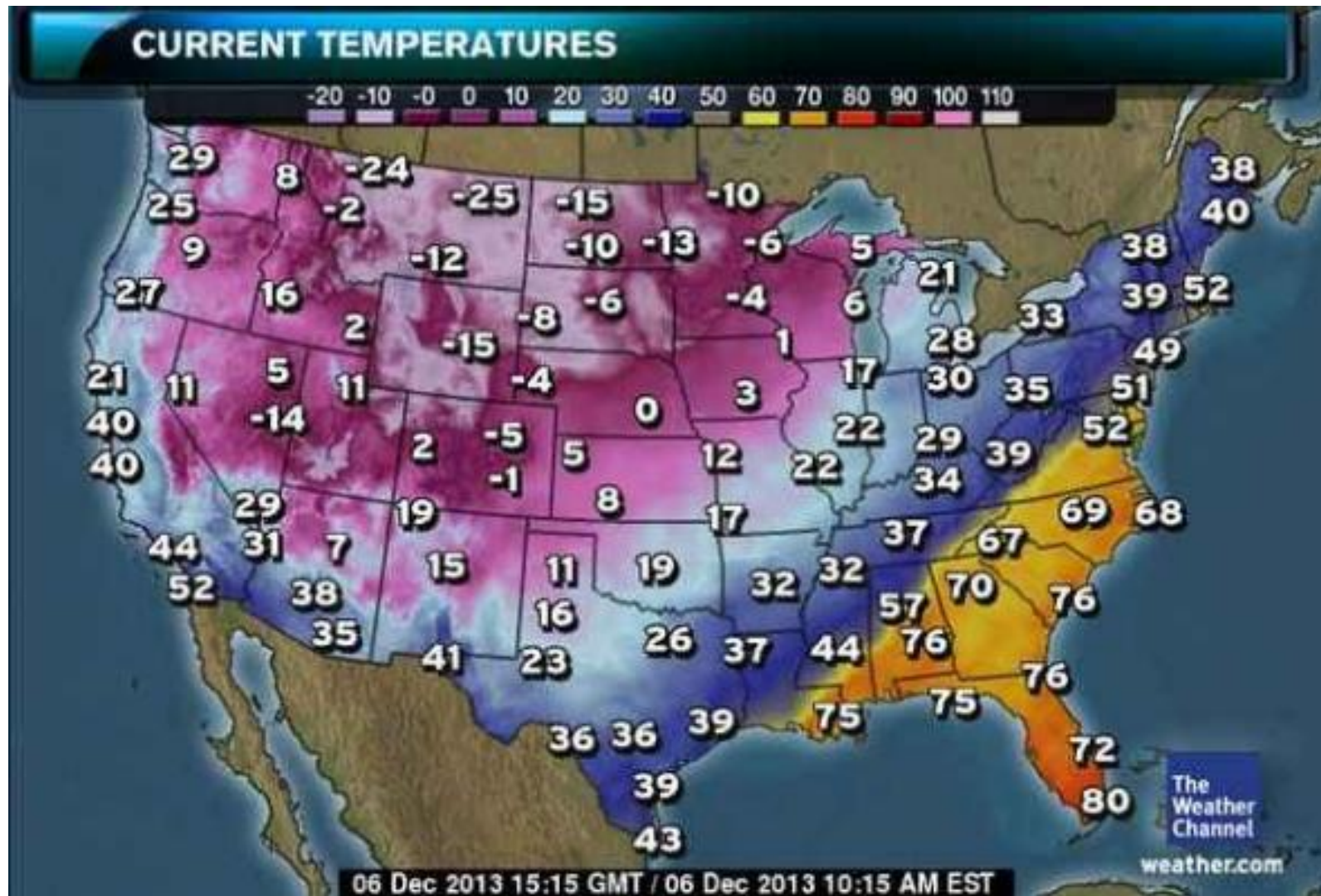
2 Degrees of Separation



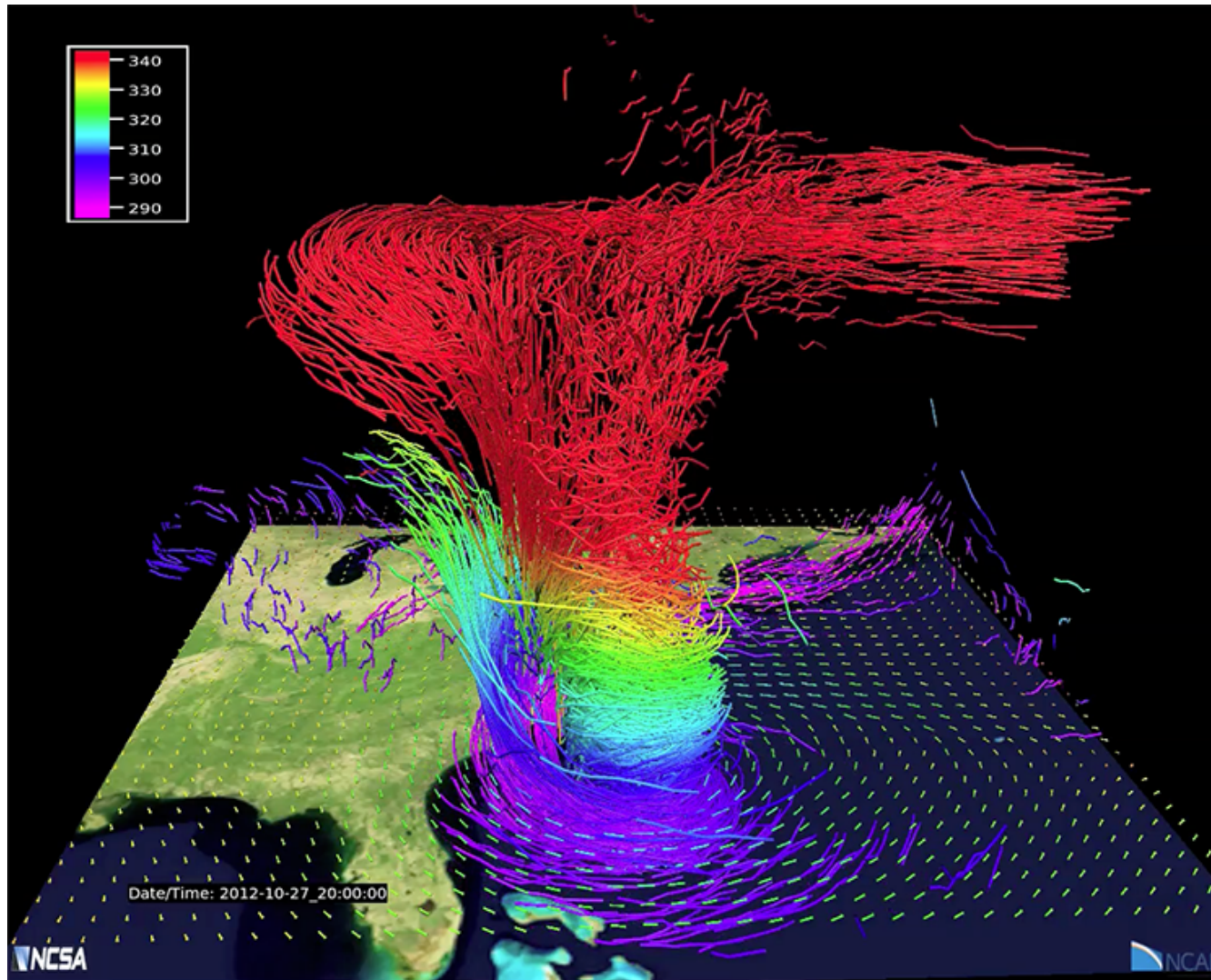
Scientific Visualization (with apologies)

- Data for *scivis* generally represents *physical* properties over *physical* spaces (plus time)
- For example, **weather data**
 - Physical space might be the the atmosphere over the south-east US, measured in latitude, longitude and altitude
 - Physical properties might be temperature, barometric pressure, wind direction and velocity etc.
 - $F(\text{lat}, \text{lon}, \text{alt}, \text{time}) \rightarrow (\text{temperature}, \text{pressure} \dots)$

A Visualization of Weather Data



A Visualization of Weather Data



Info/Sci Visualization vs. *Illustration*

Visualization

Gleans understanding from the data

Conveys understanding *of* the data

The data is the subject

Illustration

Conveys *ideas* visually

Can be data driven

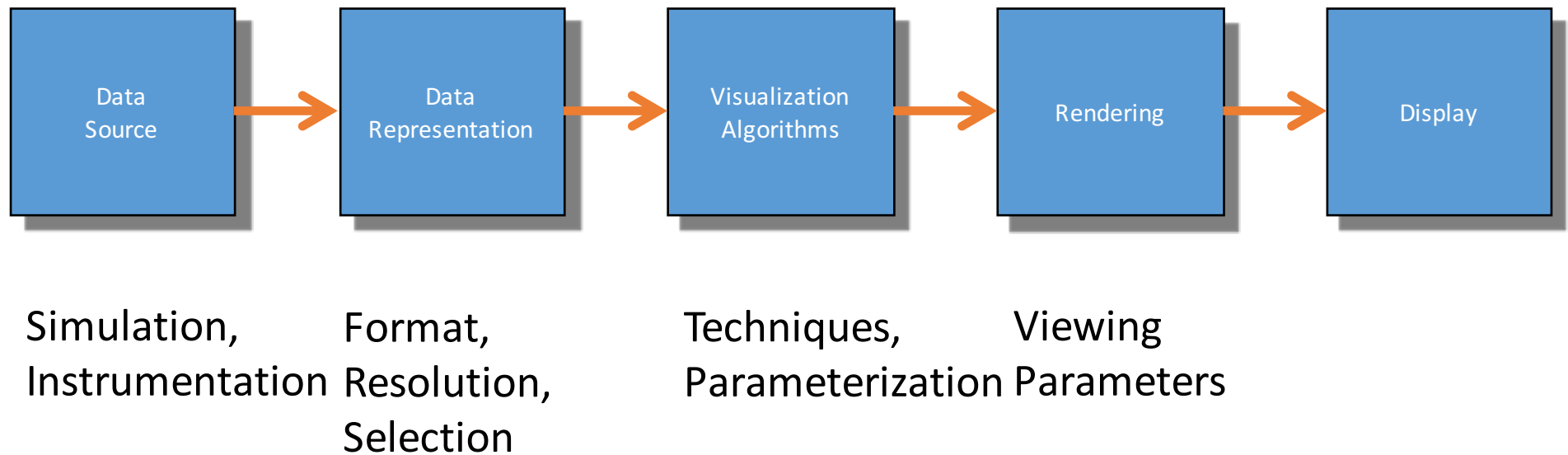
The *idea* is the subject



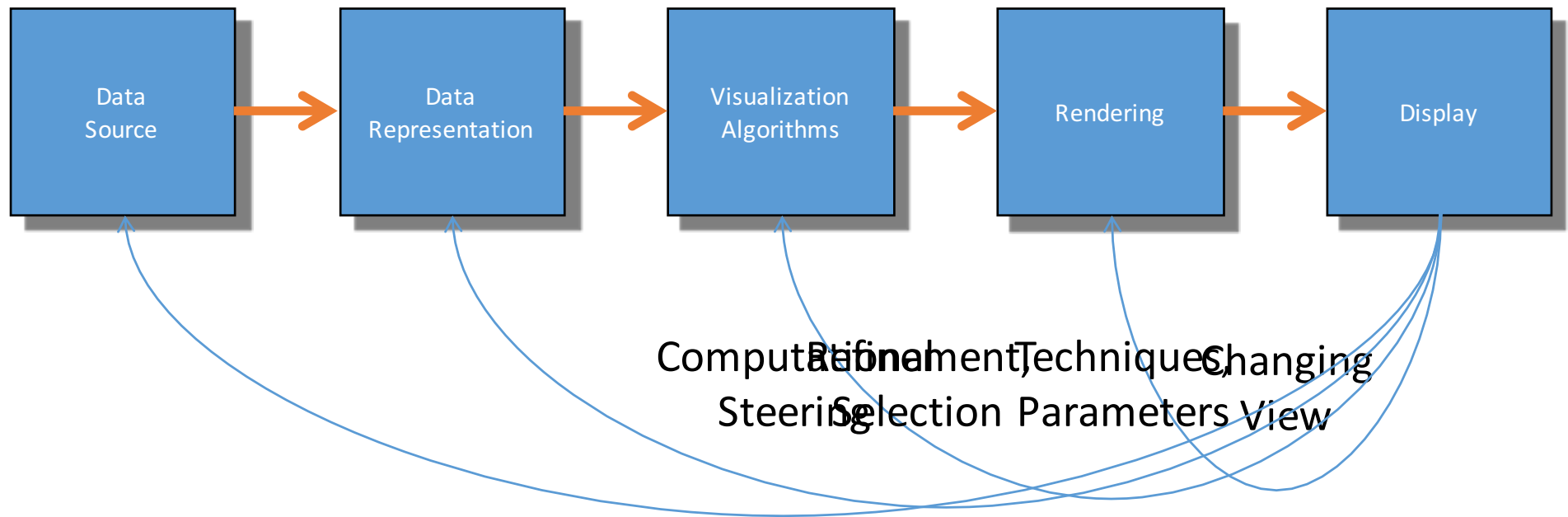
Illustrating Voyager 2 Saturn Flyby



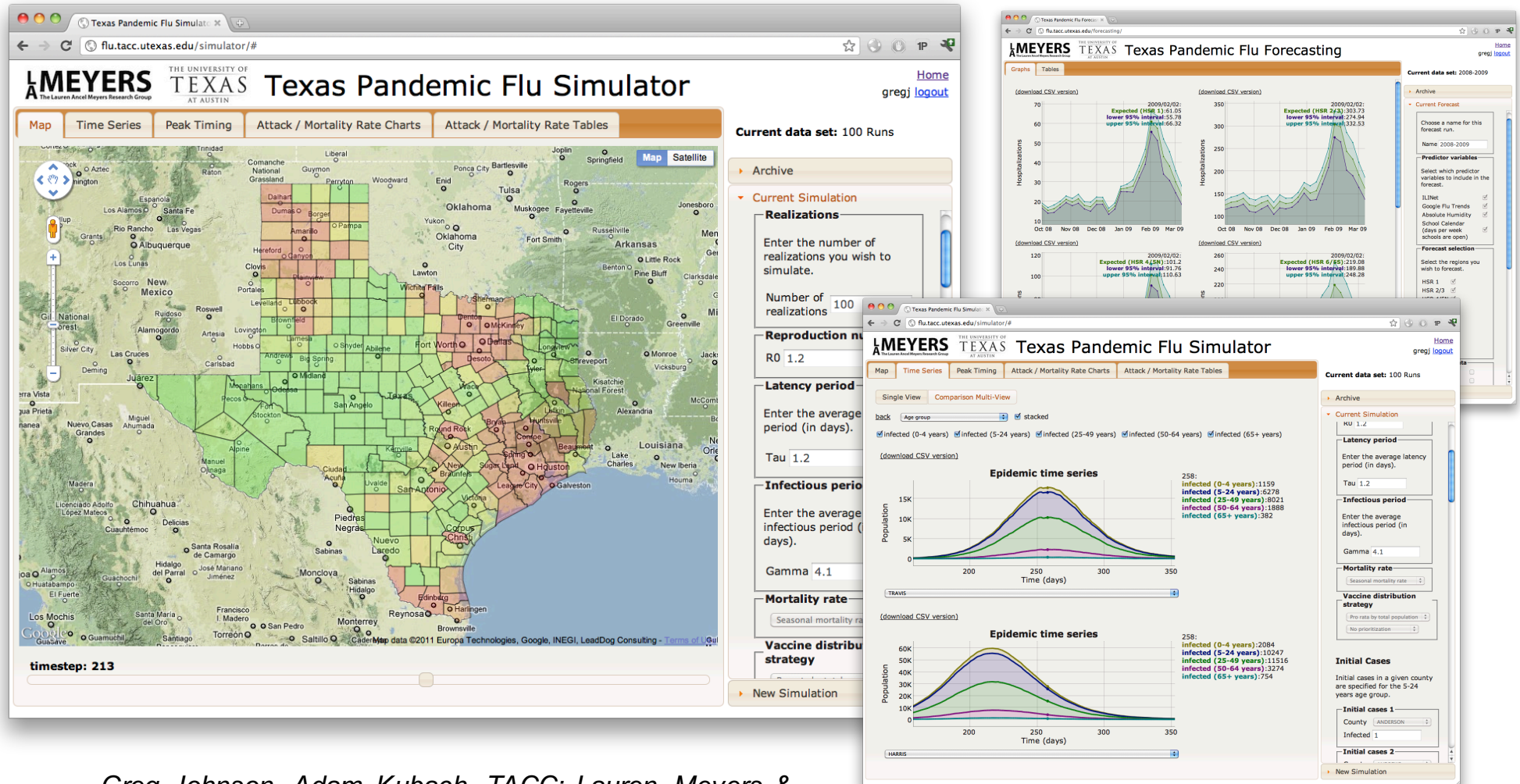
Forward Path from Data to Insight



Feedback: from Insight to Insight

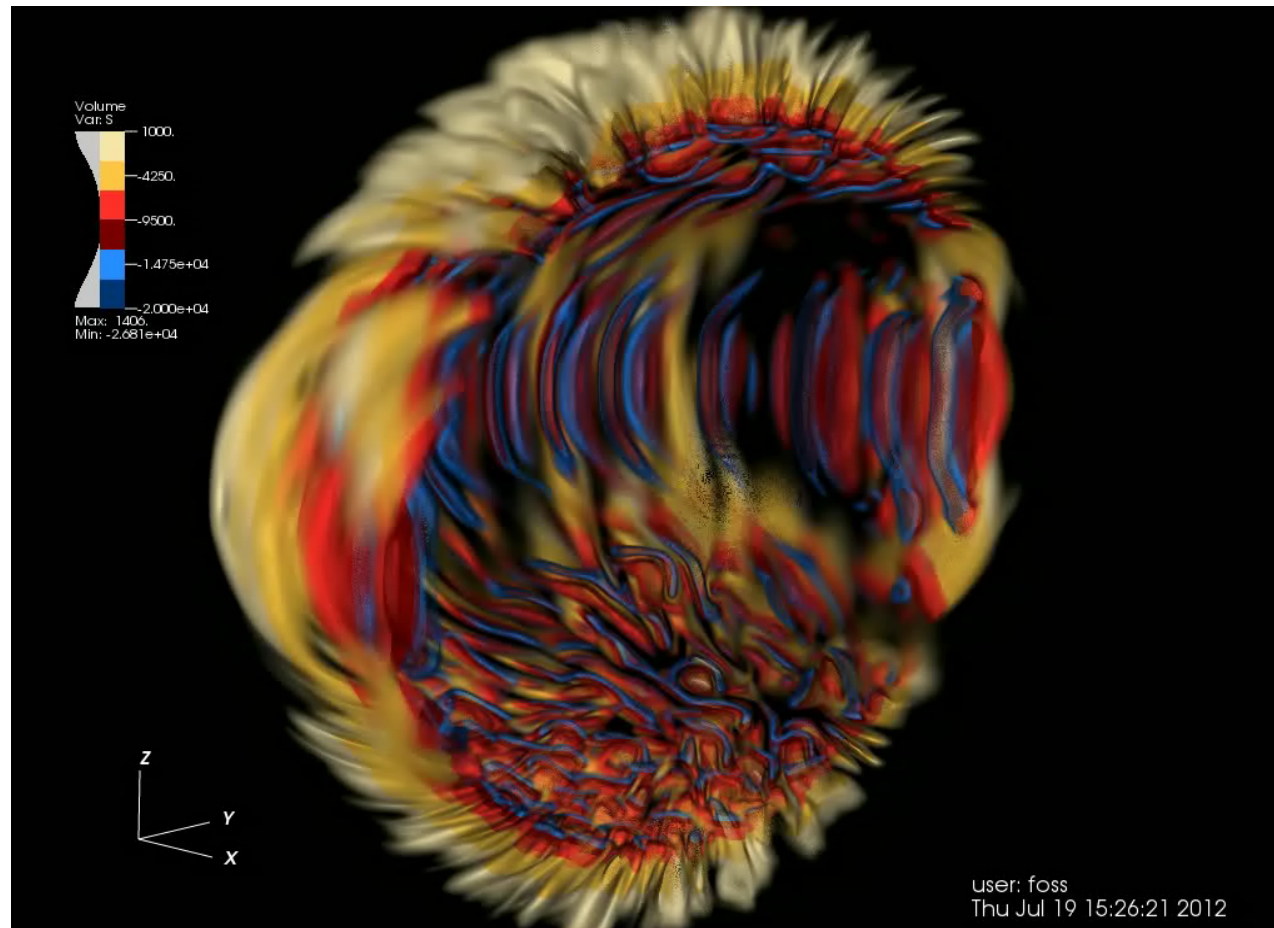


Texas Pandemic Flu Toolkit



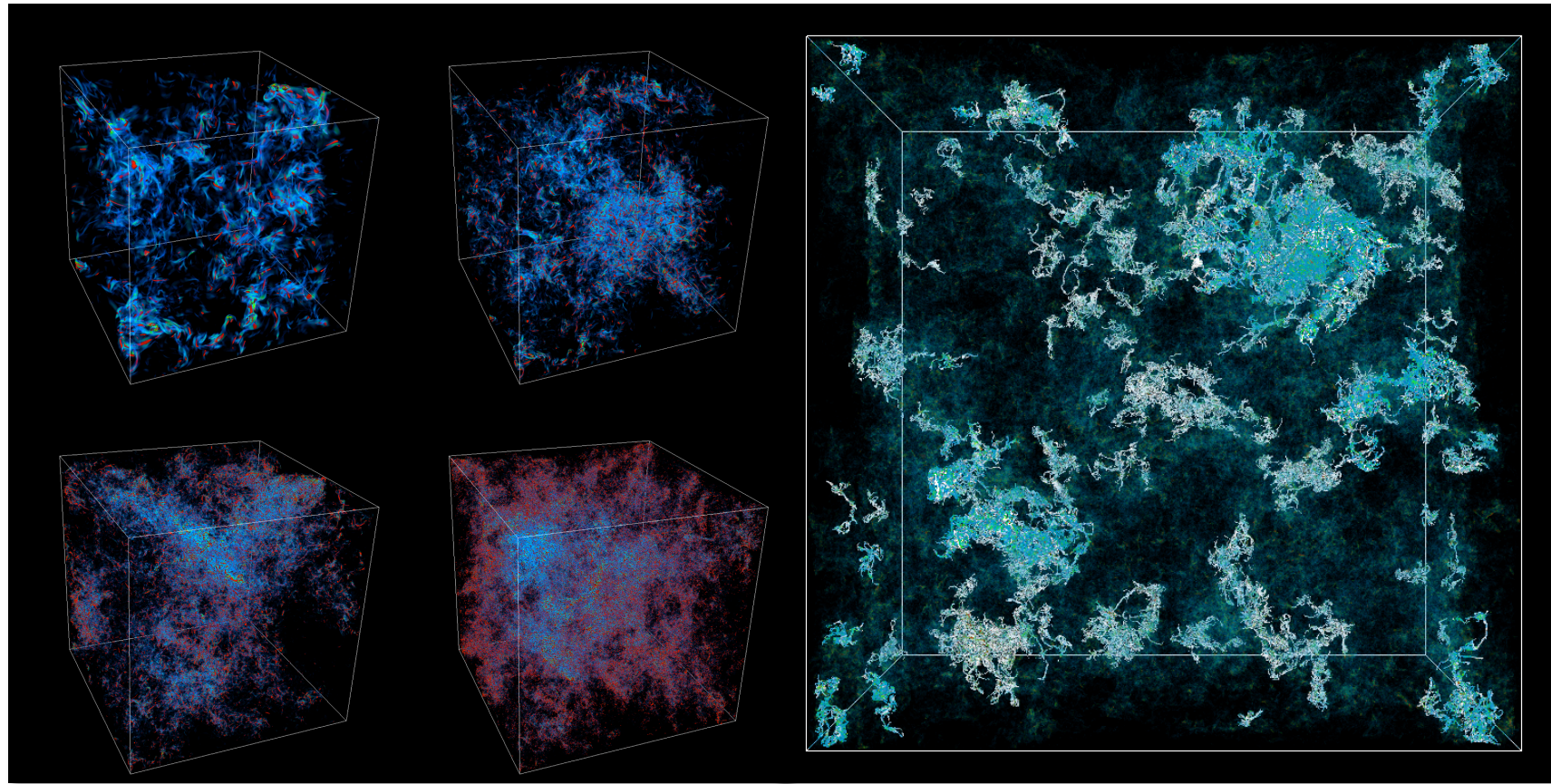
Greg Johnson, Adam Kubach, TACC; Lauren Meyers & group, UT Biology; David Morton & group, UT ORIE.

Stellar Magnetism



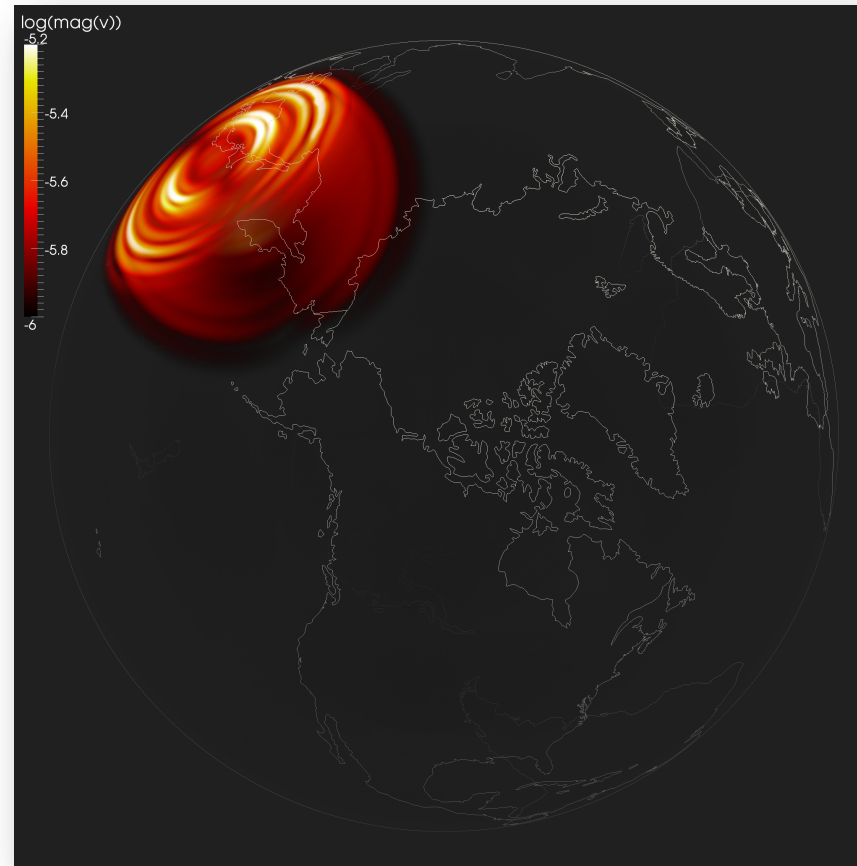
*Greg Foss, TACC; Ben Brown, University of Wisconsin,
Madison*

Visualization of Large Scale Turbulent Flow



Kelly Gaither, Hank Childs, Greg Johnson, Karl Schulz, Cyrus Harrison, Diego Donzis, Texas A&M; P.K. Yeung, Georgia Tech

Volume Visualization of Tera-Scale Global Seismic Wave Propagation



*Carsten Burstedde, Omar Ghattas, James Martin, Georg Stadler and Lucas Wilcox, ICES;
Greg Abram, TACC*

Thank you.

Questions