Introduction to Block Maxima

Flood Frequency Analysis PROSPECT

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Purpose

- Understand a fundamental technique in statistical hydrology

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Outline

1. Block maxima
2. Annual maximum series

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Block Maxima

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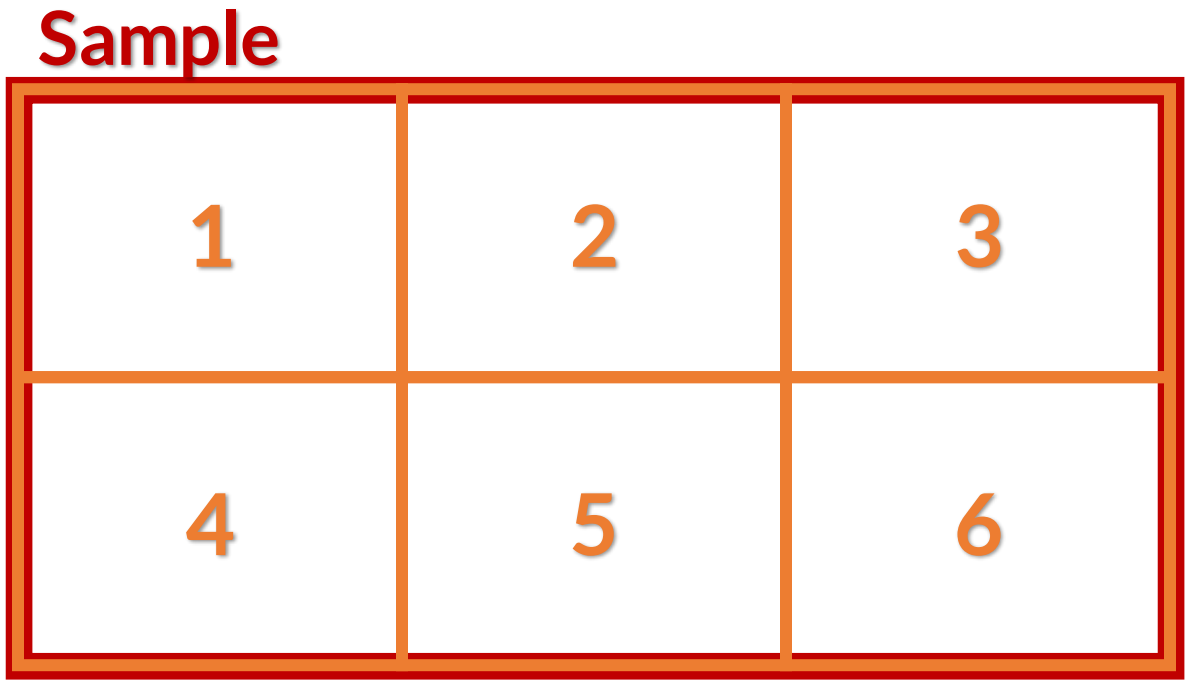
Block Maxima

- Break a sample into equal sized parts
  - Parts can't overlap
- Take the largest observation from each part



Block	Maximum Value
1	117.7
2	110.9
3	112.2
4	115.9
5	107.3
6	122.5

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Why?

- Helps with the “IID” assumption
  - Observations are:
    - Independent
    - Identically-distributed
- Lets us look at behavior of large observations (i.e. floods)
- The math is “friendly”

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Example

Kindergartners

Class 1	Class 2	Class 3
Class 4	Class 5	Class 6

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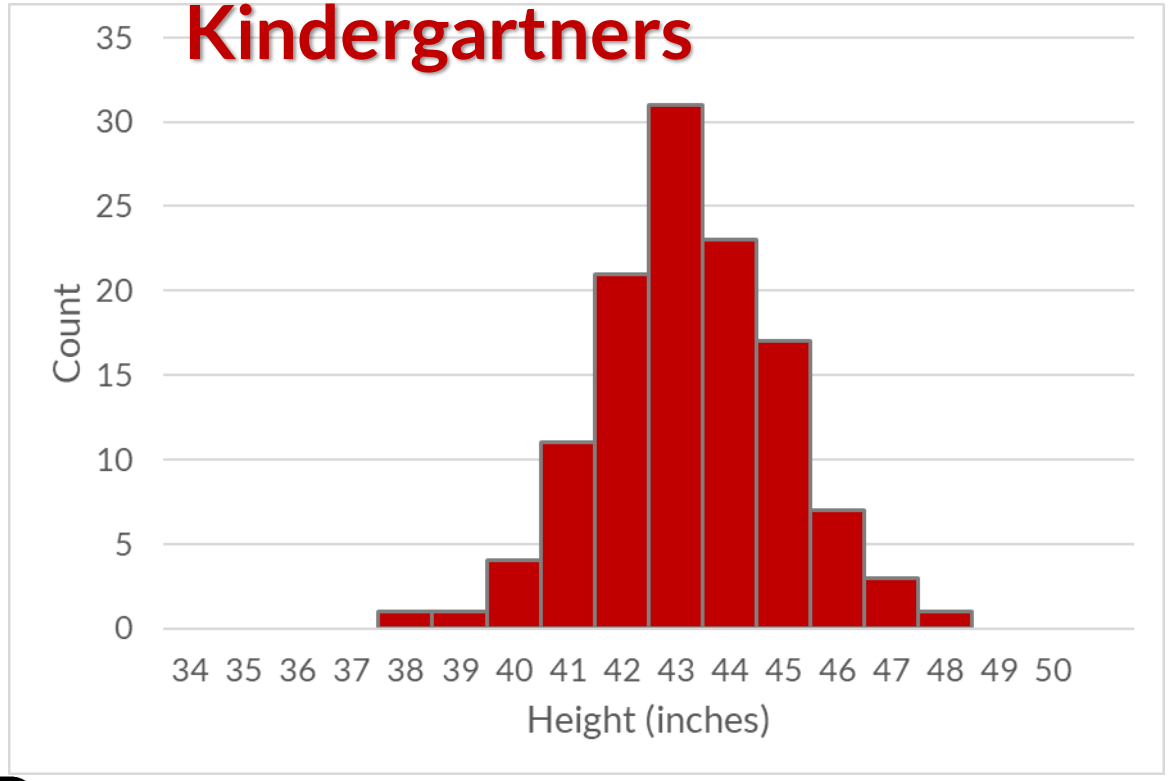
Each kindergartner has a height of N(42.8, 1.76) inches
20 children / class
Children are randomly assigned to a class

Example



Class	Max Height (in)
1	47.5
2	46.2
3	46.6
4	45.7
5	45.9
6	46.2

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Time Series Block Maxima

- Selected block size is a unit of time
- Blocks should be **homogeneous**
  - Make sure the largest value in each block means the same thing
  - If your process repeats with a regular cycle length, use that as the block size

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Annual Maximum Series

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Annual Maximum Series

- Block maxima where the groups are years
  - Water year
  - Calendar year
- Collect up the maxima and analyze them
- 1 observation per year

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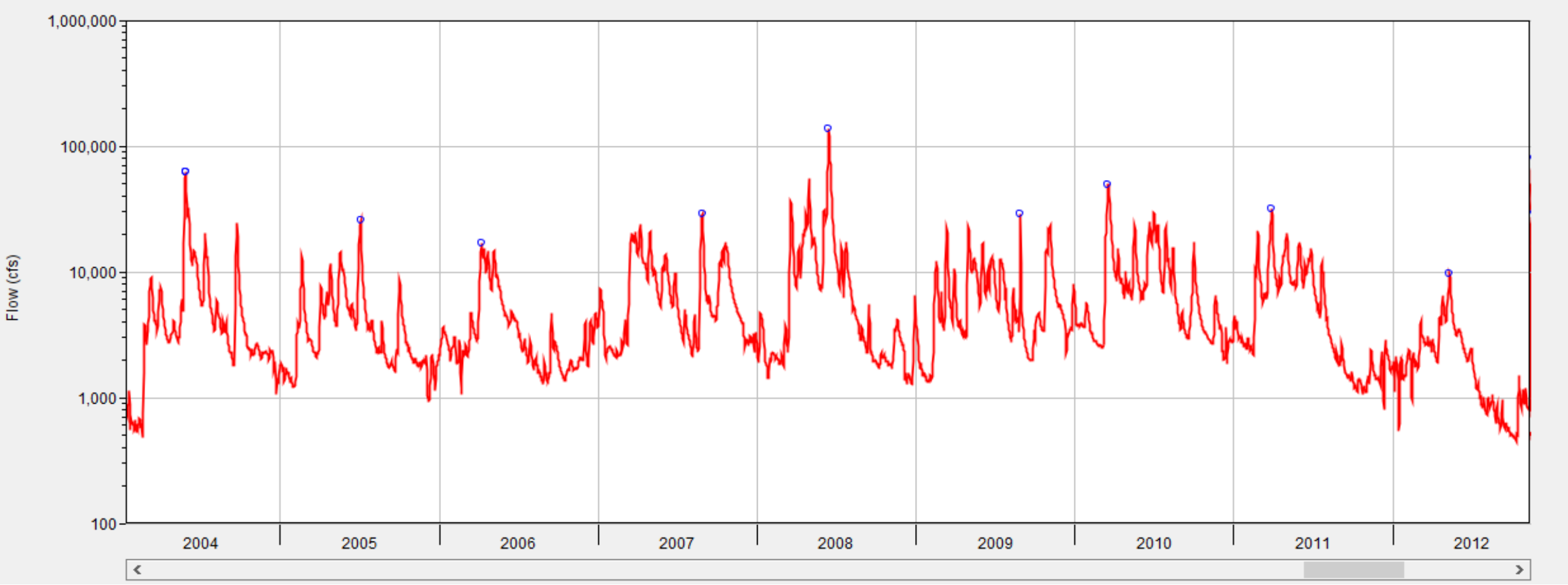

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Water Year

- Split the year during the driest part
- Make sure one flood event doesn't create maximum in two years
- October 1st is the traditional break point
- Check your flow record!

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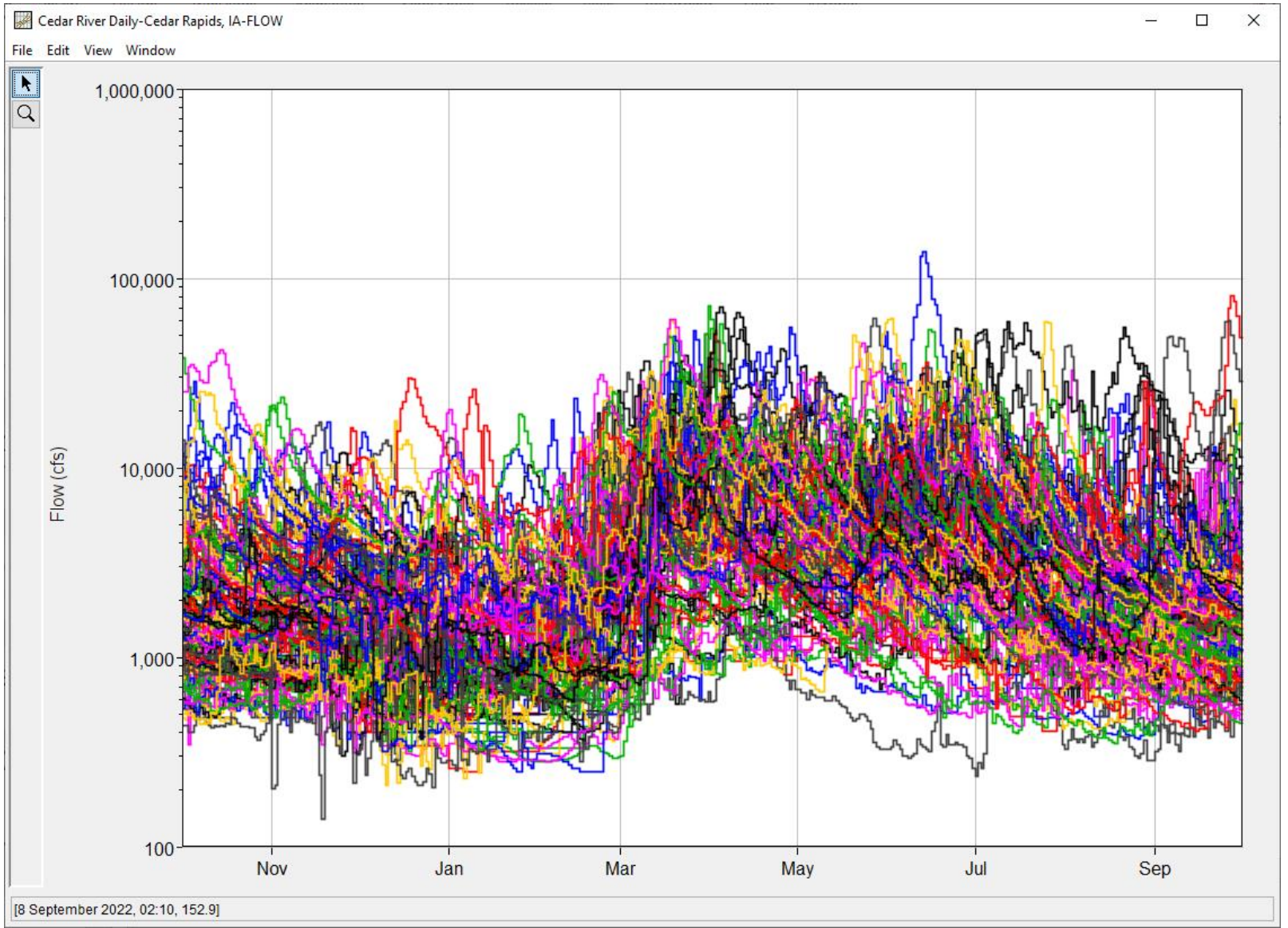
Year-Over-Year Plot



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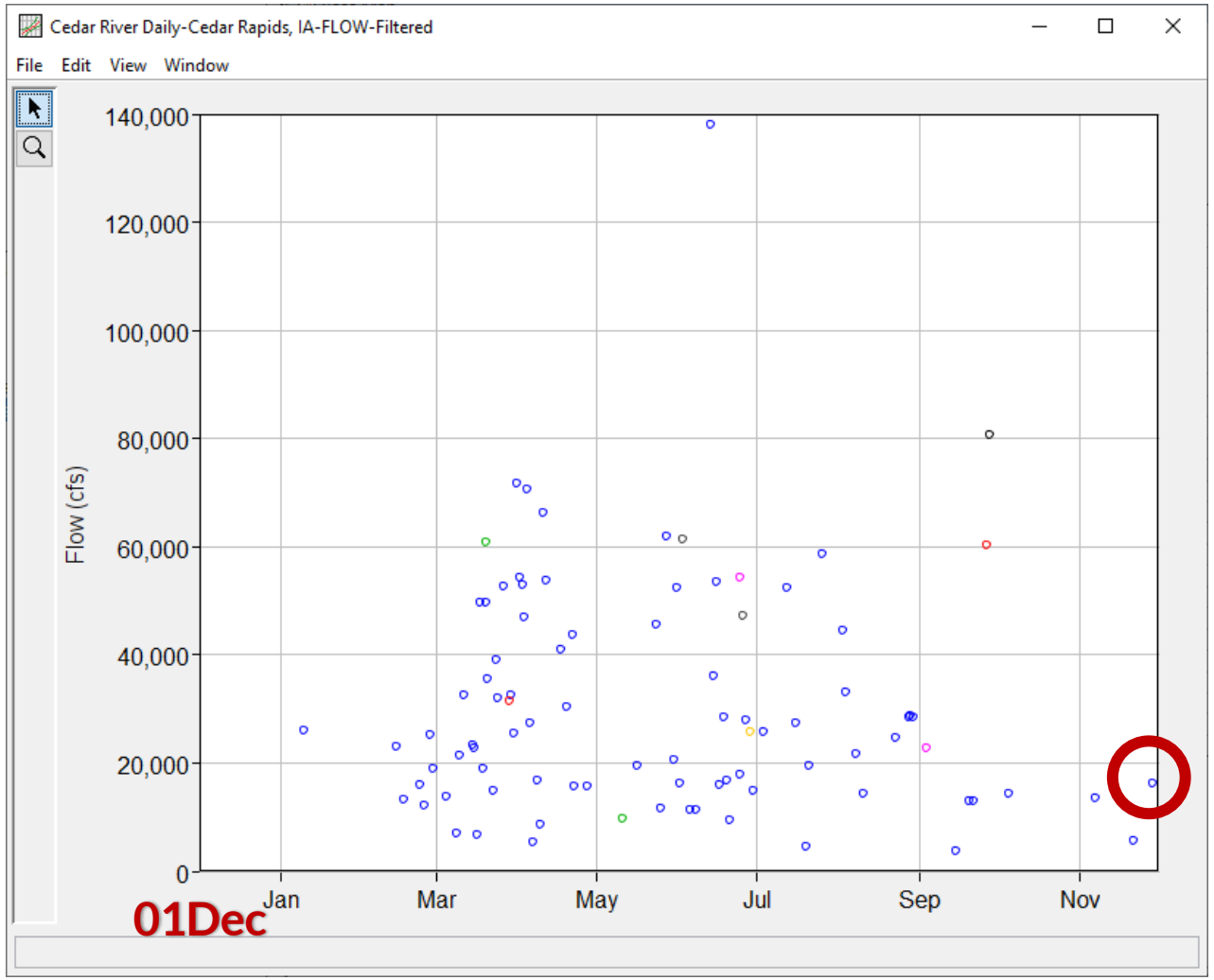
Water Year



/Cedar River/Cedar Rapi...

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Ordina...	Date	Time	Cedar Rive... FLOW USGS
20	27 Feb 1922	24:00	19,000
21	04 Apr 1923	24:00	15,700
22	22 Aug 1924	24:00	24,500
23	18 Jun 1925	24:00	12,200
24	21 Sep 1926	24:00	9,450
25	25 May 1927	24:00	11,500
26	29 Aug 1928	24:00	28,500
27	18 Mar 1929	24:00	59,600
29	28 Nov 1931	24:00	16,300
30	02 Apr 1932	24:00	18,600
32	09 Apr 1934	24:00	8,440
33	08 Mar 1935	24:00	25,800
34	15 Mar 1936	24:00	22,700
35	09 Mar 1937	24:00	36,300
36	21 Sep 1938	24:00	12,800
37	18 Mar 1939	24:00	18,800
38	21 Nov 1940	24:00	5,440
39	06 Nov 1941	24:00	13,400
40	03 Aug 1942	24:00	32,900
41	31 Mar 1943	24:00	15,400
42	18 Jun 1944	24:00	28,400
43	19 Mar 1945	24:00	49,600
44	09 Jan 1946	24:00	26,000
45	15 Jun 1947	24:00	53,300
46	20 Mar 1948	24:00	32,500
47	08 Mar 1949	24:00	28,500
48	11 Mar 1950	24:00	32,400

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Limitations

- Non-maximum events in a year can be larger than annual maxima
- Some small annual maximum events will not be floods

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Questions?

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