L04: Arrays

Create and manipulate arrays

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Version: release

Announcements

My teaching style combines lecture and discussion (for a more interactive and engaging experience). I will, however, try to:

- Cover the most fundamental topics on Mondays and Wednesdays
- Cover "advanced" topics on Fridays

Today:

- Arrays

Friday:

- More on functions (subfunctions, nested functions, anonymous functions, function handles)
- Give me feedback! (written, with drop box)

Lab 01 due on Friday (January 27^{th} at 12 pm)
Lab 02 (posted tomorrow): step up in difficulty and length

Gridded data in science and engineering

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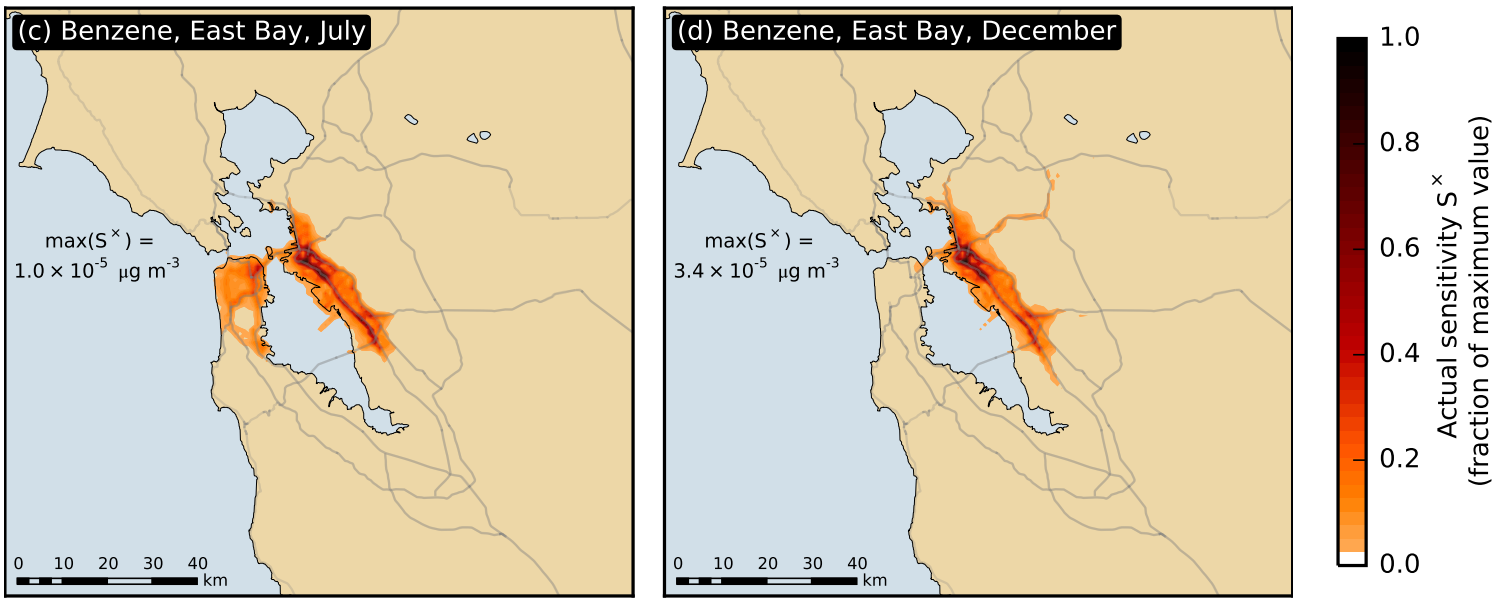

Figure from Bastien et al. (2015) *Environmental Science & Technology*, 49, 7276–7284 (copyright: ACS)

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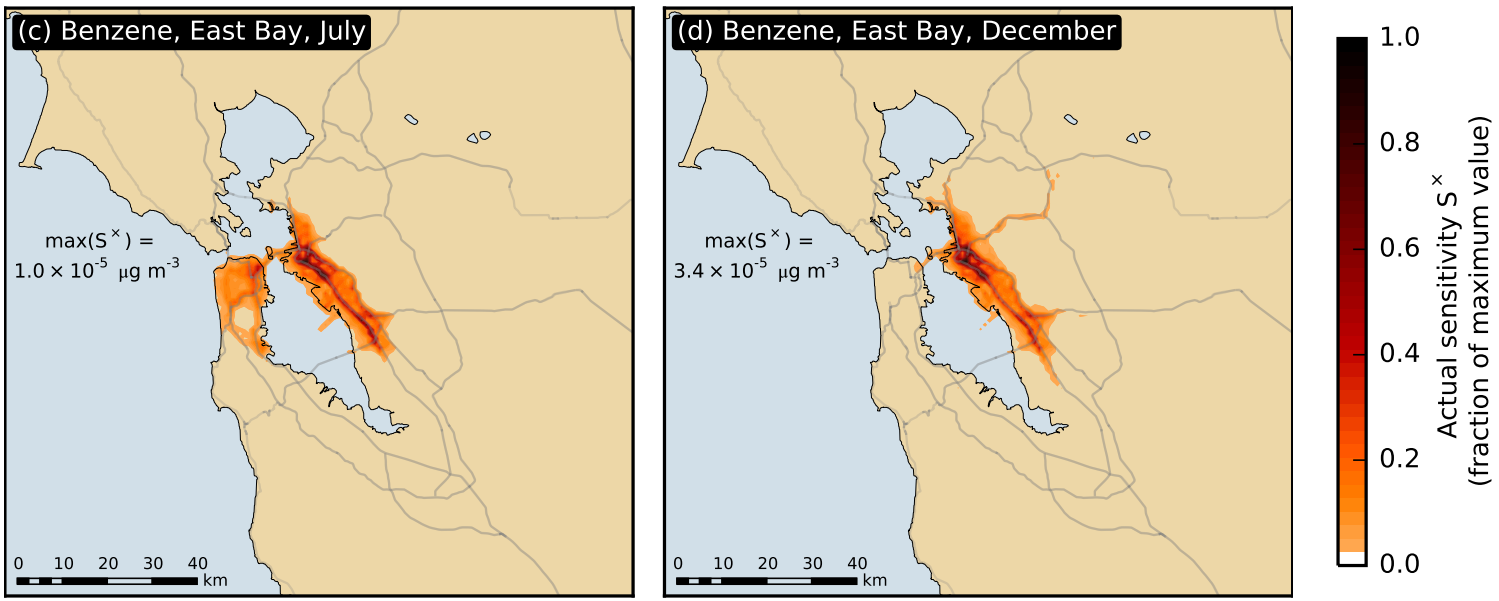

→ **It is important to know how to create and manipulate arrays of data using computer programming**

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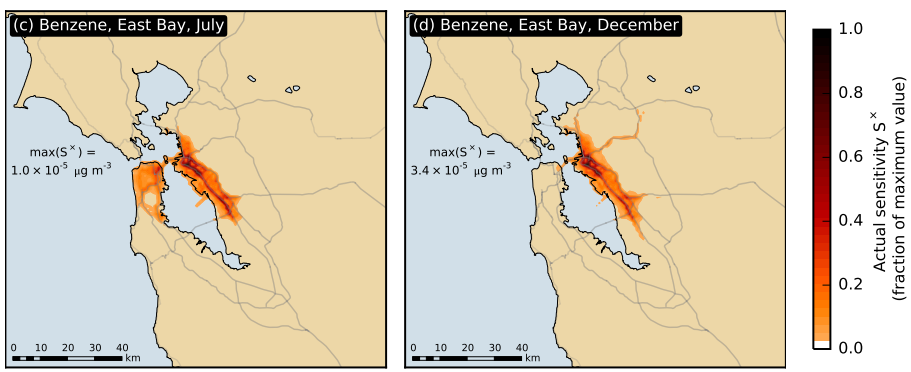
Computer programming in science and engineering

Some of the steps* involved in creating this figure:

- Understand how the atmosphere behaves
- Understand how atmospheric pollutants behave
- Translate this understanding into mathematical equations
- Derive numerical methods to "solve"** these equations***
- Write computer programs that implement these methods***
- Write computer programs to analyze and visualize the data obtained from previous steps***

*: taken by me or from previous research

**: here, "solve" means "find approximate solutions"



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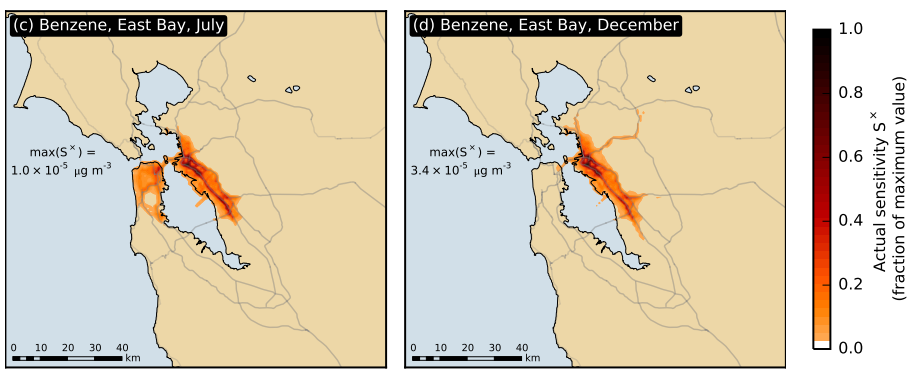
***: **topics discussed in E7!**



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   - Announcements
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2. I will write a lot of commands at the Matlab command prompt to show you how to create and manipulate arrays
   - The diary (separate PDF file) summarizes what we are going to cover today, and provides additional information. **You must understand and be able to apply the information presented in this diary**

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3. There will be practice questions on arrays

Questions on arrays

Consider the following two arrays:

```
>> a = [2, 4, 5; 3, 0, 1];
>> b = [7, 0; 10, 10];
```

Which of the following command(s) do(es) not make Matlab throw an error when executed?

(A) [a; b]

(B) [a, b]

(C) a .* b

(D) a(:, 1:end-1) .* b

(E) a(1:end-1, :) .* b

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Questions on arrays

Consider the following array:

```
>> a = [2, 5, 7, -4, 5; -1, -5, 8, -2, 4]
   a =
        2       5       7      -4       5
       -1      -5       8      -2       4
```

Which of the following commands can be used to change all negative elements of the array into zeros?

(A) $\mathrm{a} = \mathrm{a} .* (\mathrm{a} >= 0)$

(B) $\mathrm{a}([2, 4, 7, 8]) = 0$

(C) $\mathrm{a}(\mathrm{a} < 0) = 0$

(D) All of the above

(E) None of the above

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```

Which of the following commands can be used to change all negative elements of the array into zeros?

(A) $a = a .* (a >= 0)$

(B) $a([2, 4, 7, 8]) = 0$ ← **Linear indexing**

(C) $a(a < 0) = 0$

(D) All of the above

(E) None of the above

Questions on arrays

Consider the following array:

```
>> a = [2, 3, 7, 0; 4, 7, 1, -4]
   a =
        2       3       7       0
        4       7       1      -4
```

What is the value of mean(min(a))?

(A) 0.5

(B) 2

(C) -2

(D) $[2, 3, 1, -4]$

(E) $[3, 5, 4, -2]$

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```

What is the value of mean(min(a))?

(A) 0.5

(B) 2

(C) -2 ← **min(mean(a))**

(D) $[2, 3, 1, -4]$ ← **min(a)**

(E) $[3, 5, 4, -2]$ ← **mean(a)**

Questions on arrays

Consider the following array:

```
>> a = [-2, 0, 7, 10; 5, -2, 0, -2]
   a =
        -2      0      7     10
         5     -2      0     -2
```

Which of the following command(s) would return, if executed, the number of times the minimum element of the array (-2) appears in the array (3 times)?

(A) numel(min(a))

(B) sum(min(a))

(C) numel(a(a == min(min(a))))

(D) sum(a == min(min(a)))

(E) sum(sum(a == min(min(a))))

Questions on arrays

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