

L04: Arrays

Create and manipulate arrays

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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)

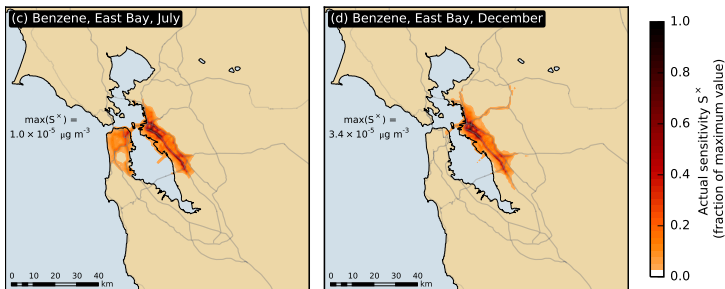
Lab 01 due on Friday (January 27th at 12 pm)

Lab 02 (posted tomorrow): step up in difficulty and length

Gridded data in science and engineering

Gridded data (i.e. data in arrays) are **common in science and engineering**, often used to represent space- and/or time-varying data

For example: sources that contribute to benzene air pollution in the East Bay at 1 km horizontal resolution



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

Computer programming in science and engineering

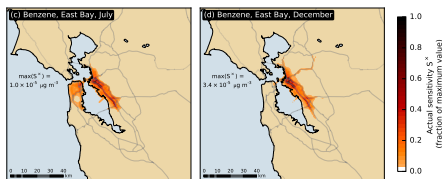
Some of the steps* involved in creating this figure:

- ▶ 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”

***: topics discussed in E7!



Format of today's lecture

1. These slides contain:
 - ▶ Announcements
 - ▶ Background information and motivations
 - ▶ Practice questions
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**
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`

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) $a = a .* (a \geq 0)$

(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]

← `min(mean(a))`

← `min(a)`

← `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))))