

Climate Change Factors (quick review)

Climate Prediction

Feedback Mechanisms

Climate Simulations
- net logo



Climate Change Factors

External

Solar Variations

- Orbital Patterns
- Sunspots

Solid Earth Variations

- Position of Plates
- Spreading Rates
- Volcanism

Internal

Atmosphere Variations

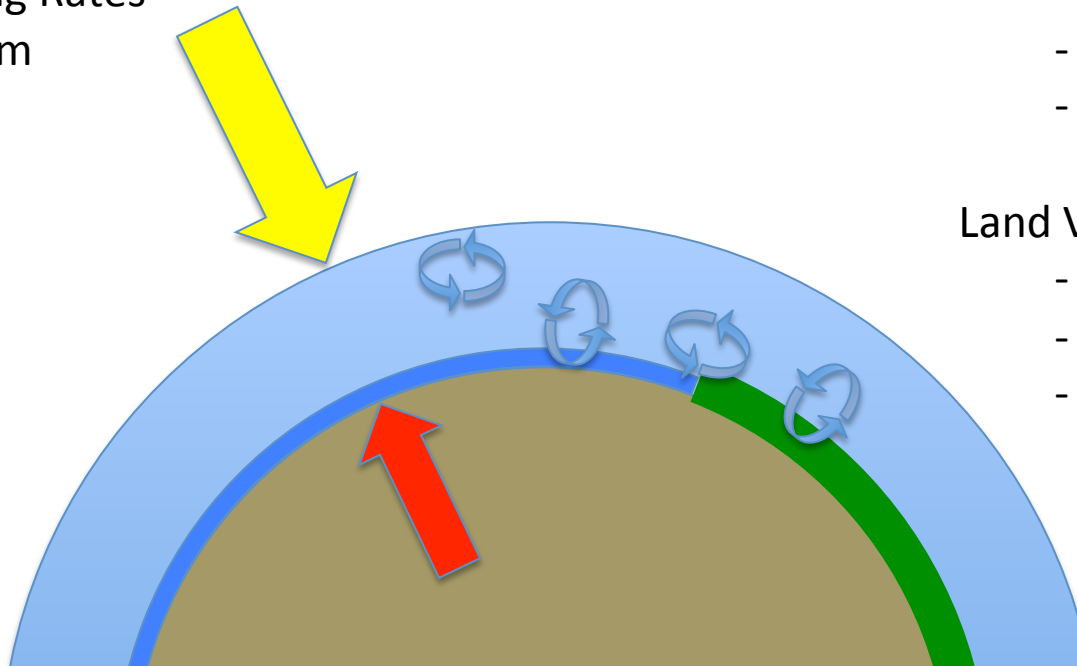
- Clouds
- Winds
- Composition

Ocean Variations

- Ocean Circulation
- Composition
- Ice Cover

Land Variations

- Land use
- Sea Level
- Vegetation



How will an increase in clouds impact global climate ????

Think-Pair-Share

- Create causal chain (e.g., clouds increase => cause A => cause B => cause C)
- Hint: think temperature & evaporation

Clouds Increase

=> Earth cooler during day
=> Less evaporation
=> **Clouds decrease**
=> Earth warms
=> More evaporation
=> **Clouds increase**

Negative Feedback

Clouds Increase

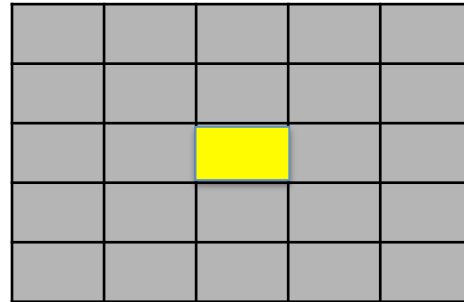
=> Earth warmer at night
=> More evaporation
=> **Clouds increase**
=> Earth warmer at night
=> More evaporation
=> **Clouds increase**

Positive Feedback

Feedback Mechanisms

Activity

Model Earth



Step 1

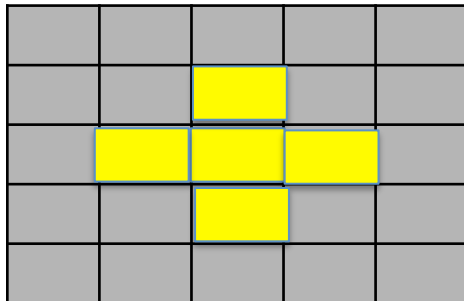
- Place yellow post-its (i.e., daisies) on any grid cell

Repeat Step 2

Step 2

- Count no. of daisies & record on graph

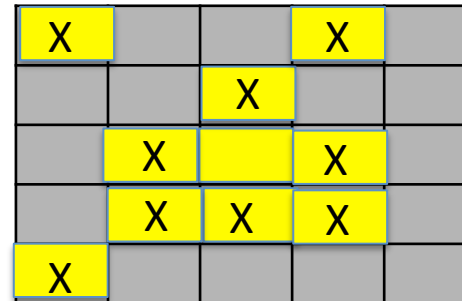
If no. daisies < 10



Step 3a

- Place new daisies next to existing daisies

If no. daisies ≥ 10



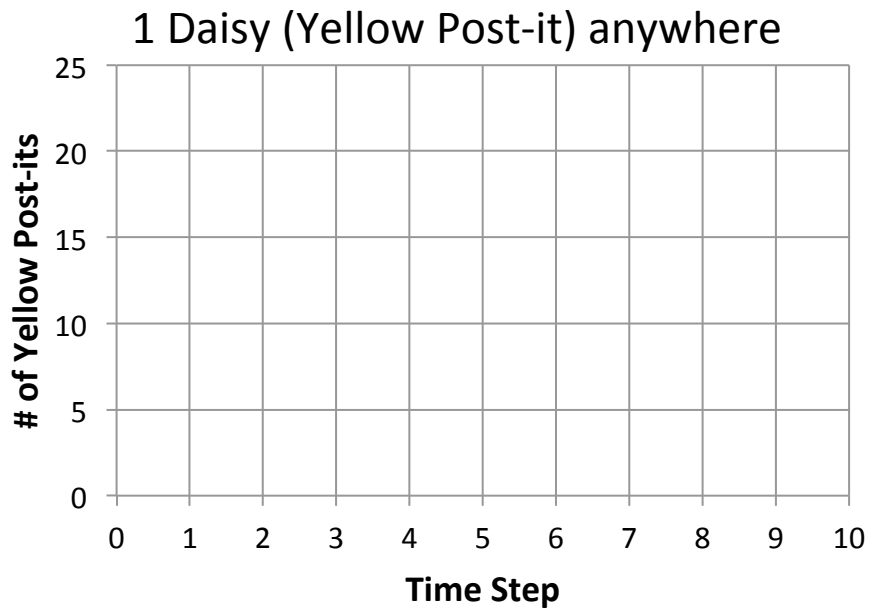
Step 3b

- Remove daisies adjacent to gray grid

Repeat Step 2

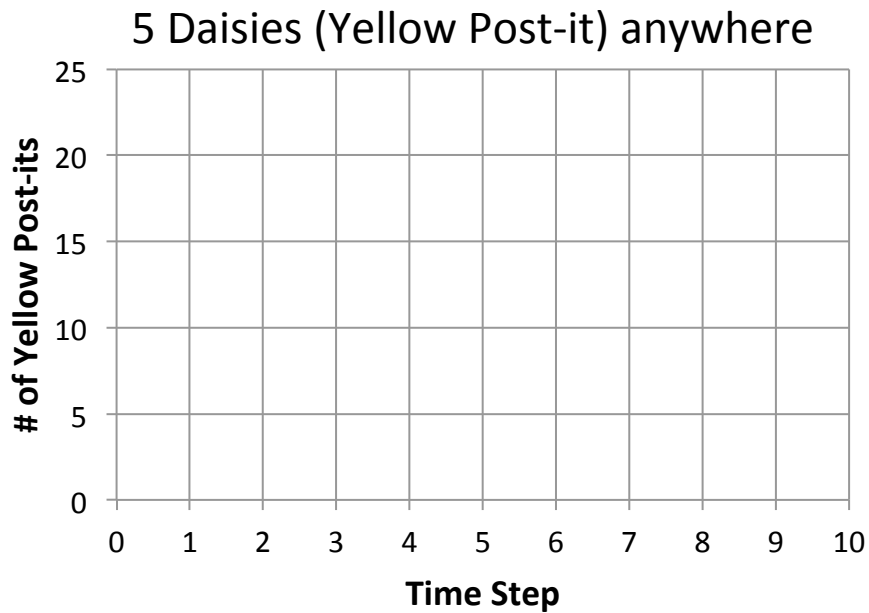
1 Daisy (Yellow Post-it) anywhere

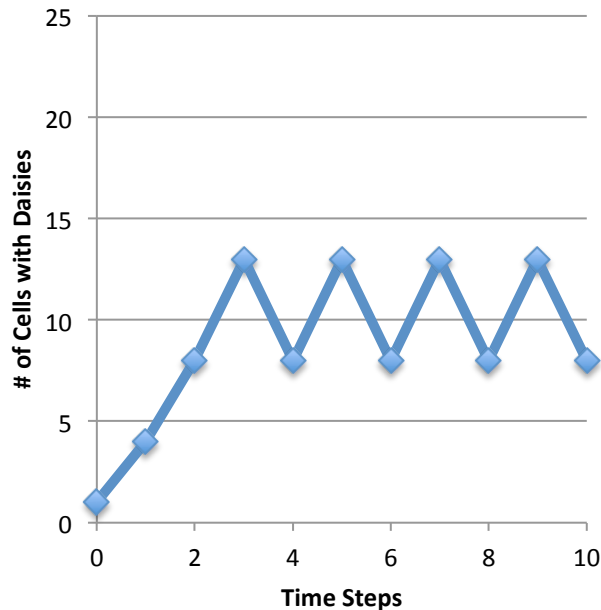
Time Step	# of Yellow Post-its
0	
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	



5 Daisies (Yellow Post-it) anywhere

Time Step	# of Yellow Post-its
0	0
1	0
2	0
3	0
4	0
5	0
6	0
7	0
8	0
9	0
10	0





Daisies Increase

=> Increase Albedo (reflectivity)

=> Earth cools

=> **Temp. still good for daisies, so daisies increase**

=> Increase Albedo

=> Earth cools

=> **Temp. bad for daisies, so daisies decrease**

=> Decrease Albedo

=> Earth warms

=> **Temp. good for daisies, so daisies increase**

Clouds Increase

=> Earth cooler during day

=> Less evaporation

=> **Clouds decrease**

=> Earth warms

=> More evaporation

=> **Clouds increase**

Clouds Increase

=> Earth warmer at night

=> More evaporation

=> **Clouds increase**

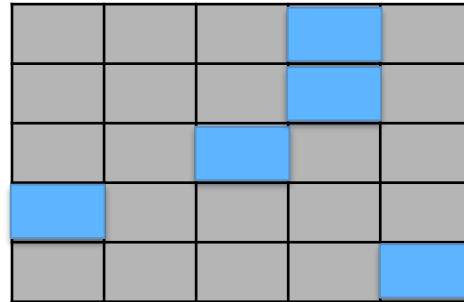
=> Earth warmer at night

=> More evaporation

=> **Clouds increase**

Activity

Model Earth



Step 1

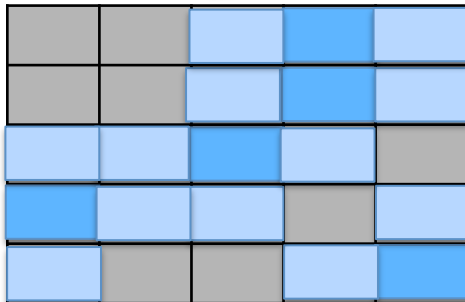
- Place 5 blue post-its (i.e., glaciers) on any grid cell

Repeat Step 2

Step 2

- Count no. of glaciers, negate & record on graph

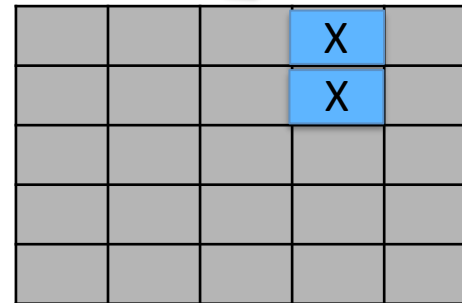
If -glaciers < minimum T (-2)



Step 3a

- Place new glaciers next to existing glaciers

If -glaciers $\geq$ minimum T (-2)

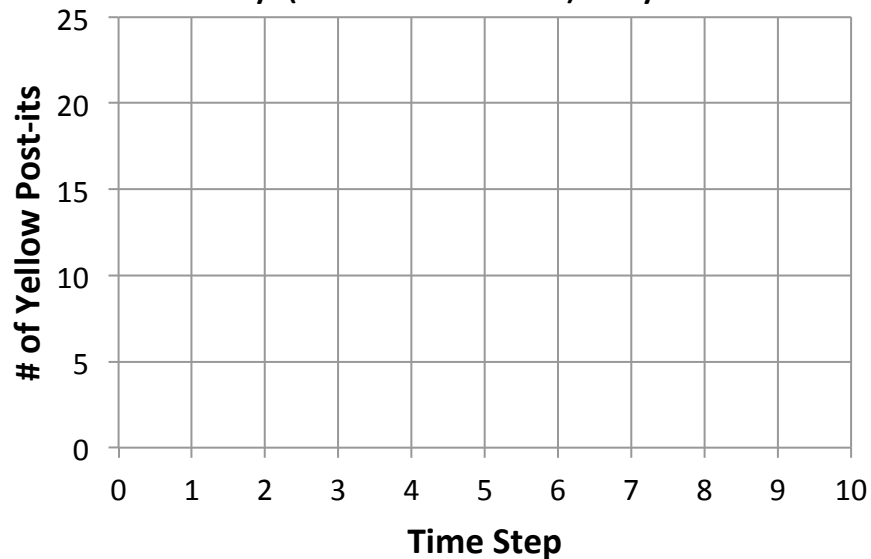


Step 3b

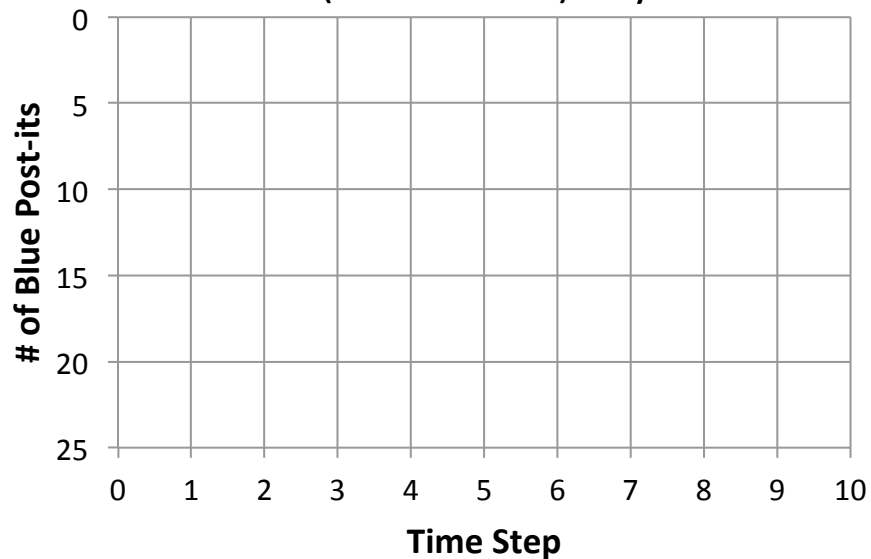
- Remove glaciers adjacent to gray grid

Repeat Step 2

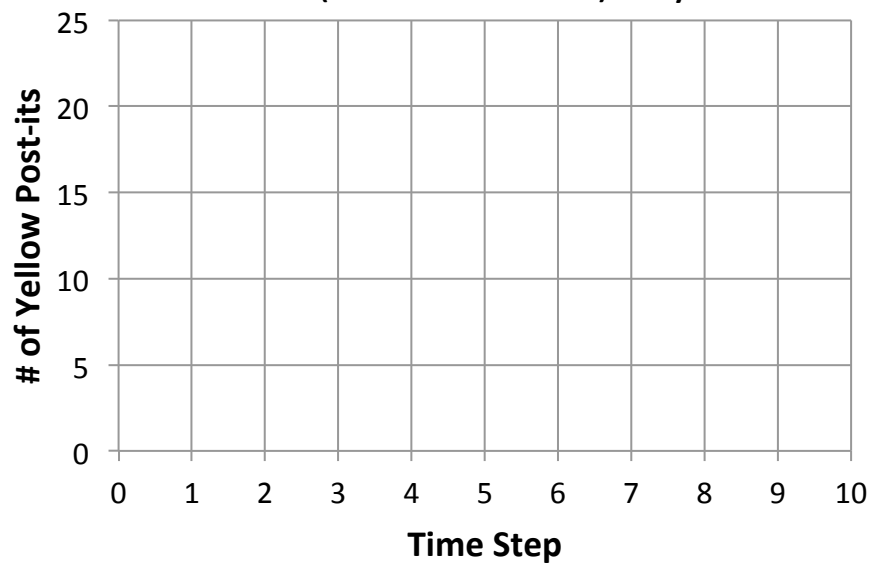
1 Daisy (Yellow Post-it) anywhere



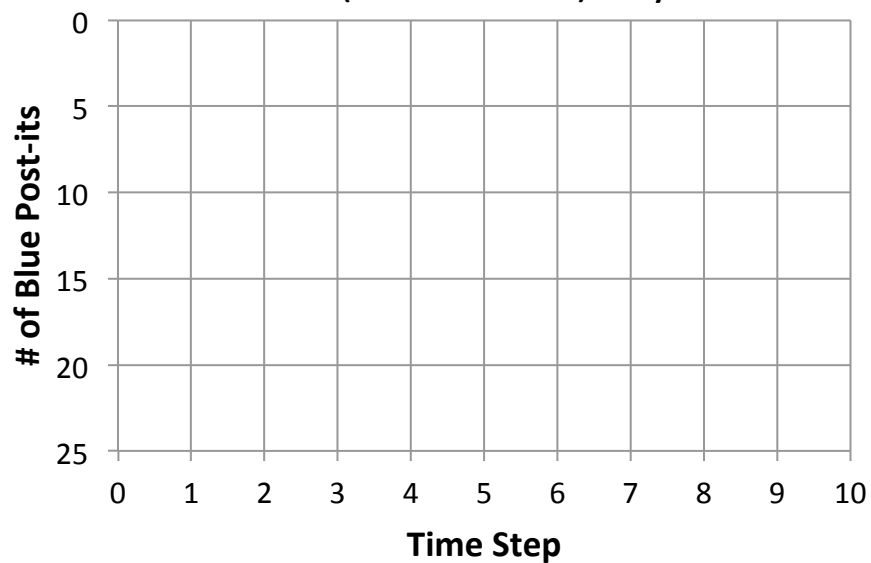
1 Glacier (Blue Post-it) anywhere

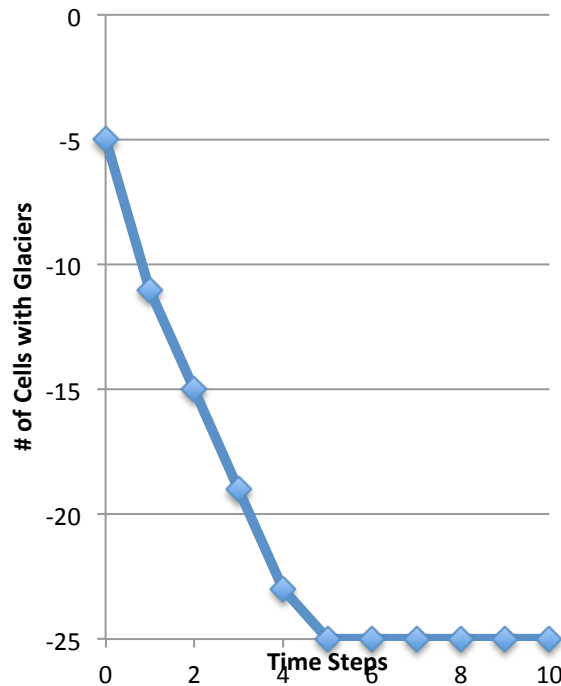


5 Daisies (Yellow Post-it) anywhere



5 Glaciers (Blue Post-it) anywhere





Glaciers increase

=> Increase Albedo (reflectivity)

=> Earth cools

=> **More ice formation, glaciers decrease**

=> Increase Albedo

=> Earth cools

=> **More ice formation, glaciers decrease**

=> Increase Albedo

=> Earth cools

=> **More ice ice formation, glaciers decrease**

Clouds Increase

=> Earth cooler during day

=> Less evaporation

=> **Clouds decrease**

=> Earth warms

=> More evaporation

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Clouds Increase

=> Earth warmer at night

=> More evaporation

=> **Clouds increase**

=> Earth warmer at night

=> More evaporation

=> **Clouds increase**

Feedback Mechanisms

Impact of present actions on future conditions

Causal Chains

1) Gas Prices

2) Interest on Savings

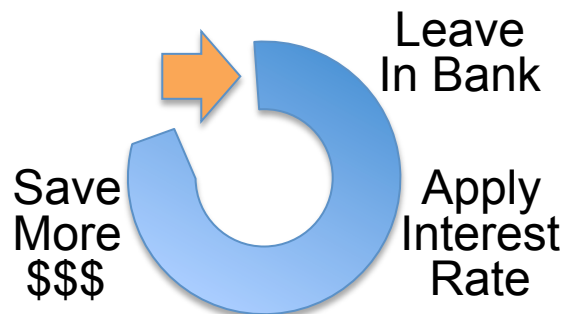
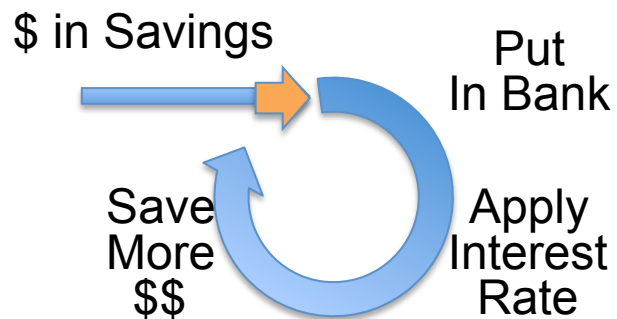
3) Not Paying Credit Card Bills

Feedback Mechanisms

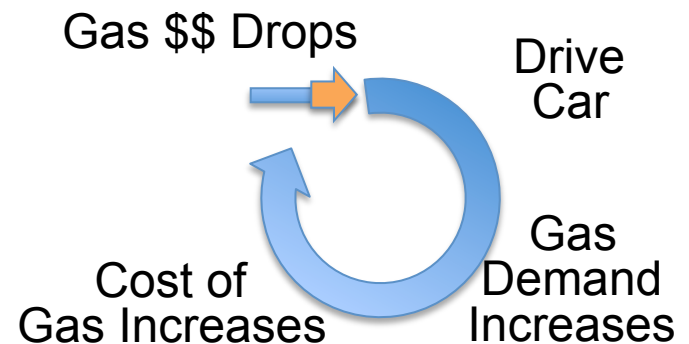
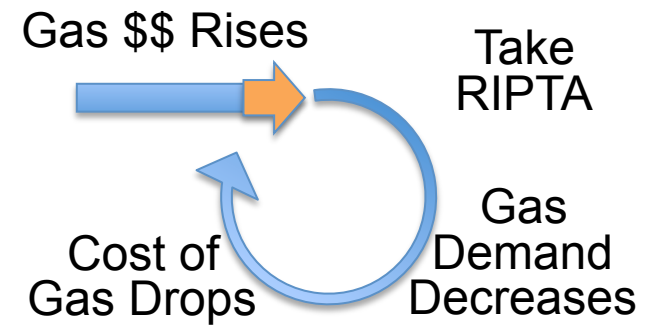
Feedback Mechanisms

Impact of present actions on future conditions

Positive => amplifies change
(e.g., interest rates)



Negative => minimizes change
(e.g., supply & demand)



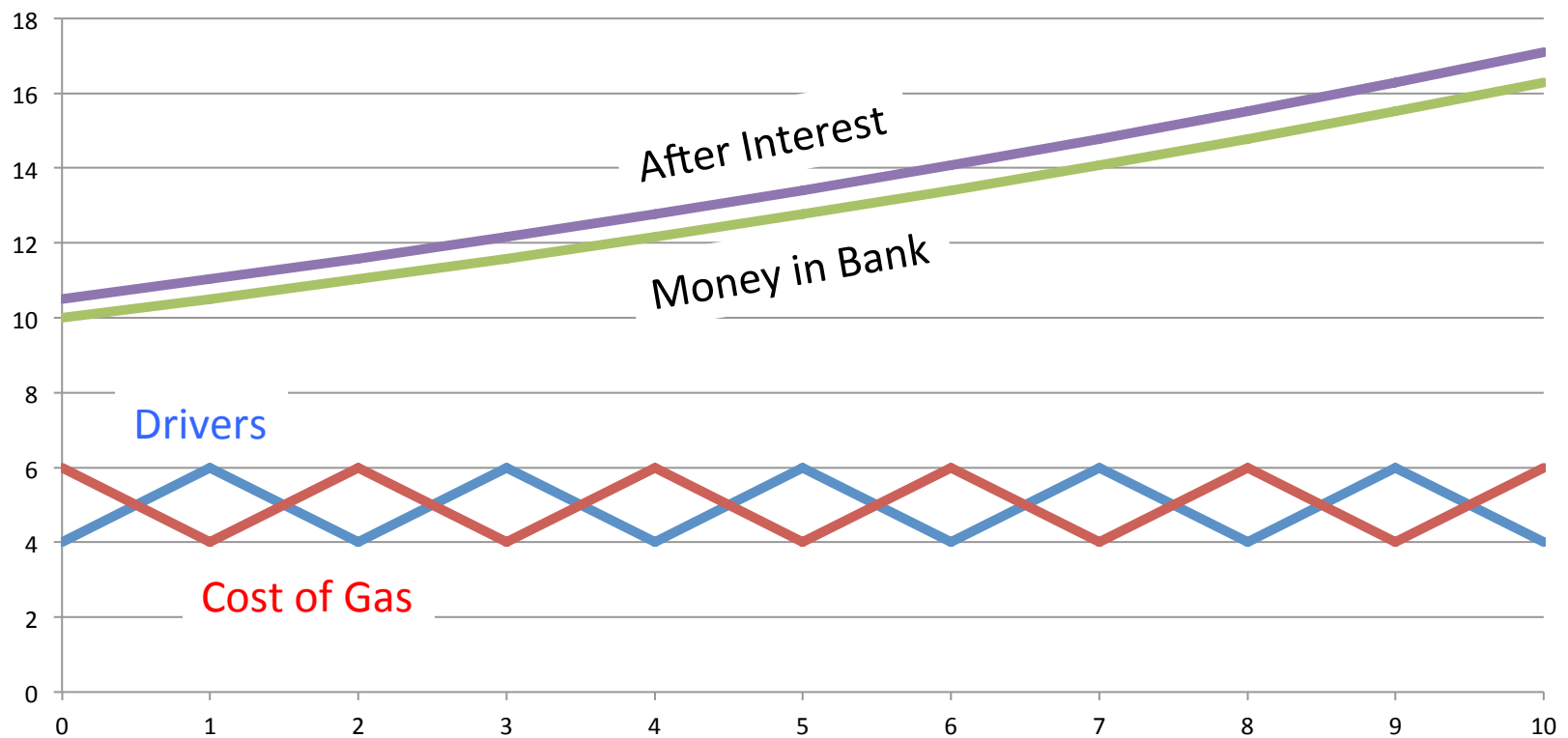
Feedback Mechanisms

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Impact of present actions on future conditions

Positive => amplifies change
(e.g., interest rates)

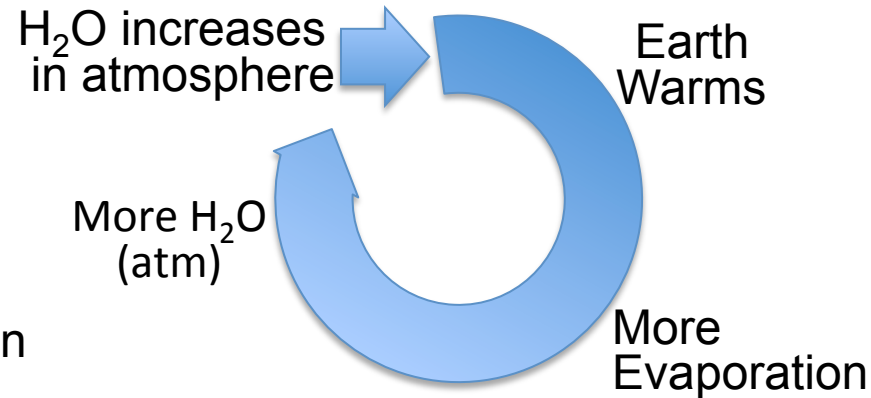
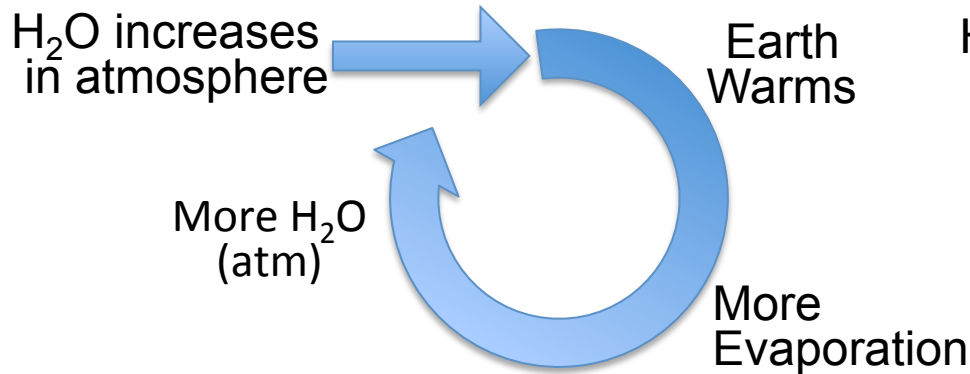
Negative => minimizes change
(e.g., supply & demand)



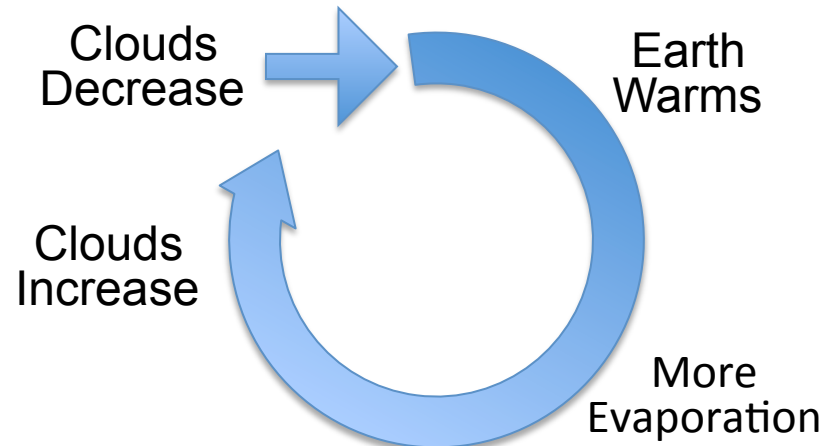
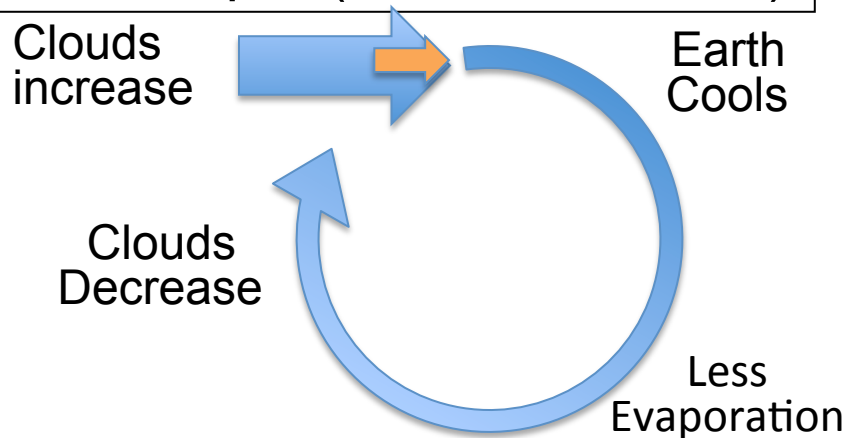
Feedback Mechanisms

Feedback Mechanisms

(+) Water Vapor (Greenhouse Gas)

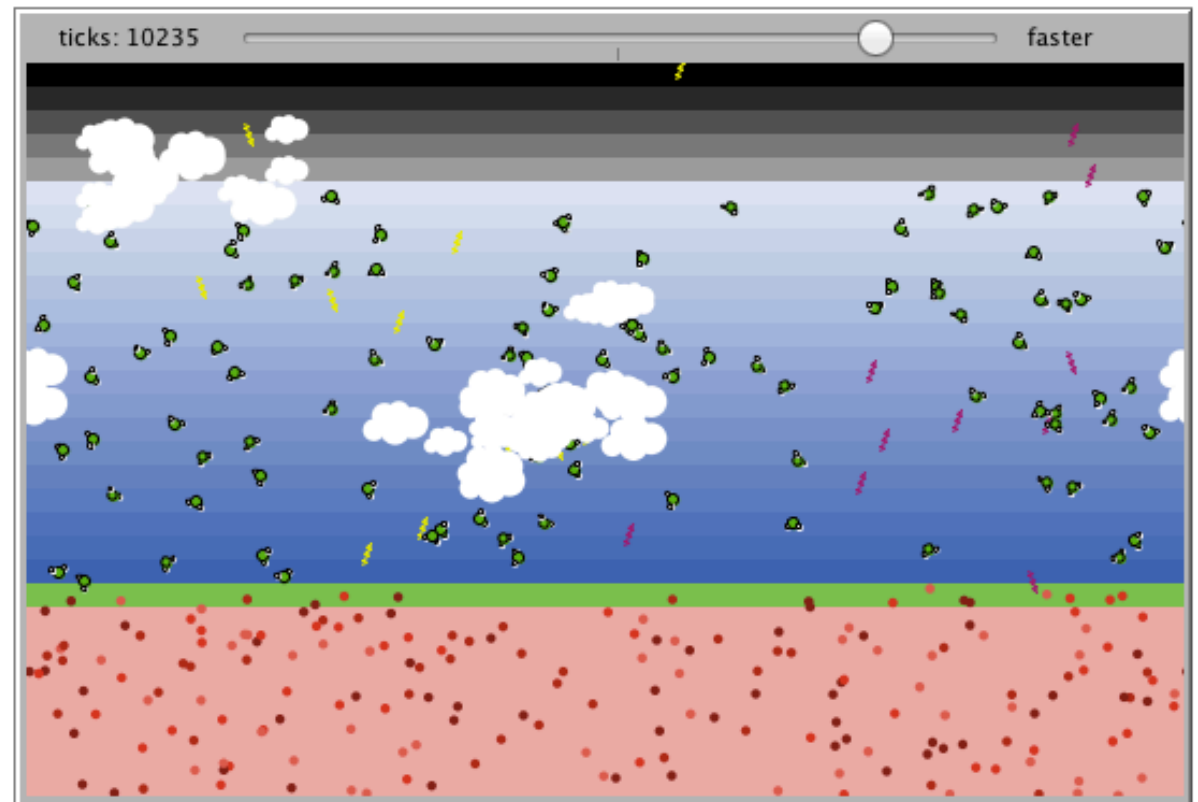
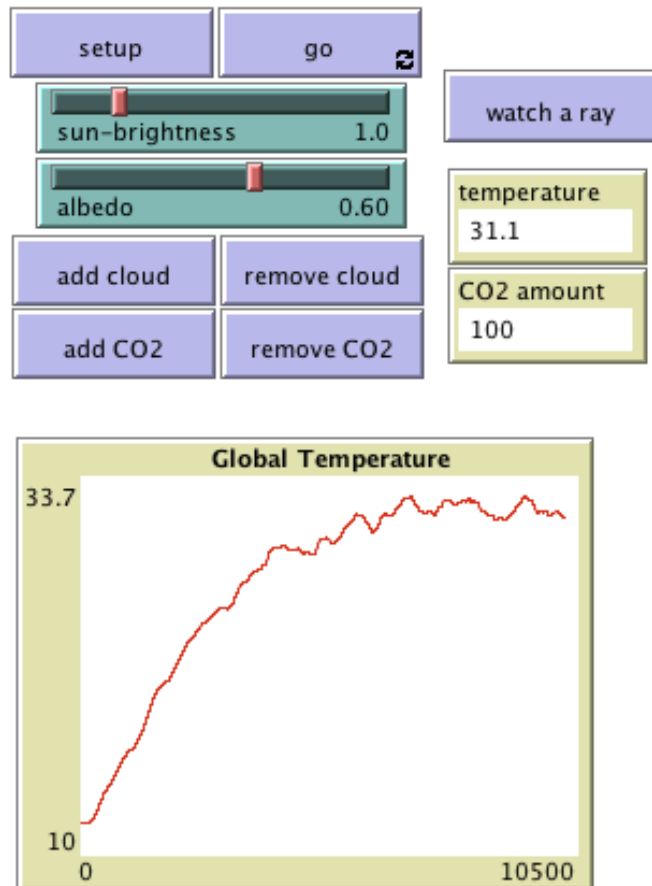


(-) Water Vapor (Increase Albedo)



Climate Simulations

Climate Simulations



Climate Change Factors

- External (solar radiation, plate tectonics)
- Internal (atmosphere, ocean & land interactions)

Feedback Mechanisms

- Positive => amplify process (interest rates, microphone feedback)
- Negative => mitigates process (supply & demand)