Wednesday August 31st
OBJECTIVES FOR TODAY'S CLASS:

COURSE TOPICS:

-Wrap up **TIME SERIES graphs** description – with a "close to home" illustration of a time series

- Address a typical **"Denier" argument.**

- Review the basics of **MATTER**

COURSE LOGISTICS:

- Try out your **clickers!**

First . . . A look at a catastrophic flood event . . .

Hurricane Cost Seen as Ranking Among Top Ten

Vyto Starinskas/The Daily Herald, via Associated Press

Road crews evaluate the flood damage to Route 4 in Mendon, Vt. on Monday. Many towns in the state have been cut off by roads washed out after Hurricane Irene.

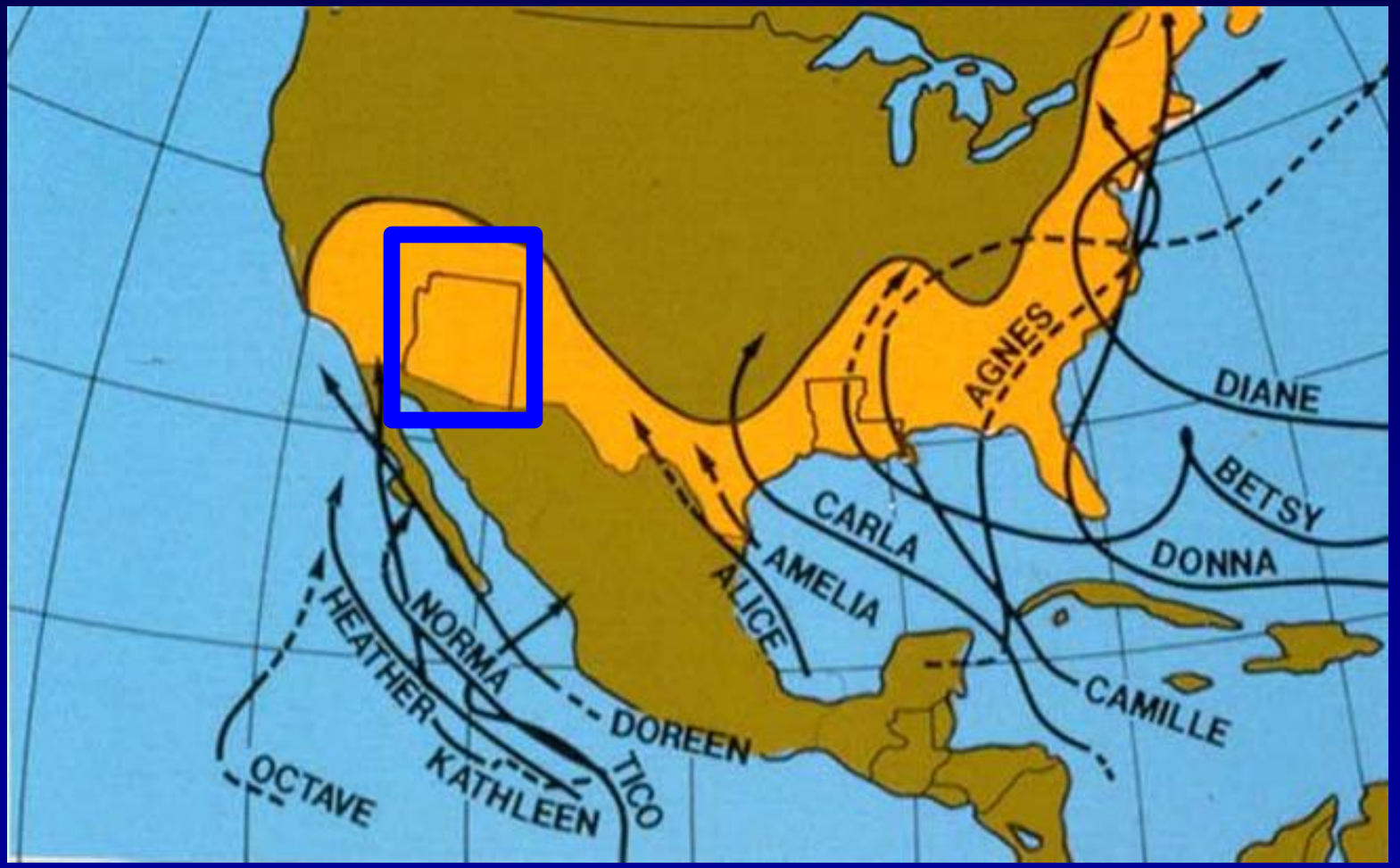
By MICHAEL COOPER
Published: August 30, 2011

Hurricane Irene will most likely prove to be one of the 10 costliest catastrophes in the nation's history, and analysts said that much of the damage might not be covered by insurance because it was caused not by winds but by flooding, which is excluded from many standard policies.

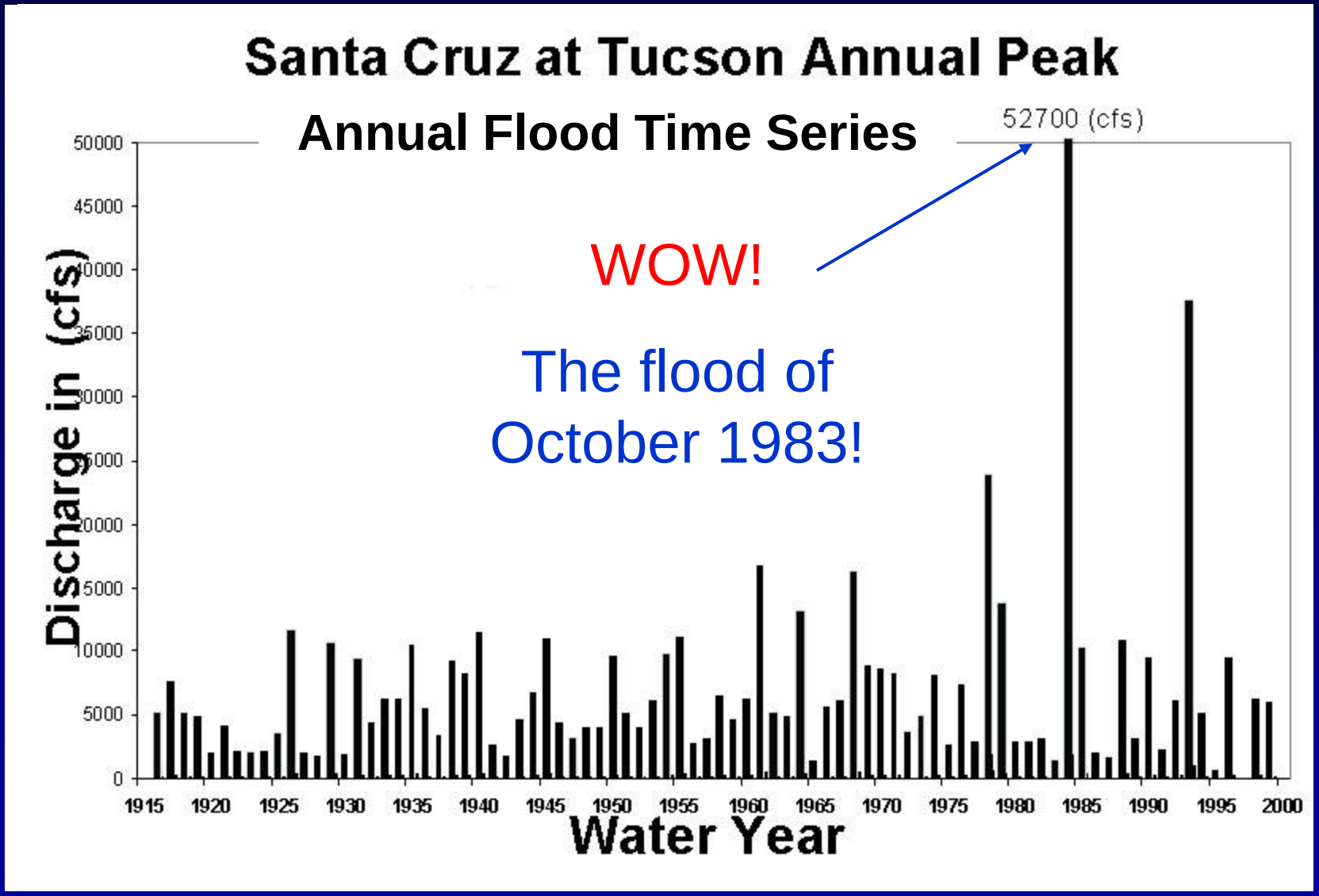
http://www.nytimes.com/2011/08/31/us/31floods.html

Video of Vermont floods in action shown at the start of class:
http://www.youtube.com/watch?v=f1tCdtoMzsU

IMPORTANT FLOOD-PRODUCING TROPICAL STORMS & HURICANES

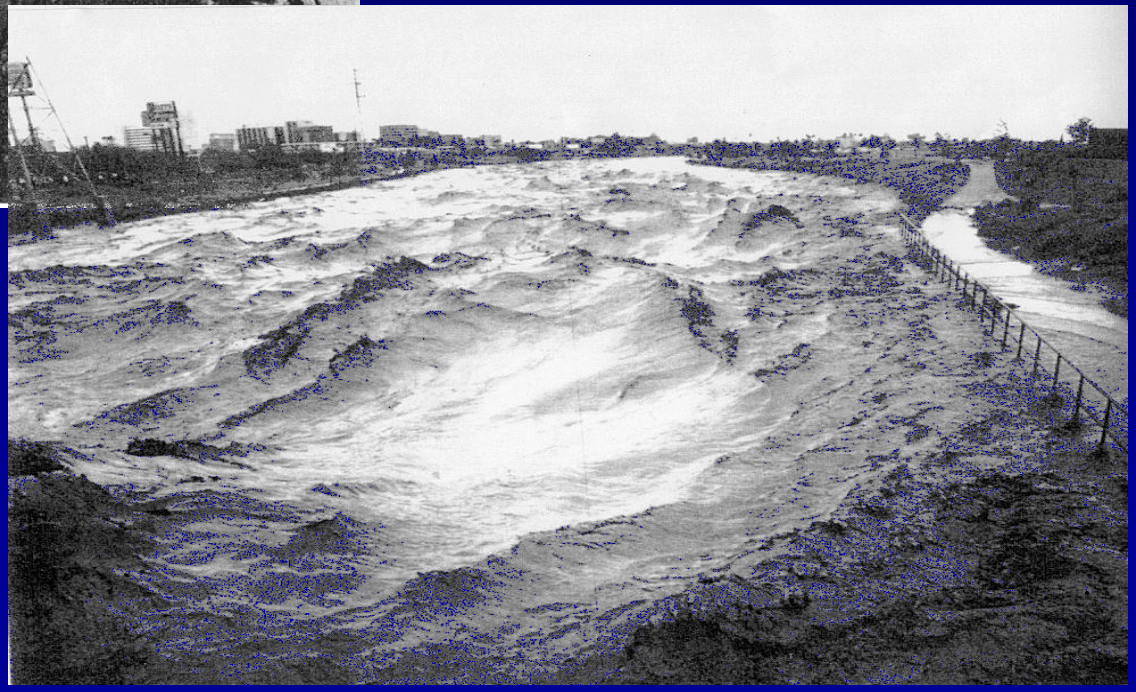


A Time Series CLOSE TO HOME!



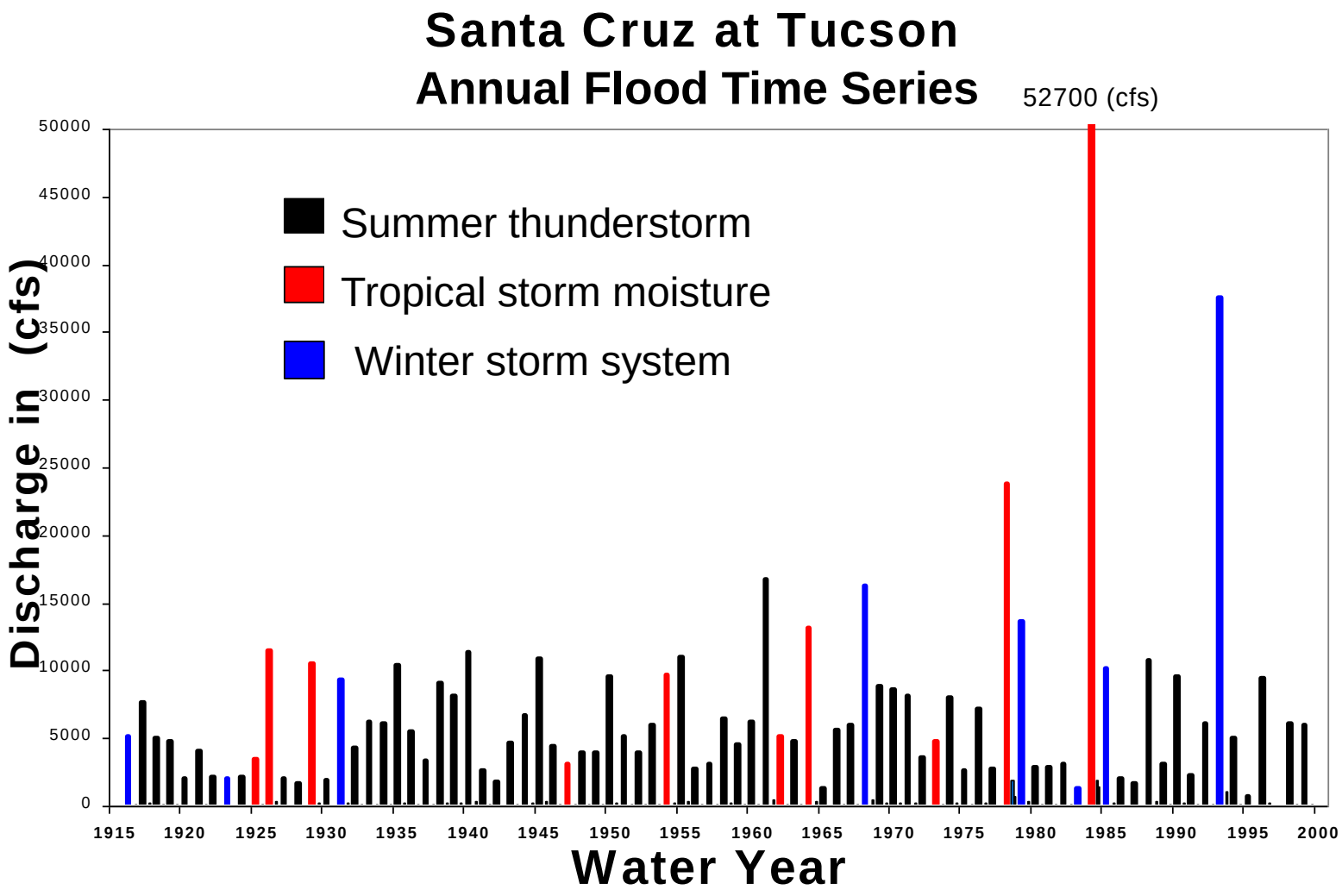
Santa Cruz River, Tucson

Typical dry river bed or minor trickle of stream flow

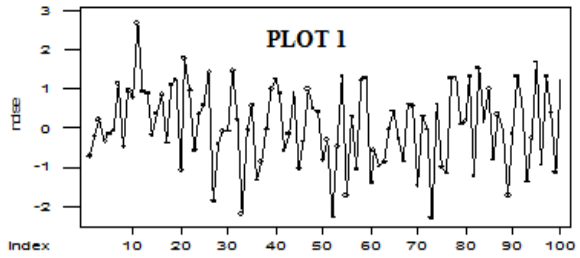


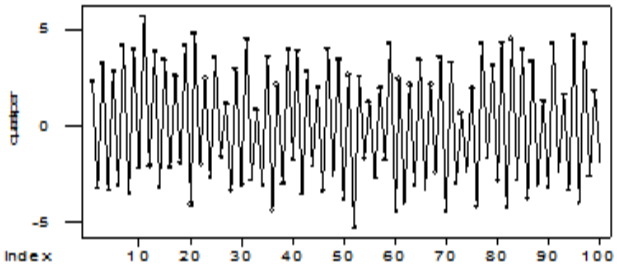
The record flood of October 1983!

What kind of storms caused each flood?

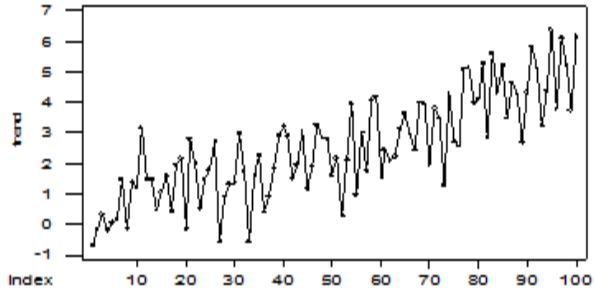


ANSWERS TO TIME SERIES GRAPHS FROM TUESDAY'S CLASS

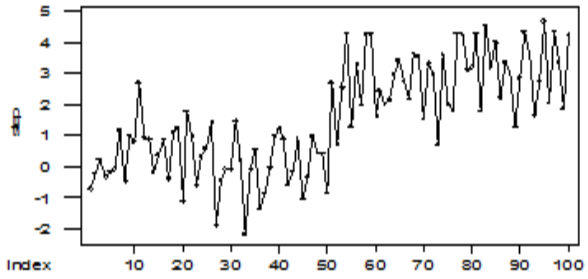




PLOT 2



PLOT 3



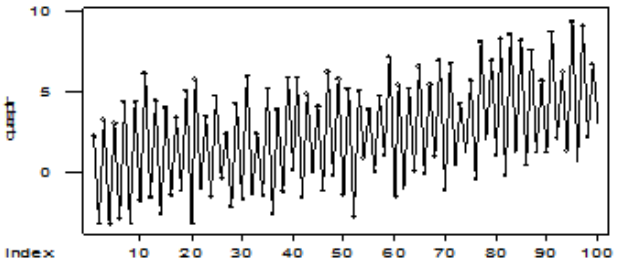
PLOT 4

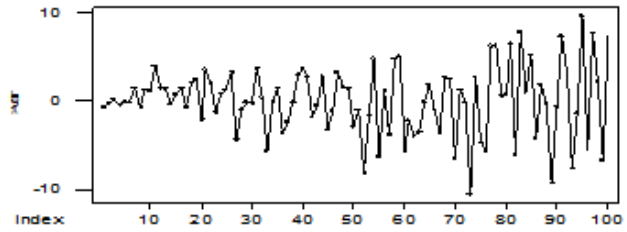
PLOT #1: "White noise" (random fluctuations) but with constant mean and variance [answer given for you]

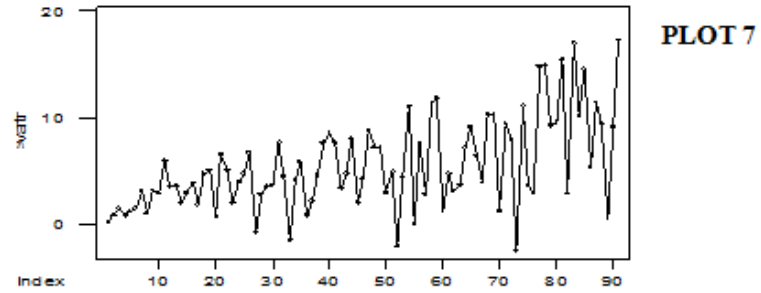
PLOT #2: **"**Quasi-periodic plot" with constant mean and variance. [Graph goes up and down very regularly (periodically); the mean stays the same, the range of fluctuations above and below the mean stays about the same over time.]

PLOT #3: "Trend" plot with the mean increasing over time, but a constant variance. [Graph shows trend of increasing values and increasing mean; the range of fluctuations is about the same.]

PLOT #4: "Step change" plot with an abrupt jump between two series like Plot 1. [Graph shows a "jump" or abrupt change between two different time series, each having a constant mean and variance]







PLOT #5: "Quasi-periodic with upward trend" plot [Graph shows an increasing trend and increasing mean, but has regular periodic ups and downs above and below the increasing mean.]

PLOT #6 "Increasing variance but constant mean" plot. [Graph's mean is constant but the range of fluctuations above and below the mean increases over time.]

PLOT #7 "Trend with increasing mean and increasing variance" plot [Graph had both an increasing mean and an increase in the range of fluctuations above and below the mean over time – the extremes are getting bigger!]

KEELING CURVE QUESTION:

Answer = Plot #5 WHY? The Keeling curve shows an increasing trend with a regular to quasi-periodic oscillation

Plot #3 is the second best answer.)

To make an incontrovertible case about the role that humans play in global warming, what do scientists need?

1) a long-term temperature record, i.e., centuries
2) over a large part of the globe
3) To be able to say . . . . .

"What's the average been for several hundred years, & is this a significant departure from that?"

"And that's very difficult to do."

(James Trefil, physicist)

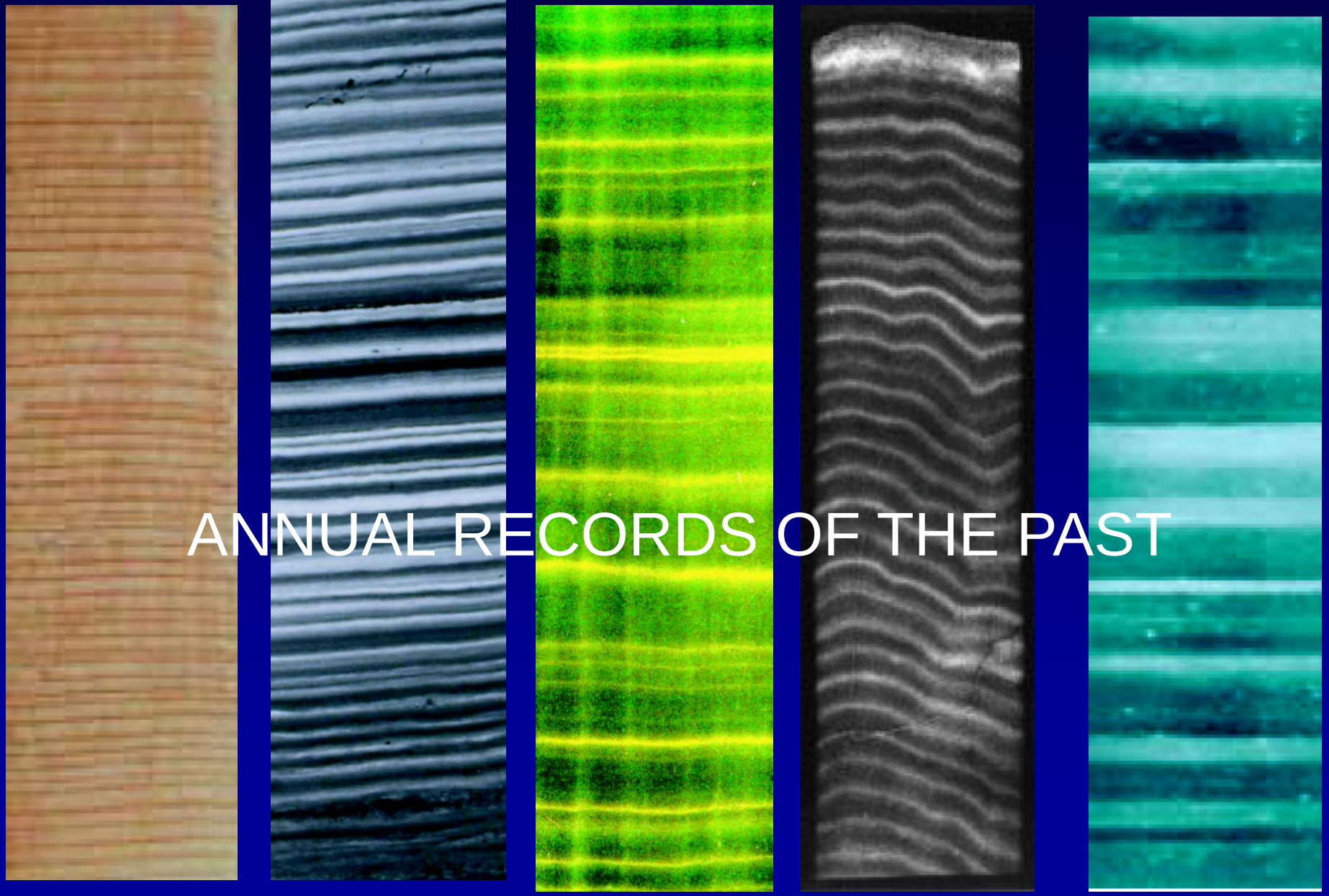
Tree rings

Lake varves (sediments)

Speleothems (from cave)

Coral (annual growth)

Ice Core

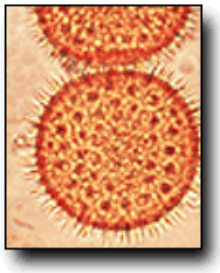


ANNUAL RECORDS OF THE PAST

“PROXY” DATA or NATURAL ARCHIVES of CLIMATE

Corals

Ice cores



Pollen

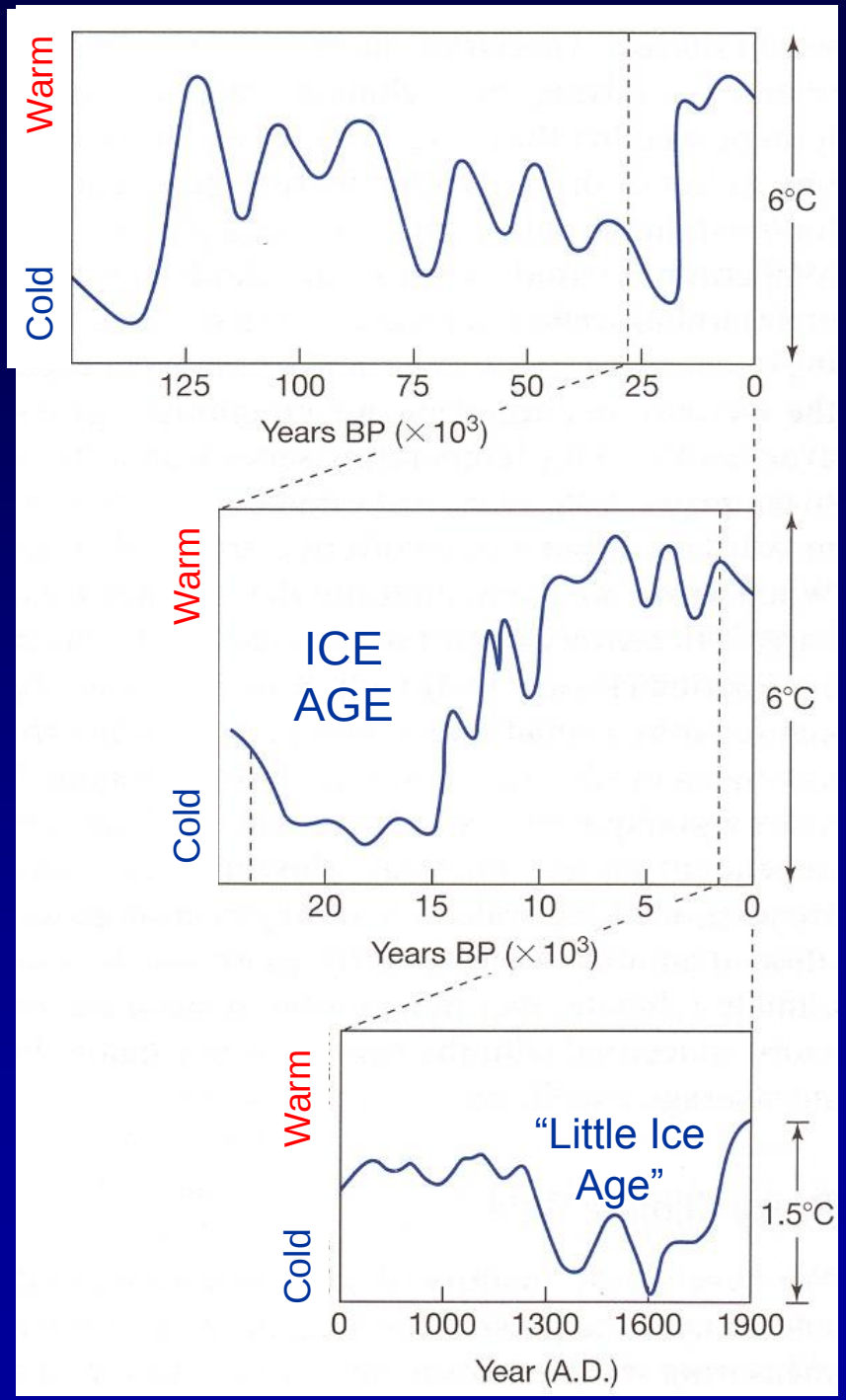
Lake, bog & ocean sediments

WHAT NATURAL ARCHIVES REVEAL:

Over different "Telescoping" Time Scales Of Variability about:

Mean Global Temperature Change

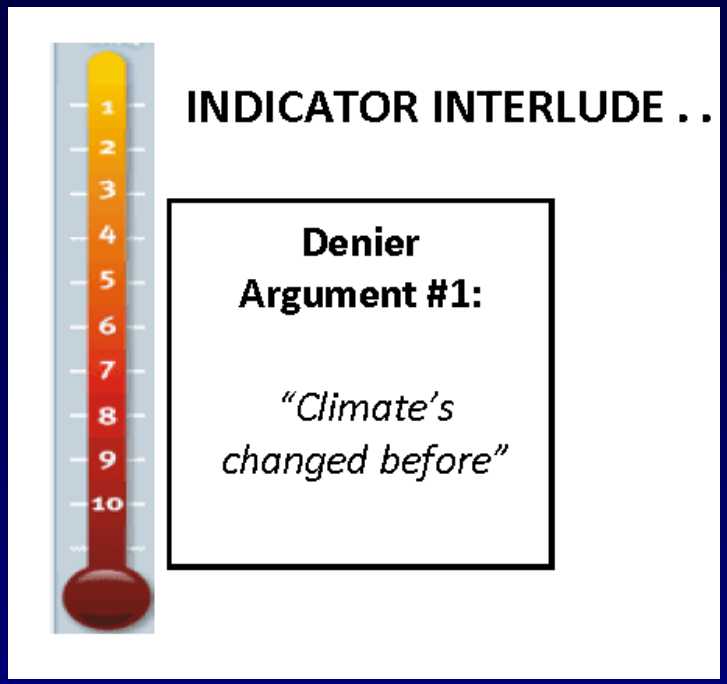
Since The Last Glacial Maximum
(Years BP = "years before present")



Generalized oxygen isotope curve from deep-sea sediments

Generalized estimates from pollen data & alpine glaciers (mid-latitudes of eastern N. America & Europe)

General estimates from historical documents (emphasis on the North Atlantic region)



Response:

Yes, the climate has changed before – see the times series plots we just looked at!

Scientists have studied this thoroughly for years and no one disputes this.

Natural climate change in the past PROVES that climate is sensitive to an energy imbalance.

If the planet accumulates heat, global temperatures will go up.

Currently, increased amounts of CO2 are imposing **an energy imbalance** due to the enhanced greenhouse effect.

Past climate change actually provides evidence for our climate's sensitivity to CO2.

CLICKER START UP:

1) Remove plastic strip (if you haven't yet)
2) Press any key to turn it on
3) Select Menu: Change Channel? Y
4) Press #'s for Channel 41
5) Hit ENTER / then hit Menu a couple times
6) Be sure you are in Presentation Mode & Channel 41 / wait for screen to go blank

YOU ARE READY TO BEGIN!

Q1. I am a . . .

1 - FRESHMAN

2 - SOPHOMORE

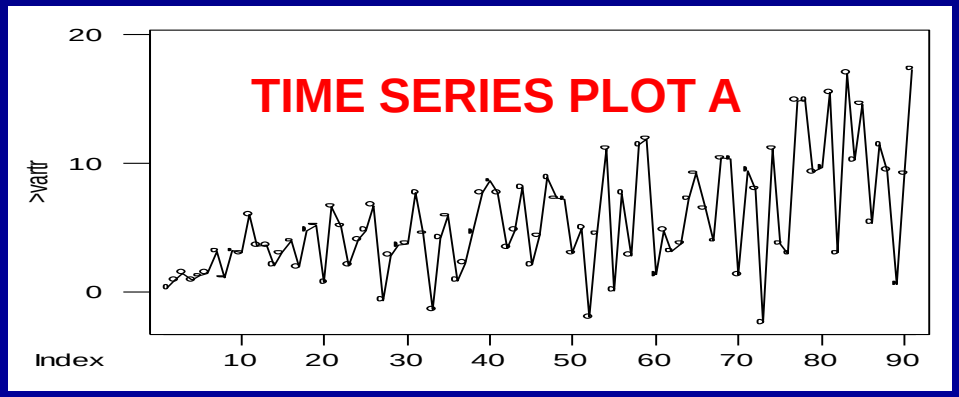
3- JUNIOR

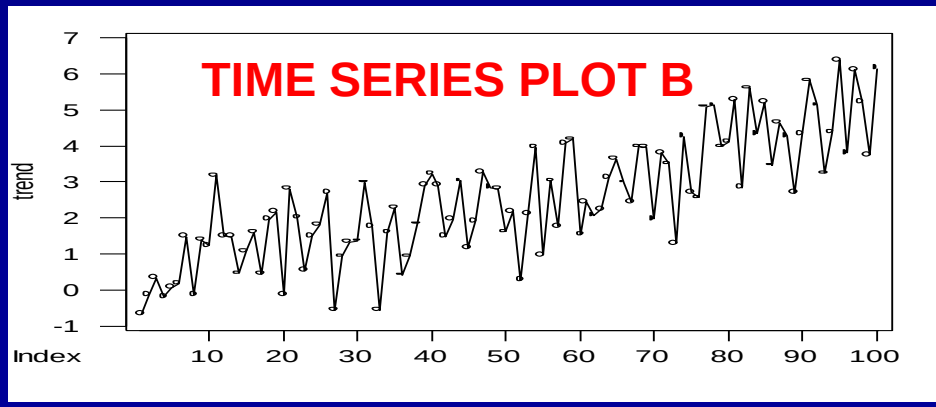
4 – SENIOR

5 - OTHER

Q2. What is the difference between Time Series Plots A & B?

1. Plot A depicts a constant mean over time, but Plot B does not
2. Plot A doesn't depict any trend, but Plot B does
3. Plot A depicts increasing variance over time, but Plot B does not
4. Plot A is periodic but Plot B is not
5. There is no difference – they are both random plots with no trends





Topic #4
ENERGY & MATTER
OVERVIEW

OBJECTIVES:

To review basic physical concepts of energy and matter and some key ways in which they interact.

"Science shows us that the visible world is neither matter nor spirit;

the visible world is the invisible organization of energy."

Heinz R. Pagels (b. 1939), U.S. Physicist

QUICK
MATTER REVIEW

Matter:

Whatever occupies space & is perceptible to the senses; made up of atoms; matter can be in form of solids, liquids, or gases

Atom:

-- Fundamental building blocks for all matter

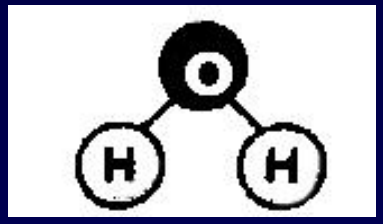
-- the smallest representative sample of an element.

Element:

A chemical substance (material) made from a single type of atom that cannot be broken down any further – and still maintain its identity as that element

. . . as in the *Periodic Table of the Elements*

Molecule:



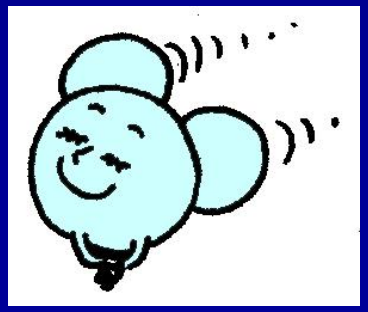
-- Any collection of two or more atoms bound together

-- a cluster of atoms bound together

MOLECULES are the basic constituent of different kinds of materials.

-- the smallest part of any substance that has all the chemical properties of the substance

e.g., a water molecule = H_2O



STATES OF MATTER

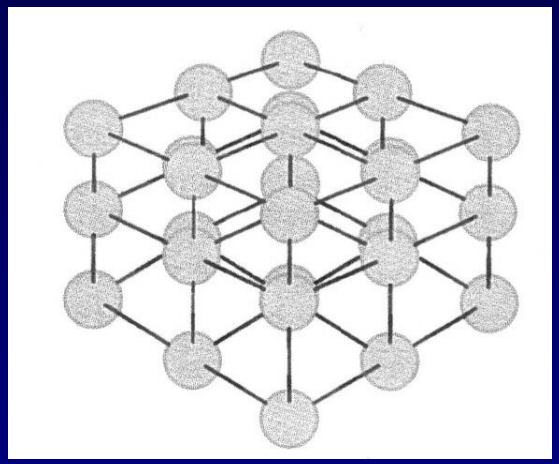
Solid:

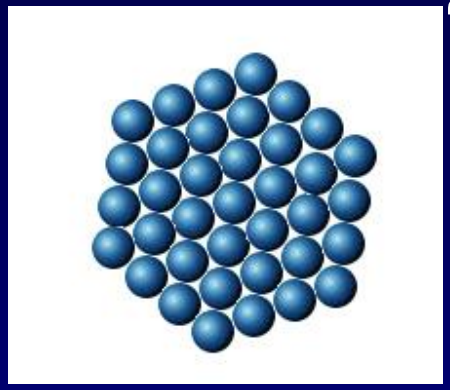
-- a substance that resists changes of shape and volume

-- characterized by *structure* in the particular order and bonding of atoms that make up the material

Example = a crystal in which the molecules are locked into a strict geometrical order.

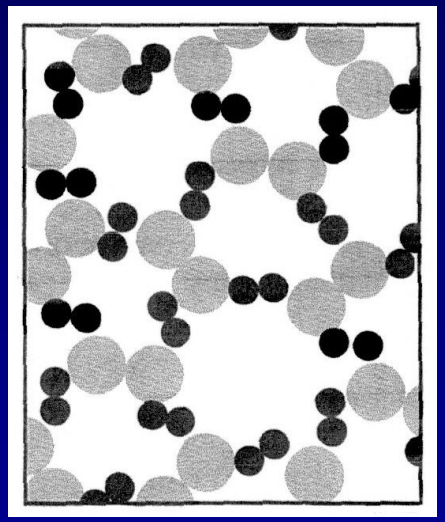
Various Representations of Molecules arranged in a SOLID



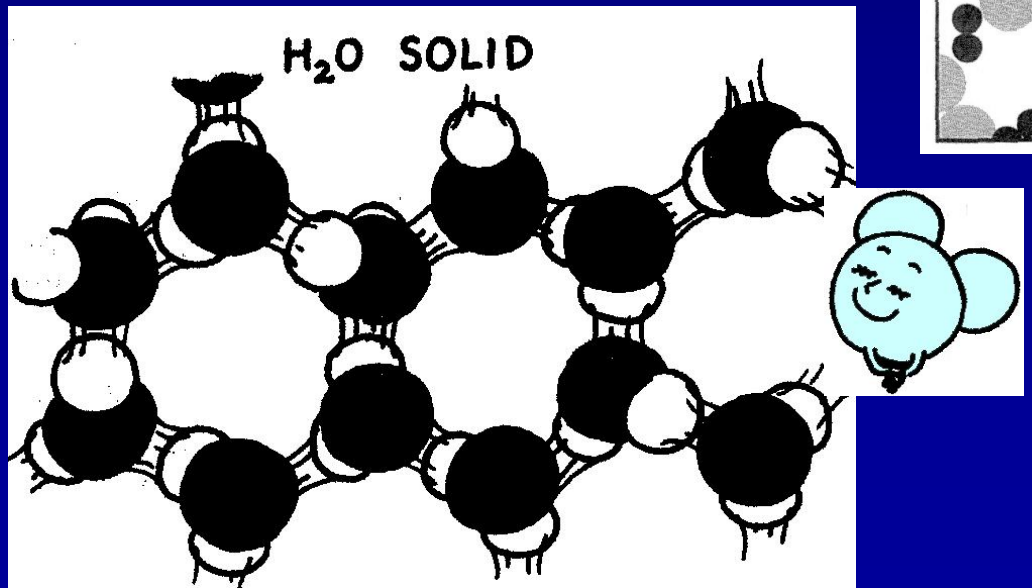


"top down" view of water (H_2O) arranged in solid (ice) form

"top down" view of a Neon crystal



3-D view of a solid crystal structure



Liquid:

-- a substance that flows freely in response to unbalanced forces

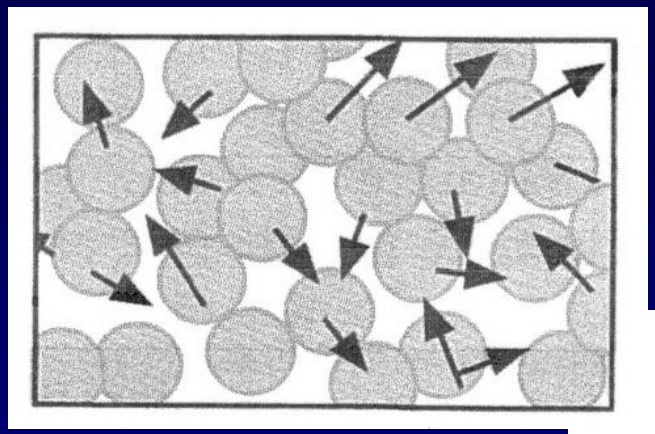
-- molecules more or less move freely past one another as individuals or small groups
-- are not confined to fixed positions (as in solids)

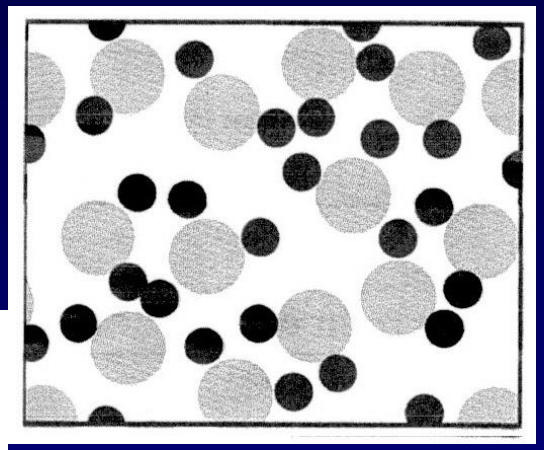
-- LIQUIDS CAN EXHIBIT PRESSURE

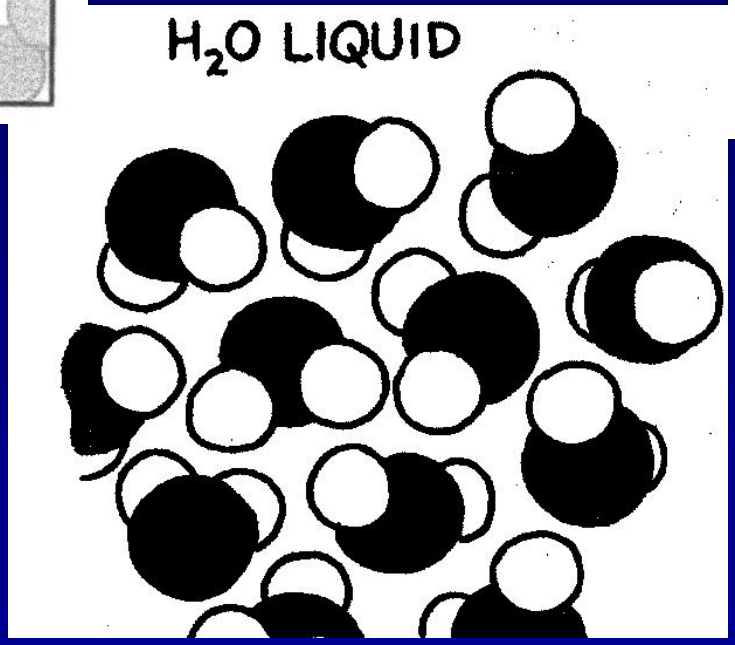
(pressure = a force per unit area)

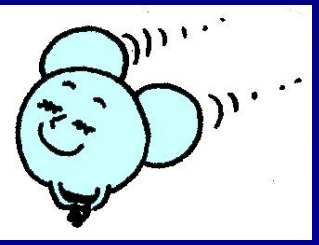
. . . and will take the shape of the container they are in.

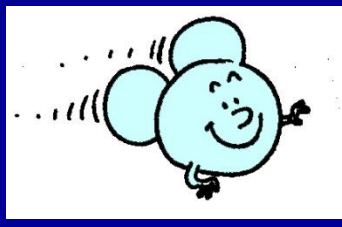
Various Representations of Molecules arranged in a LIQUID











Gas:

-- a substance that expands (and contracts) easily, rapidly, and indefinitely

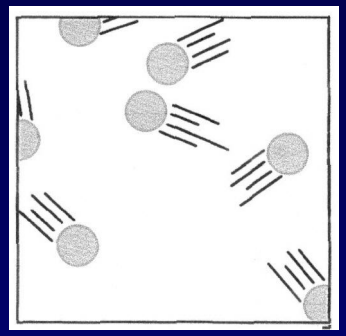
-- fills all space available to it

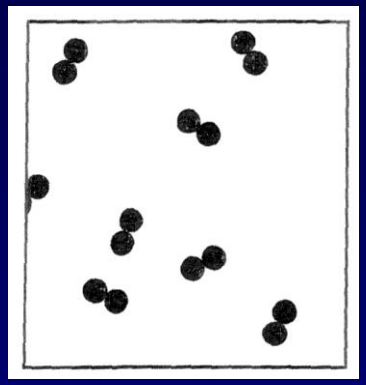
-- takes the shape of its container

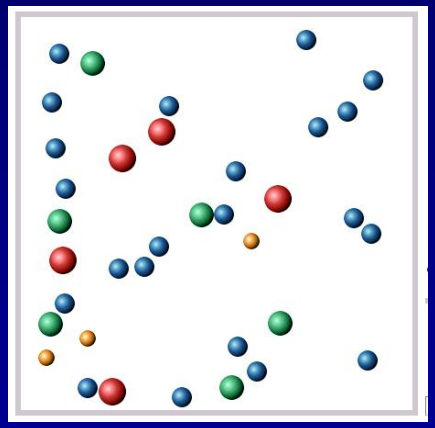
- -- the distance between molecules is such that no cohesive forces exist
- -- atoms or molecules are in high speed motion
- -- many collisions and rebounds occur

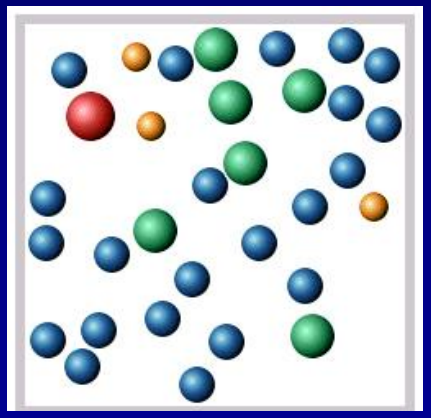
-- **GASES ALSO EXHIBIT PRESSURE**

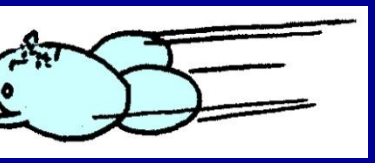
Various Representations of Molecules arranged in a GAS

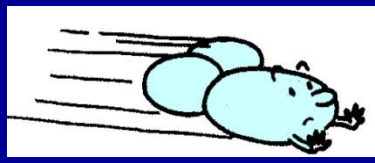








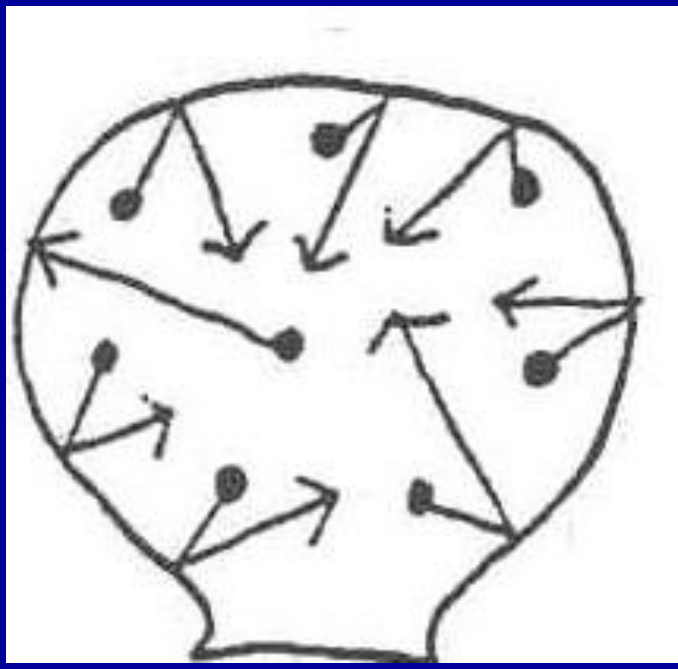


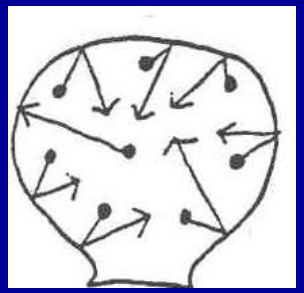


Heat added = increase in total energy + work done against outside pressure

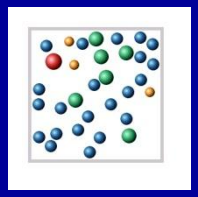
With increasing T (temperature)

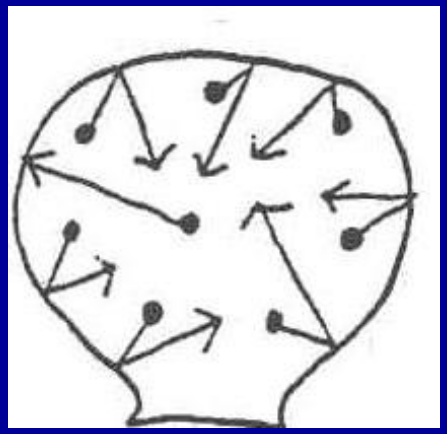
➔ Volume increases &
Density decreases



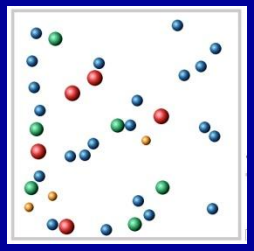


COLD

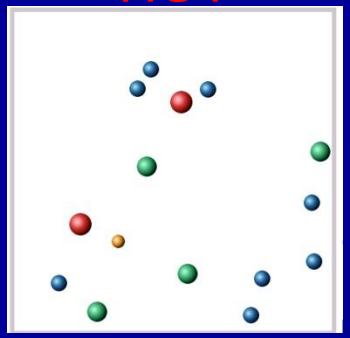


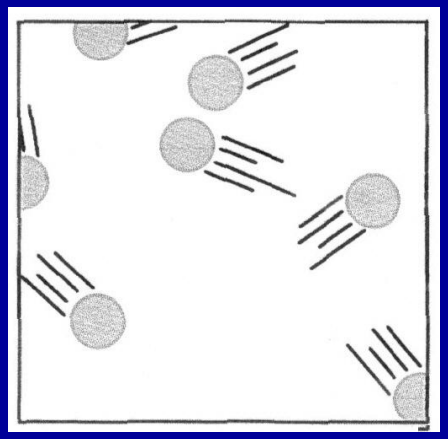


WARM



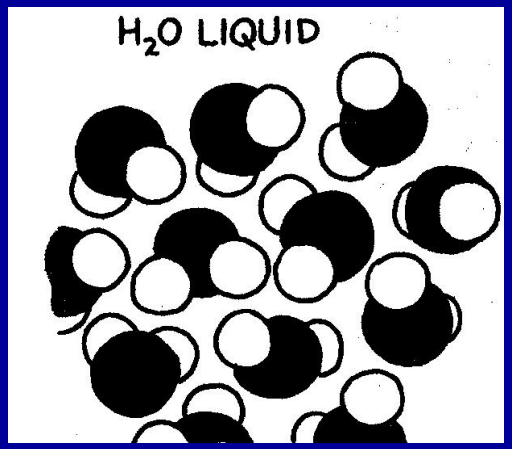
HOT



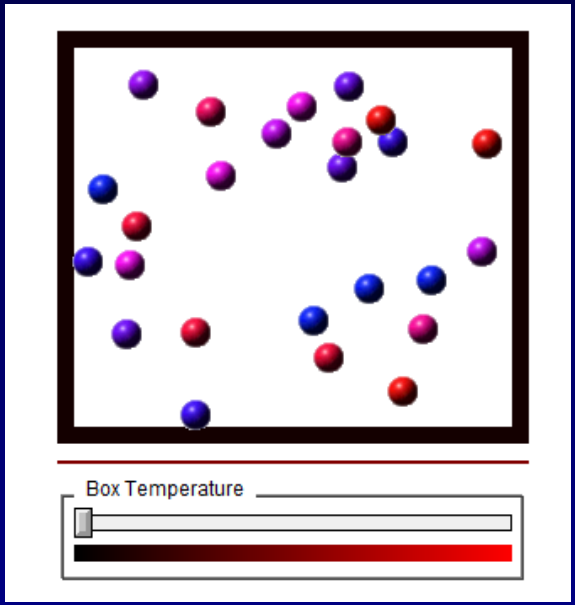


At higher air temperatures, H_2O molecules collide & rebound more frequently, leading to expansion of the air & the water vapor in the air.

At lower air temperatures as air gets more dense, H_2O molecules are more likely to bond so that a phase change to liquid water or even solid ice can occur.



A Simple Demo :



http://www.colorado.edu/physics/2000/bec/temperature.html

WHAT DOES THIS HAVE TO DO WITH GLOBAL CHANGE & MY DAILY LIFE ?????

OBJECTIVES FOR TODAY'S CLASS:

COURSE TOPICS:

-Wrap up TIME SERIES graphs description – with a "close to home" illustration of a time series

- Address a typical "Denier" argument.

- Review the basics of MATTER

COURSE LOGISTICS:

- Try out your clickers!

Wednesday August 31st
ANNOUNCEMENTS

- **REMINDER: RQ-1 will be cutoff Friday Sep 2nd exactly 30 minutes before class. Get started early!**
- **The CLASS NOTES PACKETS are supposed to be ready by 4:00 pm TODAY! (cost = $12.50)**
- **Purchase CLASS NOTES in the ASUA Bookstore at the Kiosk on the lower level next to the textbooks.) Please bring the packet to class with you on Friday – and every day from now on!**
- **ASSIGNMENT I-1 will be explained in class on Friday.**