

## CLIMATE CHANGE 6

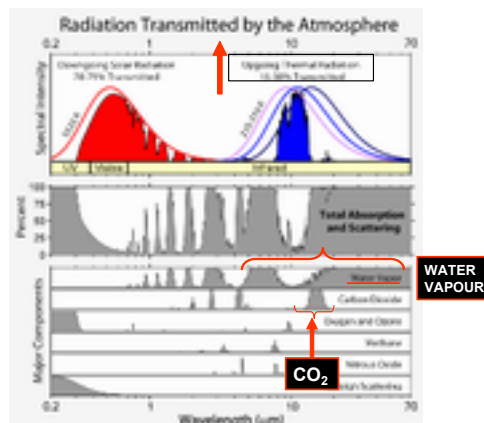
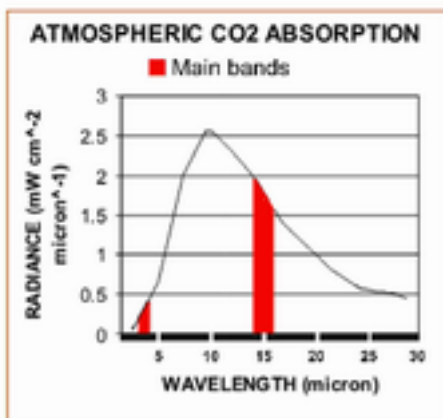
### CARBON DIOXIDE CO<sub>2</sub> and WATER H<sub>2</sub>O CONTRASTED

Showing Water has by nature a much bigger effect on Climate and Weather changes than CO<sub>2</sub> ever could

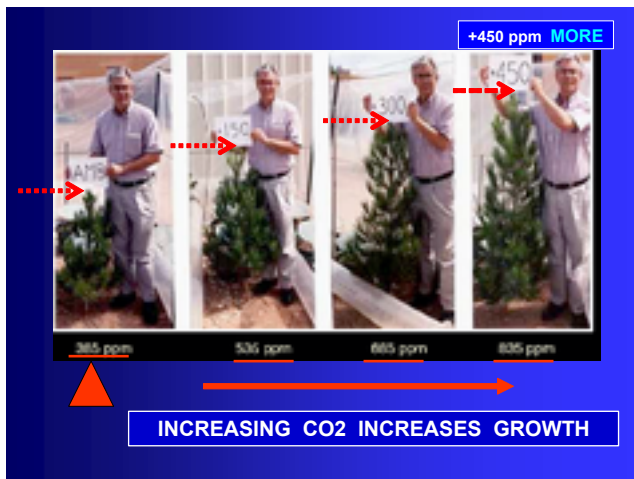
CO<sub>2</sub> ONLY affects radiant energy near the ground and only a small amount is man-made  
Water H<sub>2</sub>O affects MORE than the radiant energy near the ground – H<sub>2</sub>O forms Clouds (Evaporation and condensation unlike CO<sub>2</sub>), and Oceans store 1,000 times more energy than the atmosphere.

### CARBON DIOXIDE CO<sub>2</sub>

- CO<sub>2</sub> is **NOT** a pollutant or a toxin [*Carbon MONOXIDE CO is the toxin*]
- CO<sub>2</sub> in the atmosphere is vital for **LIFE** – we would die without it !
- Crops, trees, plants convert CO<sub>2</sub> into sugars, cellulose, fruit, vegetables and more
- Leaf 'factories' convert CO<sub>2</sub> into C compounds and O<sub>2</sub>
- Marine plankton uptakes and converts CO<sub>2</sub>
- Humans *exhale* 1 kg CO<sub>2</sub> per day (*there is close to 7 Billion humans on Earth*)
- **NOT** all CO<sub>2</sub> in the atmosphere is man-made – most is naturally produced
- Ruminating animals put out more greenhouse gases than all the cars, buses, trucks and other vehicles in the world
- The *main* sources of anthropogenic greenhouse gases are Fossil Fuels: coal, oil, gas, and the burning of trees and other crop wastes
- CO<sub>2</sub> absorbs radiant energy over a **LIMITED NARROW BAND** [see Graph below], but water vapour H<sub>2</sub>O covers the **same band and more** [see Graph below],
- **CO<sub>2</sub> is ONLY a GAS** in the atmosphere unlike water which can also change phase (evaporates and condenses) to give a big ADDITIVE effect to the atmosphere
- For every 1,000,000 molecules of atmosphere, *only* 10,000 are greenhouse gas molecules; 9,500 of these are water molecules. Of the remaining 500, **ONLY** about 350 are CO<sub>2</sub> and less than 20% of the CO<sub>2</sub> molecules are man-made (*conservative*), say 70 molecules per 1,000,000 at most. 70 in 1 million is 0.007% or *1 molecule in 14,300!!* Can that be the culprit in Climate Change when water is 0.95%, or 1 molecule in 105???
- Whenever CO<sub>2</sub> is in the atmosphere, water is also there in *larger* quantities at the same time! CO<sub>2</sub> is **ONLY** a radiant energy absorber/emitter. Water H<sub>2</sub>O is more! It can form clouds whereas CO<sub>2</sub> does not, and therefore H<sub>2</sub>O is far more *active* in climate variation. Examining CO<sub>2</sub> without factoring in the larger effect of H<sub>2</sub>O *simultaneously* must be wrong!



Increasing CO<sub>2</sub> concentration increases crop yields as shown!



### **SUMMARY: CARBON DIOXIDE CO<sub>2</sub>**

- Atmospheric CO<sub>2</sub> is a low - concentration greenhouse gas
- Most CO<sub>2</sub> is from NATURAL causes
- CO<sub>2</sub> can only absorb / emit radiant energy
- Water vapour H<sub>2</sub>O matches CO<sub>2</sub> BUT can ALSO form CLOUDS which have a larger effect than simply unclustered CO<sub>2</sub> molecules in isolation
- Incomplete combustion (dust, particulates, pollutant compounds) are more significant in overall atmospheric effects than CO<sub>2</sub>

### **WATER VAPOUR H<sub>2</sub>O**

Water is UNIQUE and unlike CO<sub>2</sub>:

- WATER: The most abundant compound on the Earth's surface and a universal solvent. Makes up over 60% of the human body. It is in all plants, animals, cells etc ..
- WATER: H<sub>2</sub>O is the **ONLY** fluid that **FLOATS ON ITSELF** when it **FREEZES** on the surface. [ If it did not float it would sink and crush the creatures (fish, sharks, whales) in the Oceans ]. Marine life flourishes in water below the ice.
- WATER: Largest % greenhouse gas *effect* [about 35% - 65% (clear sky), 65% - 85% (cloudy sky)]
- WATER: Water vapour concentrations in the atmosphere depend on temperature and location [< 0.2% in very cold climates to 3% by mass at high Humidity in the tropics > 30 °C]
- WATER: Oceans absorb 1,000 times more heat than the atmosphere, and **BUFFER** more than 80% of the large heat fluctuations (and hence temperature) thereby moderating Climate Change greatly – this is a key factor missed when only isolating the pet subject of CO<sub>2</sub>
- WATER: Liquid water has the highest surface tension (*skin*) of all natural liquids that affects droplet formation, cloud structures, ocean surfaces, waves, evaporation rates, etc
- WATER: H<sub>2</sub>O molecules are polar (*H* slightly +ve; *O* slightly -ve) so adjacent water molecules 'attract' each other, particularly as the temperature is lowered [ *Liquid water can also ionise slightly H<sub>3</sub>O<sup>+</sup> hydronium ions, and OH<sup>-</sup> hydroxyl ions*]. *Hydrogen bonding* gives some unique features unlike CO<sub>2</sub>: H<sub>2</sub>O second highest specific heat capacity [*only ammonia\*is greater*]: H<sub>2</sub>O has a very high heat of vaporisation (2,257 kJ/kg at its boiling

point), and **ENERGY TRANSFERS** are very important in atmospheric changes (*shows up as temperature differences which are directly related to atmospheric mean temperature*)

- The 'Structure' and 'Behaviour' of H<sub>2</sub>O have **LARGE** buffering effects that moderate the Earth's Climate and Weather as they affect both evaporation from the seas and condensation in cloud formation: CO<sub>2</sub> acts ONLY as a gas and forms **NO** clouds
- WATER: The specific enthalpy of fusion (at freezing) is very high (333.6 kJ/kg at 0°C) [*only ammonia\* is higher*], and this confers resistance to melting on the ice. [*Density decrease at freezing – about 9%*]
- WATER: Water Vapour–Liquid Water–Ice COEXIST at the equilibrium Triple Point. It is *amazing* that it occurs near 0°C (*Triple Point of CO<sub>2</sub> is -56.5°C so it strongly differs from Water and has no effect in our system*), as this has some unique effects in phase transitions near the poles (eg solid ice to vapour *direct*, with no liquid water for example).
- WATER: Water has a freezing point of 0°C and a boiling point of 100°C due to its unique molecular polar structure. We live because of that!!
- The *nearest* molecule to Water with an Atomic Weight of 18 is Ammonia with an Atomic Weight of 17. In *direct contrast* its freezing point of -33°C and a boiling point of -77°C. Just as well water is THE MOST ABUNDANT COMPOUND on the EARTH'S SURFACE

### SUMMARY: WATER H<sub>2</sub>O

- Atmospheric H<sub>2</sub>O is the **HIGHEST** concentration greenhouse gas
- H<sub>2</sub>O has the **LARGEST** greenhouse gas effect
- Water vapour H<sub>2</sub>O *matches* CO<sub>2</sub> for the ability to absorb radiant energy but is *more effective over a broader range*
- Water can phase-change (evaporate/condense) to form **CLOUDS** which have a larger effect than simply CO<sub>2</sub> as gas molecules in isolation
- Water can phase-change (evaporate/condense) at oceans, lakes and rivers --- CO<sub>2</sub> cannot
- Water has unique 'thermodynamic' properties affecting *energy transfer* in Climate/Weather actions that CO<sub>2</sub> does not have

### CONCLUSION:

1. CLIMATE CHANGE RESULTS DIRECTLY FROM ENERGY MOVEMENTS FROM THE SUN, THE EARTH, THE OCEANS and THE ATMOSPHERE
2. WATER AS A VAPOUR *and* a LIQUID IS THE **LARGEST** GREENHOUSE 'GAS' – BUT IT CAN DO FAR *MORE* THAN CO<sub>2</sub>
3. CO<sub>2</sub> IS A GAS ONLY IN THE ATMOSPHERE: IT AFFECTS ONLY ELECTRO-MAGNETIC ENERGY ABSORPTION / EMISSION *NEAR* THE EARTH'S SURFACE
4. H<sub>2</sub>O PHASE-CHANGES IN THE ATMOSPHERE – CO<sub>2</sub> DOES NOT
5. EVAPORATION/CONDENSATION PHASE CHANGES OCCUR AT SEA LEVEL *AND* IN CLOUD FORMATION - CO<sub>2</sub> IS ONLY A GAS AND DOES NOT CONDENSE
6. OCEANS ABSORB 1,000 TIMES MORE HEAT THAN THE ATMOSPHERE
7. OCEANS *BUFFER* MORE THAN 80% OF THE LARGE HEAT/TEMPERATURE FLUCTUATIONS THAT MODERATE CLIMATE/WEATHER CHANGES

**IF THE WATER and WATER VAPOUR CONCENTRATION IS 20 TIMES HIGHER THAN CO<sub>2</sub> IN THE ATMOSPHERE, AND MOST CO<sub>2</sub> IS NATURALLY MADE – WHY BLAME THE SMALLER AMOUNT OF ANTHROPOGENIC CO<sub>2</sub> ON CLIMATE CHANGE ??**

**IN FACT - CO<sub>2</sub> DOES NOT EXIST BY ITSELF, and CANNOT BE EXAMINED IN ISOLATION WITHOUT CONSIDERING WATER SIMULTANEOUSLY**

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