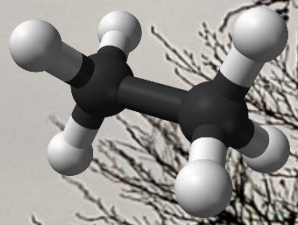
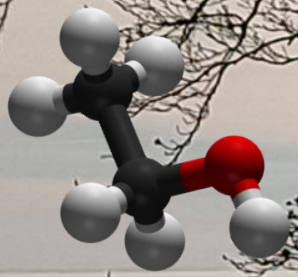
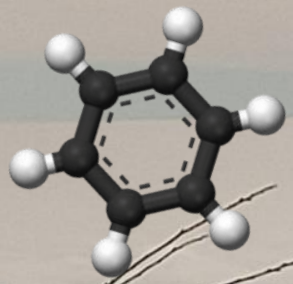
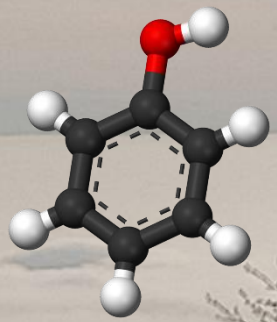
Volatile Organic Compounds



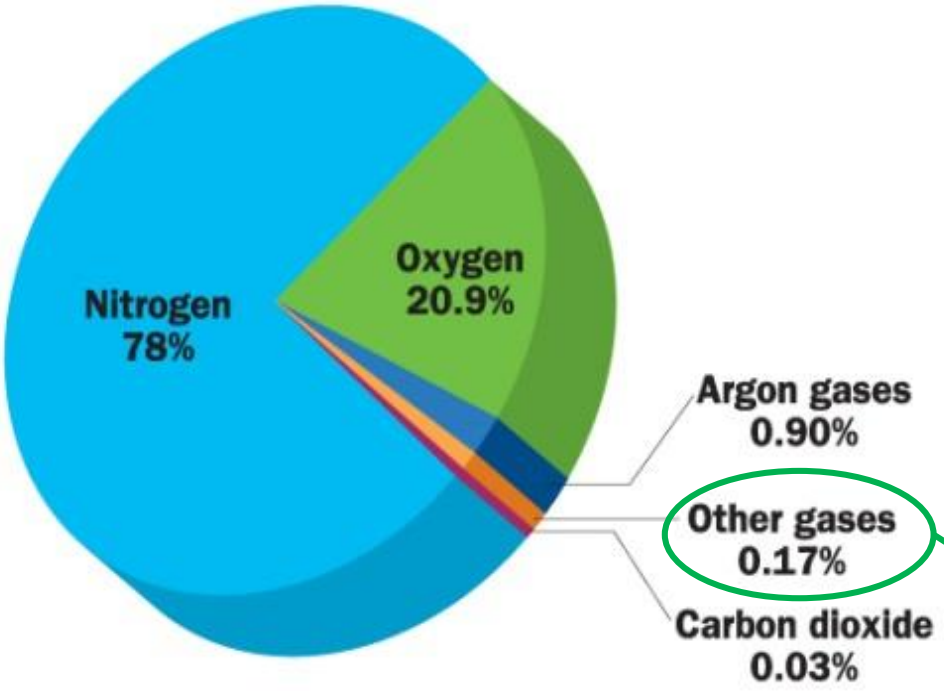


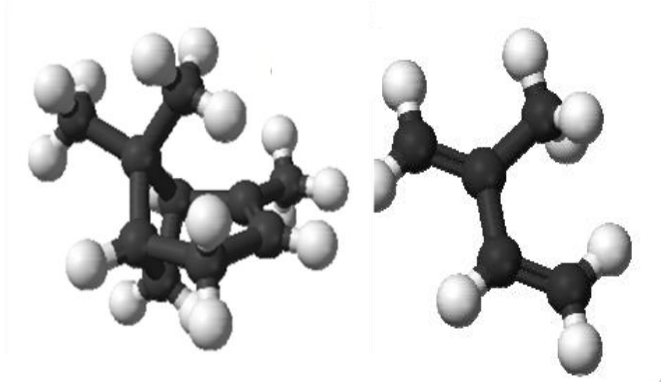




Nidhi Tripathi

Composition of the Earth's Atmosphere





Volatile organic Compounds

Trace Gases

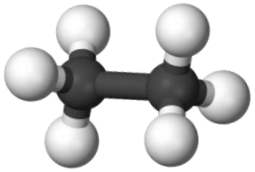
CH_4, N_2O, CO, O_3, VOCs, etc.

Volatile Organic Compounds (VOCs)

- VOCs have high vapour pressure at room/ambient temperature. For example- the vapour pressure of isoprene, benzene, DMS at 25 ^{o}C are 0.6, 0.13 and 0.5 atm, respectively. While the vapour pressure of water is 0.03 atm at 25 ^{o}C .

Classification of VOCs

Non-methane hydrocarbons (NMHCs)



Alkane (C_2H_{2n+2}), Alkene(C_2H_{2n})

- Ethane (C_2H_6), Propane (C_3H_8)
- Ethene (C_2H_4), Propene (C_3H_6)

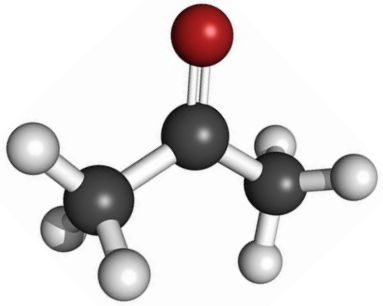
Aromatic Ring

- Benzene(C_6H_6)
- Toluene (C_6H_5-CH_3)

Isoprene (C_5H_8)

Monoterpene ($C_{10}H_{16}$)

Oxygenated-VOCs (OVOCs)



Alcohol

- Methanol (CH3OH)
- Ethanol (C_2H_5OH)
- Butanol (C_4H_9OH)

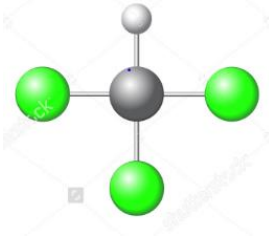
Aldehyde

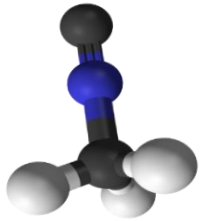
- Formaldehyde (HCHO)
- Acetaldehyde (C_2H_4O)

Ketone

- Acetone (C_3H_6O)

Hydrocarbons containing traces of N, S and halogens





Acetonitrile (C_2H_3N)

Dimethyl Sulphide (C_2H_6S)

Chloroform ($CHCl_3$)

Sources of VOCs

Natural (Biogenic) + **Anthropogenic**

(BVOCs) **(AVOCs)**

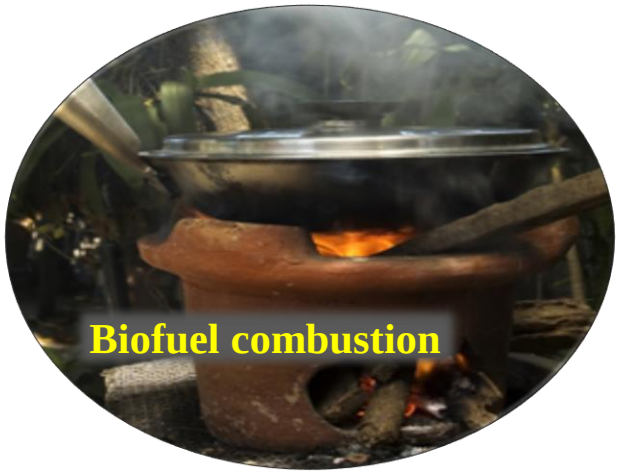
~1250 Tg yr^{-1} ~150 Tg yr^{-1}

Example of VOCs

- Isoprene
- Monoterpene
- Sesquiterpene, etc.

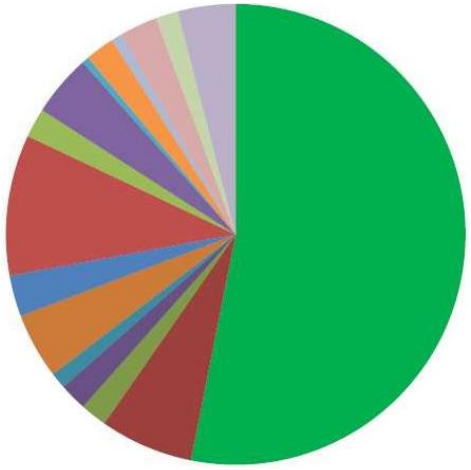
- Benzene
- Toluene
- Xylene, etc.

Anthropogenic Sources of VOCs



Biogenic Sources

Global Budget of BVOCs



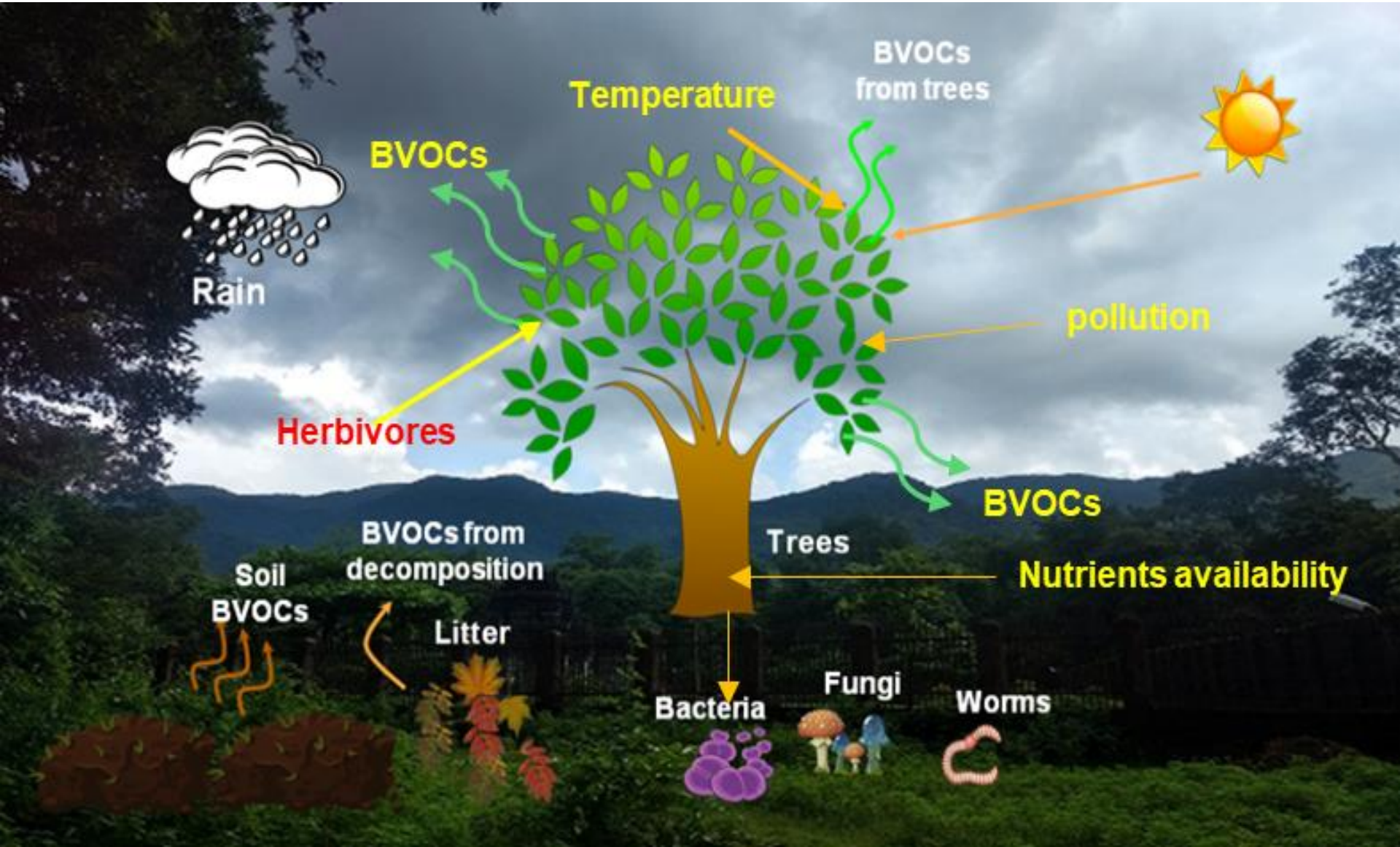
- isoprene
- α-pinene
- β-pinene
- ocimene
- limonene
- autres monoterpenes
- sesqui terpenes
- methanol
- ethanol
- acetone
- formaldehyde
- acetaldehyde
- acide form+ace
- ethene
- propene
- autres bvoc

BVOCs

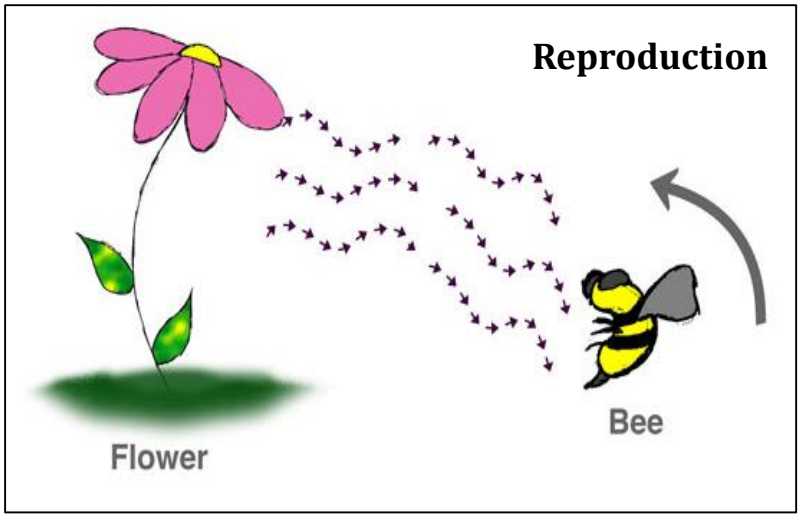
Guenther et al. 1995, 2012

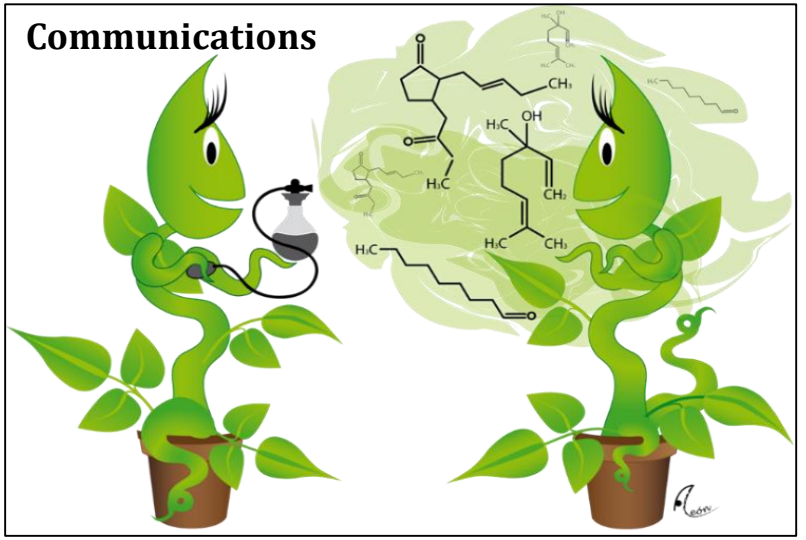
Emissions of VOCs from terrestrial vegetation

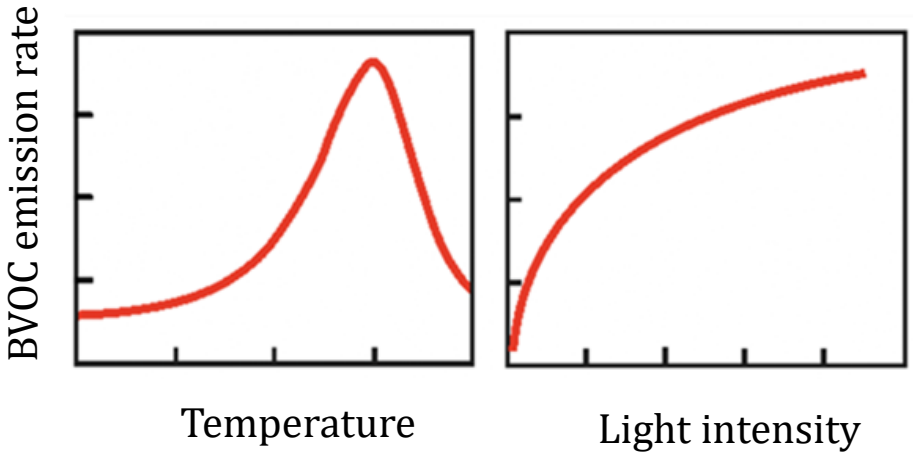
- Different BVOCs are released from the different organs of the plants for defence mechanism. By releasing VOCs, the plants protect themselves from various biotic and abiotic threats.



Emission of VOCs from Vegetation



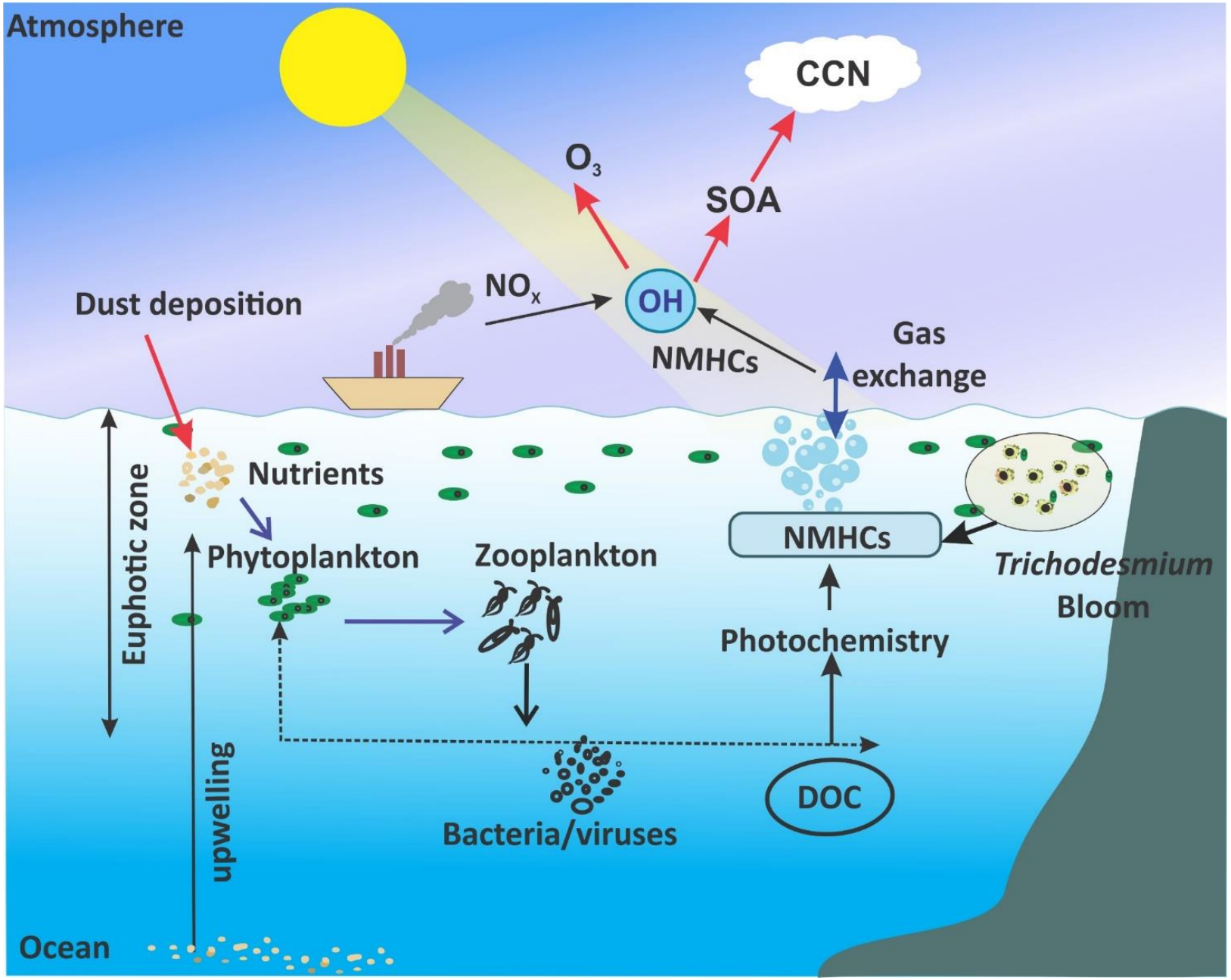




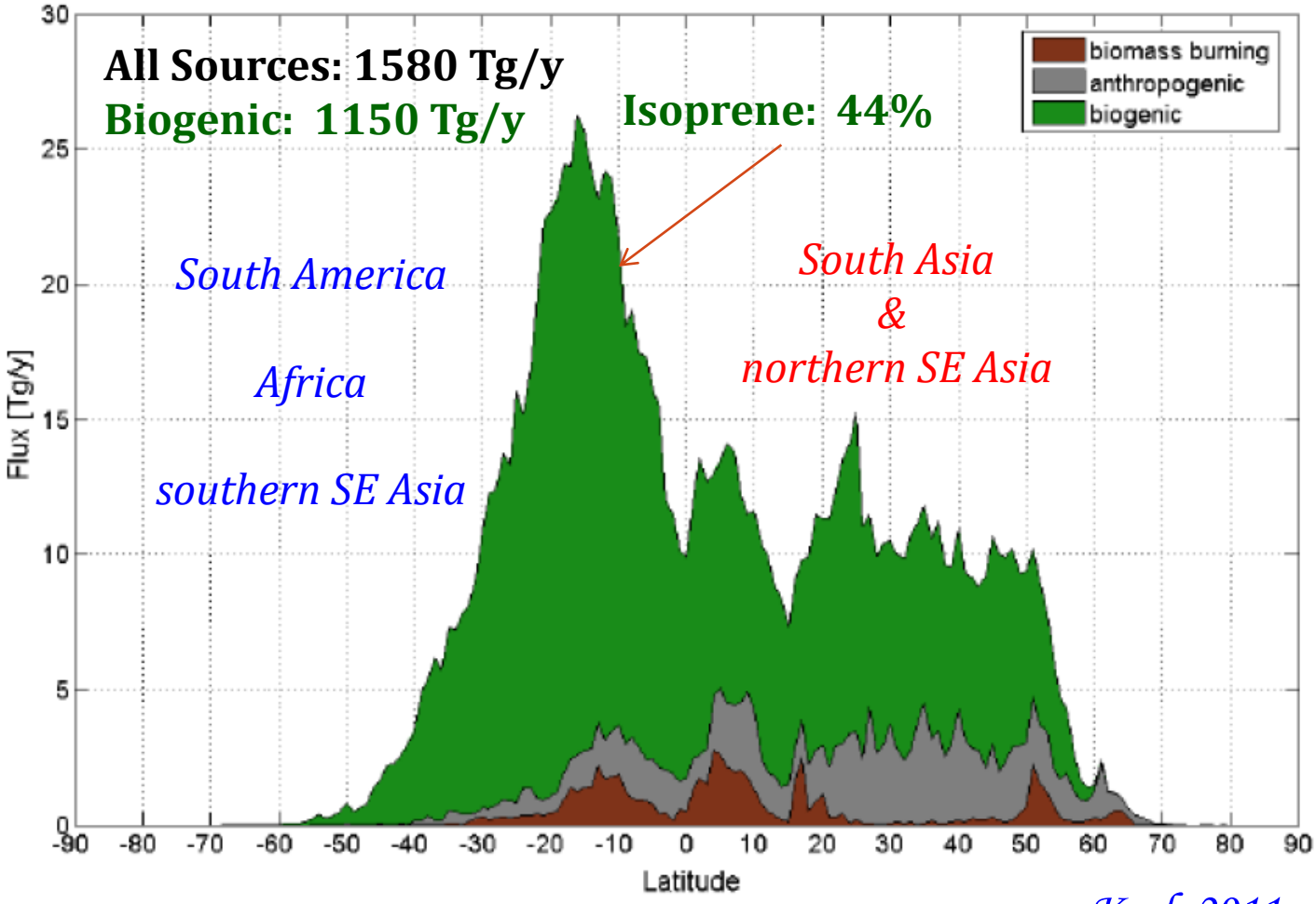
Defense Mechanism

Hewitt et al. 2009

Oceanic emissions of VOCs

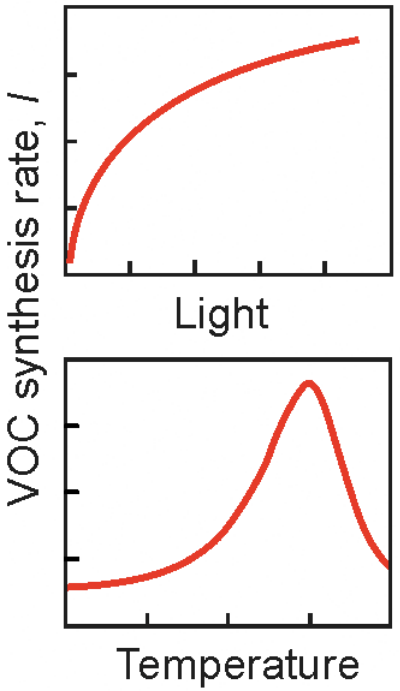


Latitudinal Distributions of Biogenic VOC Emission



Karl, 2011

Response of BVOCs

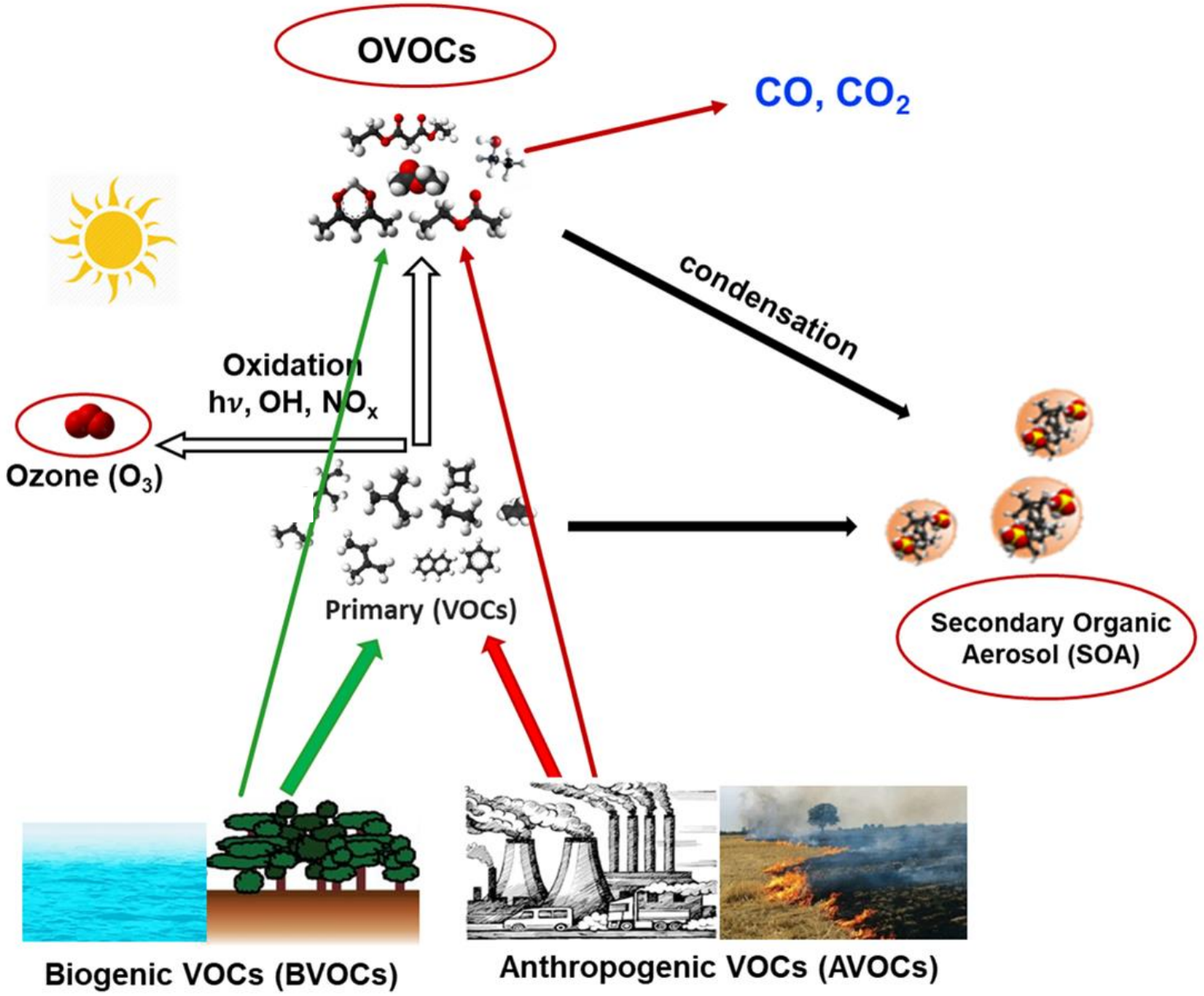


Hewitt et al., 2009

Tropics are responsible for 80% of global emissions *(Guenther, 2013)*

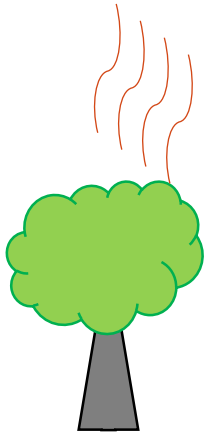
Study of BVOCs in terrestrial biogenic environments of India is missing.

Role of VOCs in the Earth's Atmosphere



BVOCs are good or bad??

BVOCs



Marine organism

Biogenic or Natural Sources

+

NO_x

Anthropogenic or Human activity

→

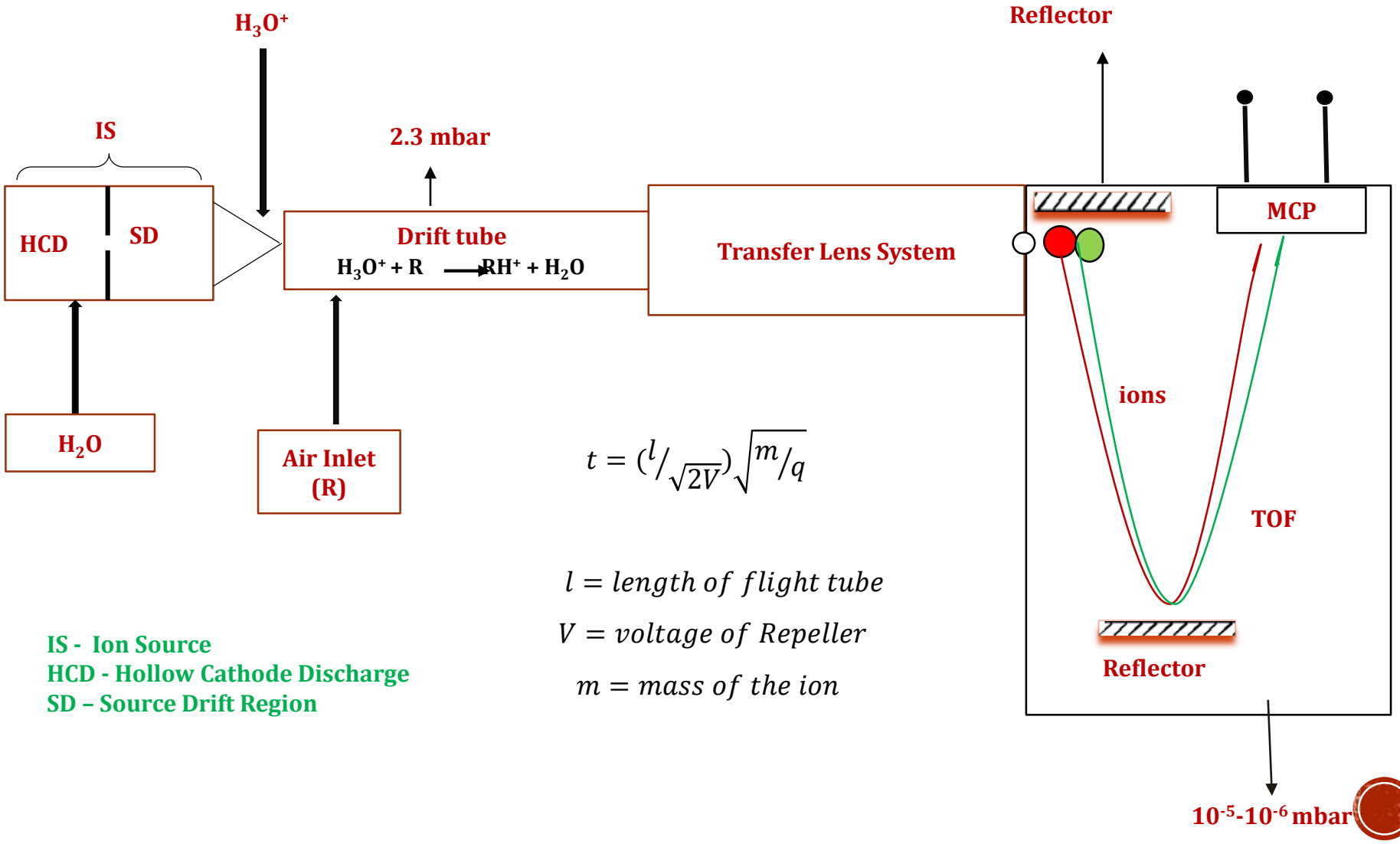
Ozone (O_3), PAN, SOA etc.

Instruments for measurements

PTR-TOF-MS

TD-GC-FID

Proton Transfer Reaction-Time of Flight-Mass Spectrometry (PTR-TOF-MS)



$$t = (l/\sqrt{2V})\sqrt{m/q}$$

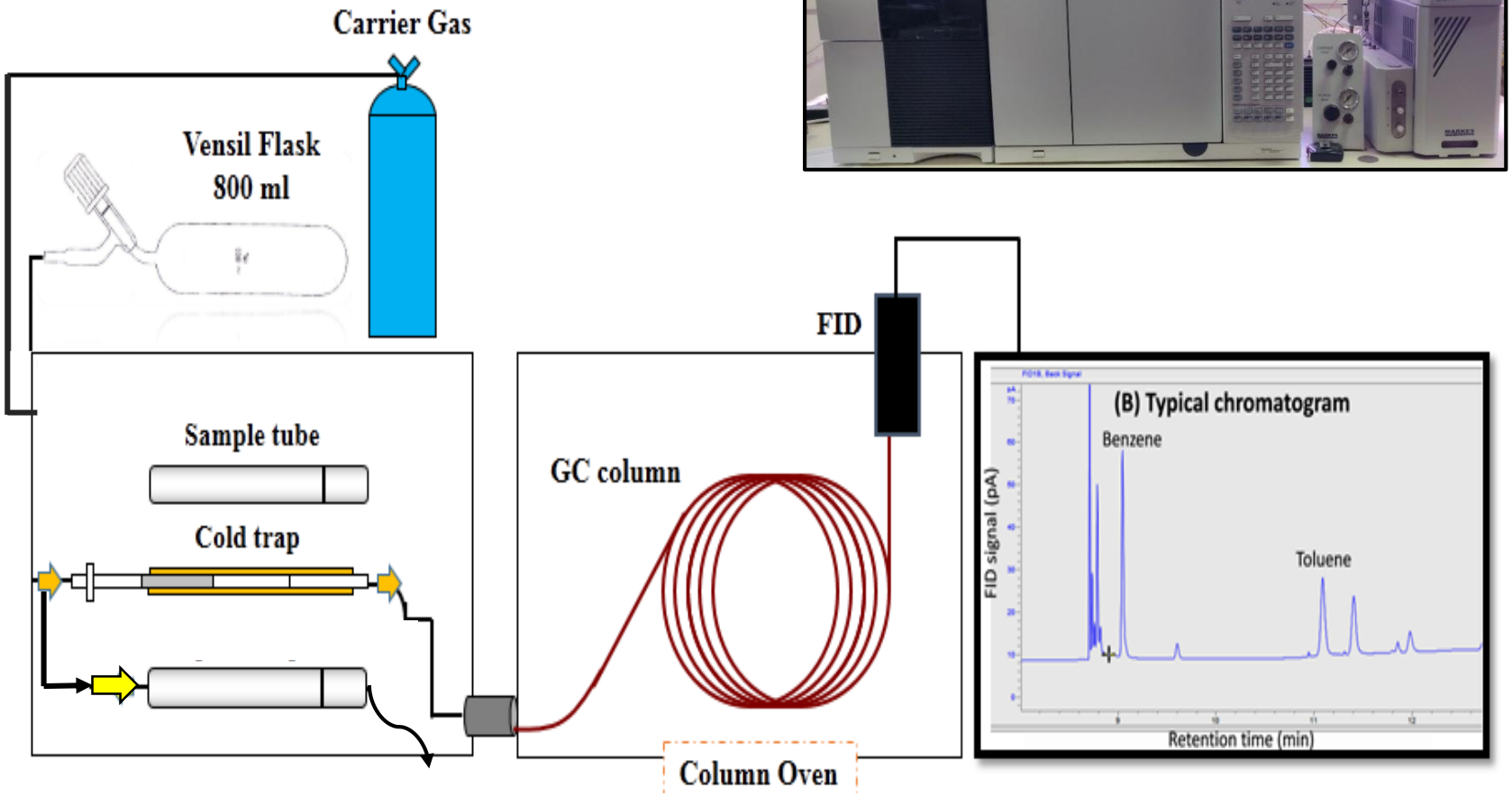
$l = length\ of\ flight\ tube$

$V = voltage\ of\ Repeller$

$m = mass\ of\ the\ ion$

IS - Ion Source
HCD - Hollow Cathode Discharge
SD – Source Drift Region

TD-GC-FID



Schematic Diagram Of TD-GC-FID