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Geography Foundation | 16 May 24

Indian Geography

12:00 – 2:30 | Lec-8

Factors / Influence to Monsoon climate of S. Asia

- Land-Water differential heating
- Role of ITCZ & its migration
- Role of Tibetan Plateau
- Role of Himalayas & N. Mountains
- Jet streams (STWJ & TEJ)
- Ocean-Atmosphere interact" in other oceans
  - Impact of ENSO (Pacific Ocean), Arctic Ocean & Indian Ocean

Modern Theories

2) Yin's Theory –

- Explains sudden burst / onset of Monsoon related to Northward migration of STWJ & disappearance of Southern Branch of STWJ on N. Plains

- However during rainy months, if a TWJ's southern branch get reestablished over N Plains, the monsoon rains can get disrupted leading to MONSOON BREAKS.
- TWJ is not easy to forecast & hence can cause crop failures & droughts during the agri growing season of Kharif crops.

Other Ocean-Atmospheric Conditions impacting Monsoons:

1] ENSO [El-Nino-Southern Oscillation]

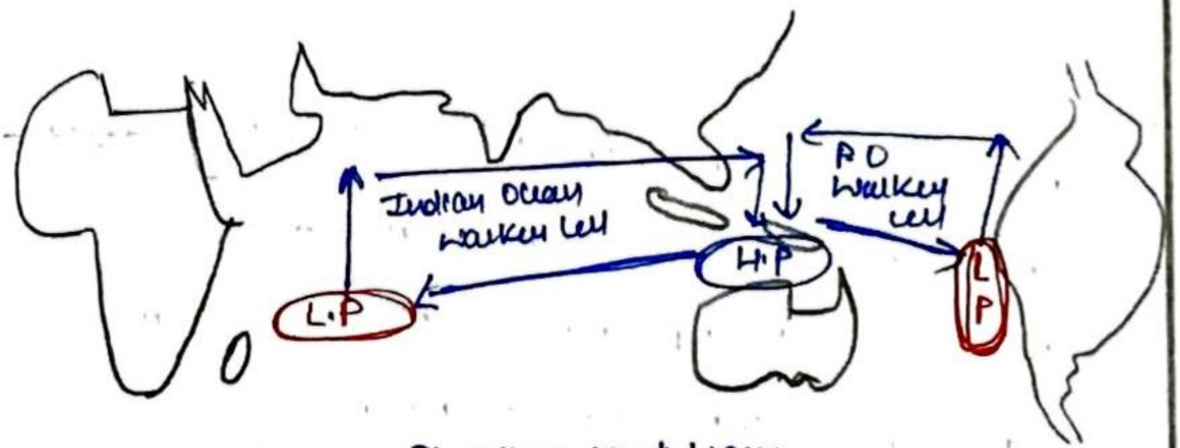


Fig - EL-Nino conditions

o Walker cell of S Pacific feed & intensifies Mascarene High Pressure (H.P) of Indian Ocean (there is an I.O component of walker cell with a sinking link over Mascarene High) = Normal year.

- In El Nino year, the pacific walker cell either weakens or reverses & thus weakens Mascarene HP also, thus intern weakens the S-W Monsoon surface winds, & Asia ∴ have droughts & reduced rains

- In La-Nina year, Pacific walker cell intensifies which also intensifies Mascarene High over Indian Ocean, intern strong then Monsoon winds towards India ∴ better rain & floods in La-Nina years

- 2019-2022 - Influence of Triple Dip Nina with India receiving above average

main. 2023 - El Nino year & India had deficit rainfall but initial few ~~months~~ weeks of June India had very heavy rains because of other factors

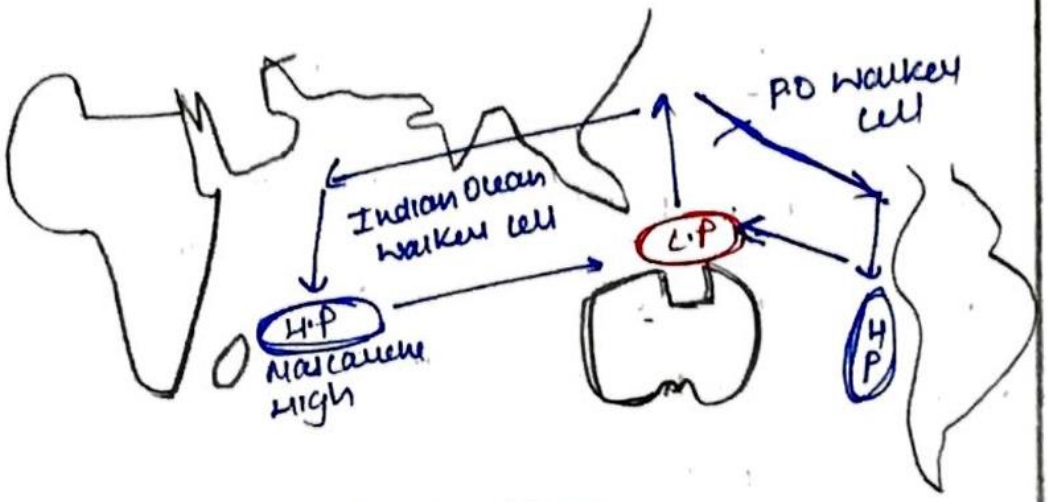


Fig normal condition

② Indian Ocean Dipole [I.O.D] / Indian Ocean El-Nino

- Because of Ocean coastline configuration & because of warm current influx from Pacific (Leeuwin current) (The Bay of Bengal waters off Indonesia are relatively warmer

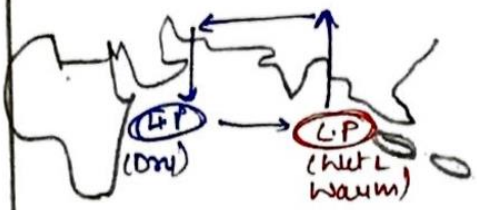
Western Indian Ocean

with L.P conditions compared to off to Somalia coast).

- This sets up local scale air circulation from Arabian sea towards Indonesia. This can disrupts S-W Monsoon winds towards India ∴ less rains along Somali coast & western Peninsular India. This is called as **Negative Phase of IOD**

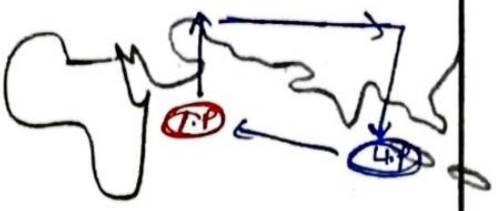
- In other years. For reasons not known well, the Temp. & Pressure patterns on Indian Ocean can reverse (cooler water & H.P off Indonesia & warmer water and L.P off Somalia).

- This strengthens the Monsoon winds causing heavy rains in W. India & in Somalia. This is called as **Positive Phase of IOD**



Negative IOD

Disrupts S-W Monsoon & causes subdued Rainfall



Positive IOD

S-W Monsoon is intensified ∴ more rainfall in India.

- There is no definite pattern in how IOD patterns sets in. In the last 10 years the frequency of IOD oscillations have increased due to climate change

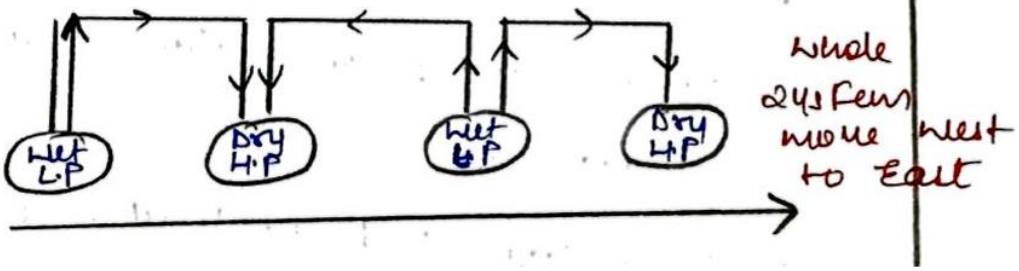
(3) MJO [Madden Julian Oscillation]-

- MJO is a system of convection with a rising air component (Enhanced phase)

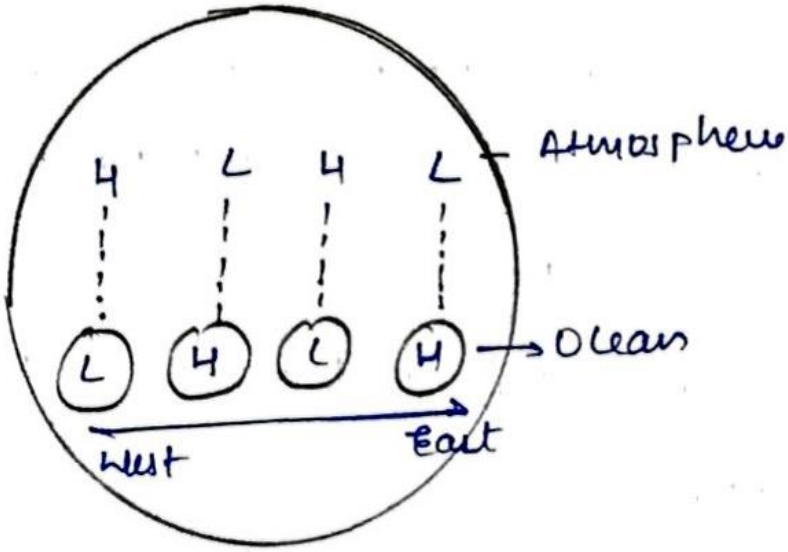
& a sinking component (Depressed/subdued phase)

- The MJO system moves from west to East generally south of equator imparting I.O waters & Pacific waters
- The system has a frequency of 30-60 -90 days.

- In some years the MJO systems shifts northwards & can move over South Asia & depending on ~~weather~~ whether L.P wet system is passing or Dry H.P is passing, India can have Enhanced Rains or subdued rains.



weeks L may coincided with Summer Monsoons in India



4] Impact of Arctic Melting -

- Arctic Melting L Rapid Loss of Arctic Sea Ice is called as Arctic Amplification.
- There are 3 consequences of Arctic Amplification -
  - (a) Higher release of water vapours into atmosphere
  - (b) Weakening of polar vortex and its shift towards Tropical Latitude

© Sharp meandering of Rossby waves that drags warmer & moist air from Arctic region towards Tropic.

[Polar Region & Rossby waves are both Upper Tropospheric circulation. This creates above avg rainfall this causes more intensifies & more cyclones in India]