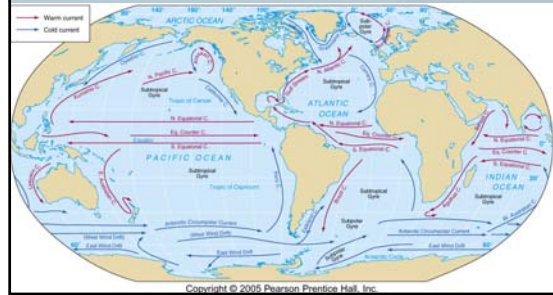


Ocean Circulation

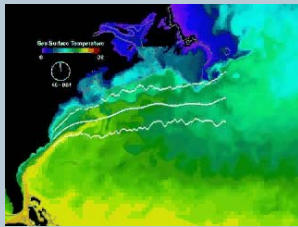
Physical Oceanography
MSCI 301
Coastal Carolina University

Surface Ocean Circulation

1. Basin Circulation
2. Equatorial Circulation
3. Polar Circulation



Why does this happen?



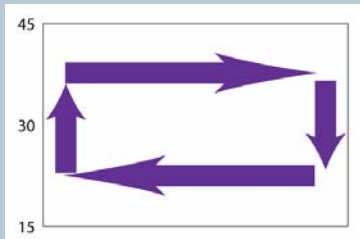
[Quicktime animation](#)

Contributors to Surface Circulation Theory

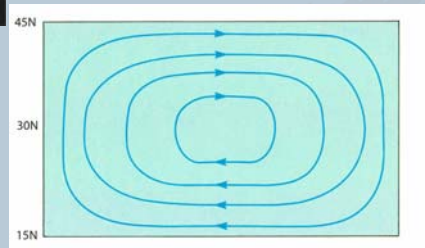
Fridtjof Nansen	(1898)	Qualitative theory, currents transport water at an angle to the wind.
Vagn Walfrid Ekman	(1902)	Quantitative theory for wind-driven transport at the sea surface.
Harald Sverdrup	(1947)	Theory for wind-driven circulation in the eastern Pacific.
Henry Stommel	(1948)	Theory for westward intensification of wind-driven circulation (western boundary currents).
Walter Munk	(1950)	Quantitative theory for main features of the wind-driven circulation
Kirk Bryan	(1963)	Numerical models of the oceanic circulation.
Bert Semtner and Robert Chervin	(1988)	Global, eddy-resolving, realistic model of the ocean's circulation.

Why do we care about the equations of motion?

Let's go back to our picture of Basin circulation....



Sverdrup's model (sort of)



Let's apply conservation of vorticity...

Stommel's model

Boundary Currents

Basin problem

Repeat the analysis of the conservation of vorticity for a basin in the southern hemisphere.

Alternate Earth

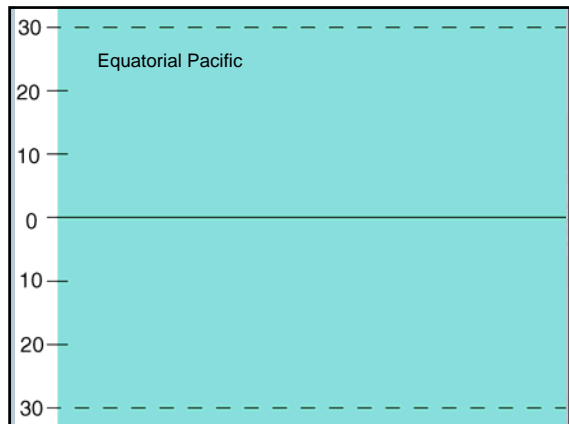
Let's assume that the earth is 1×10^8 km from the sun, and spins on its axis in 12 hours. Explain in detail how this would affect:

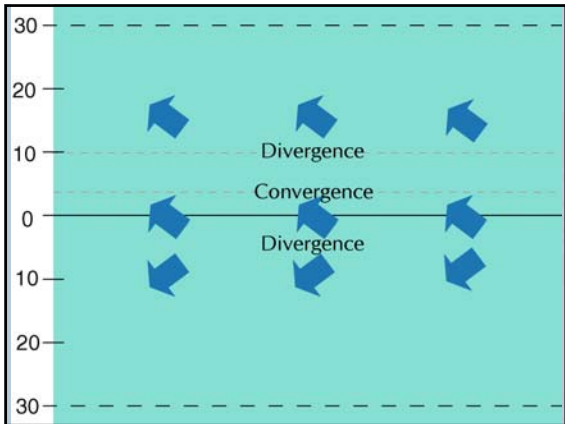
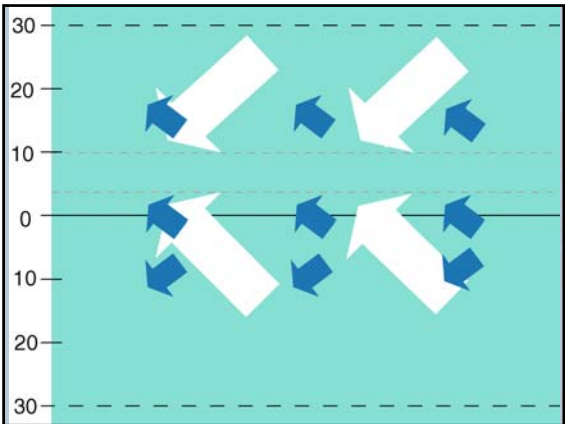
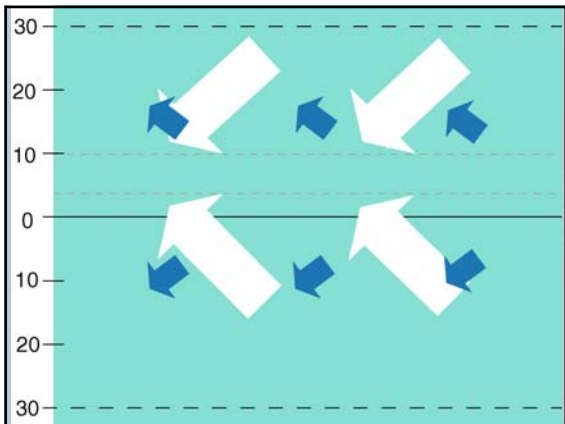
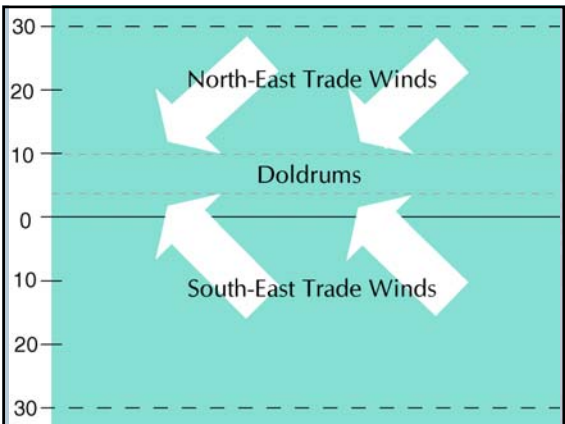
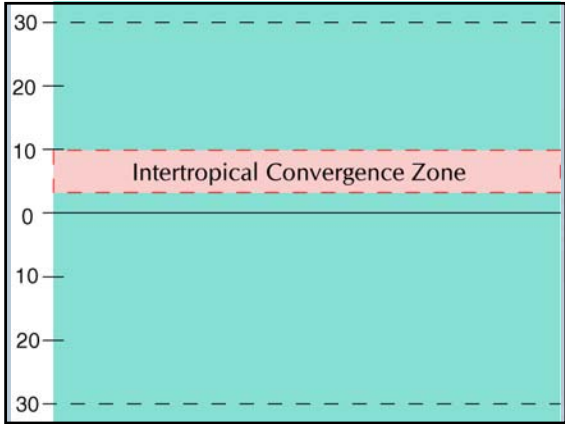
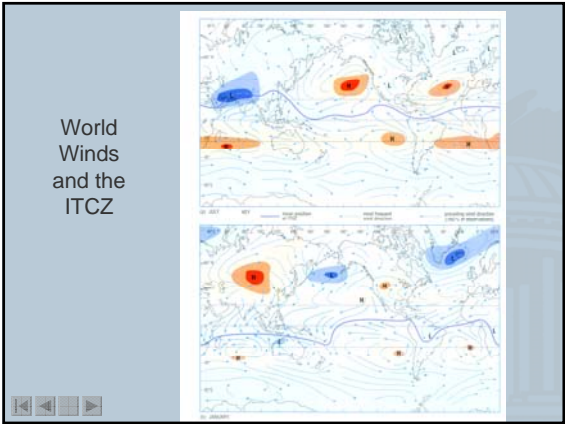
- Wind circulation
- Coriolis effect
- Ekman Transport
- Geostrophic Balance
- Basin Circulation

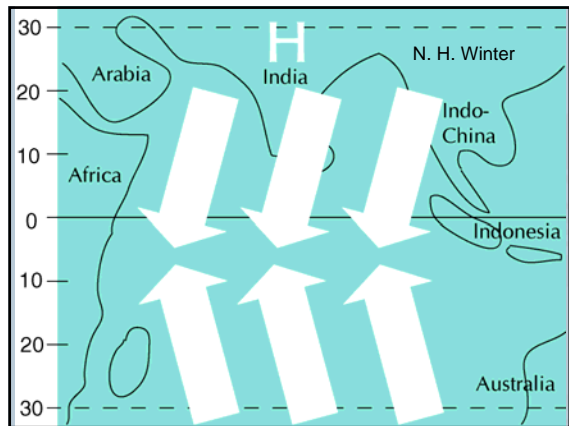
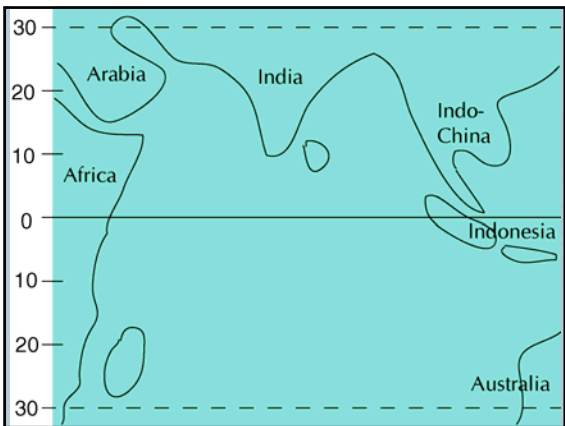
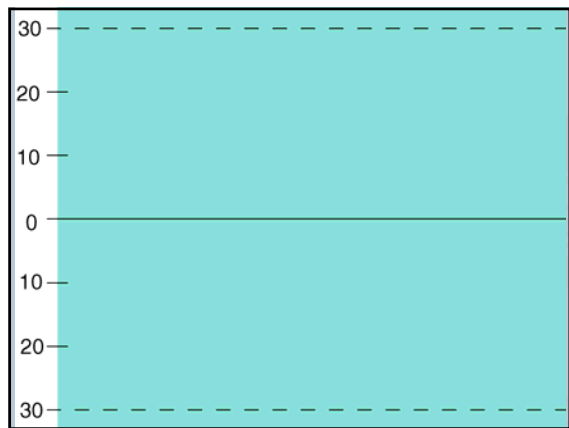
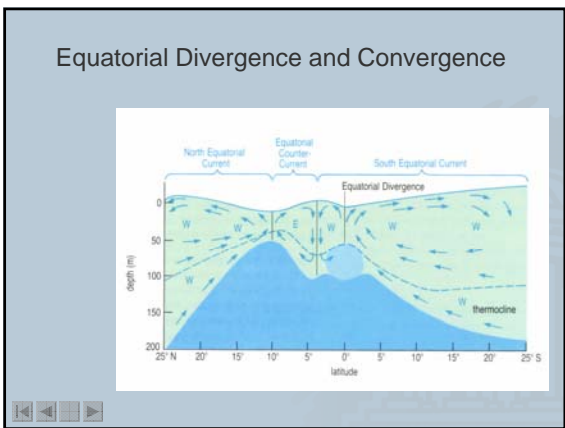
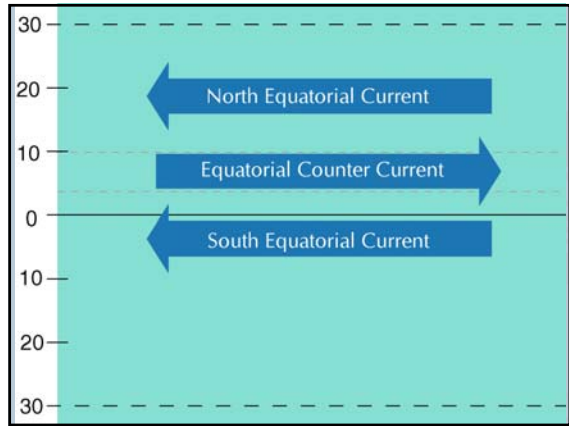
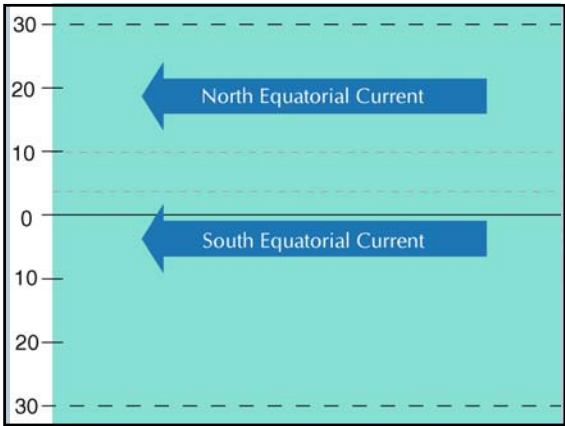
For each of these, compare the equations of the real earth to this alternate one and determine what changes in the atmosphere and oceans would result.

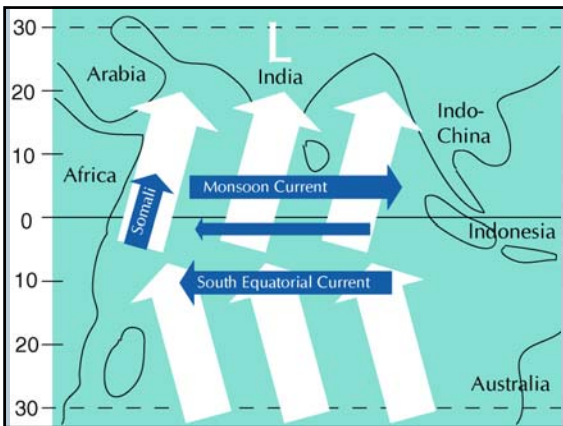
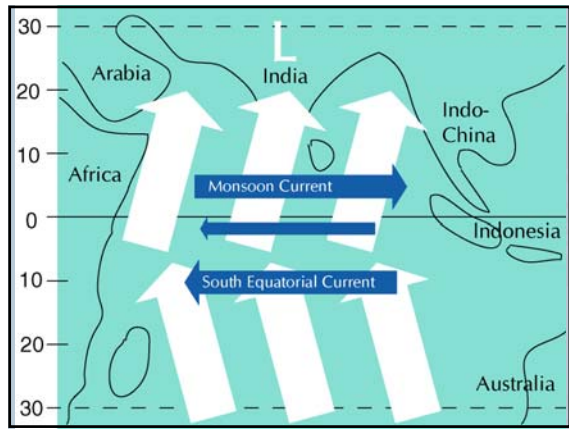
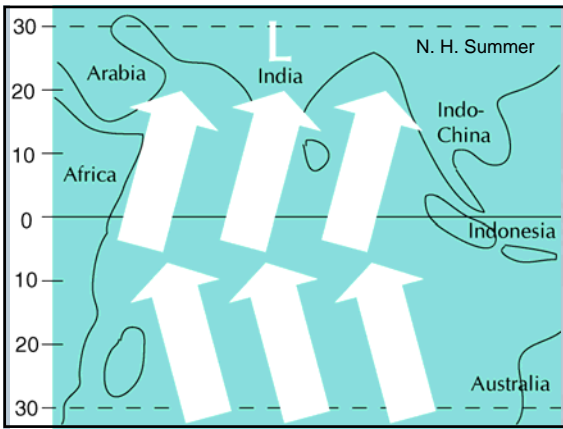
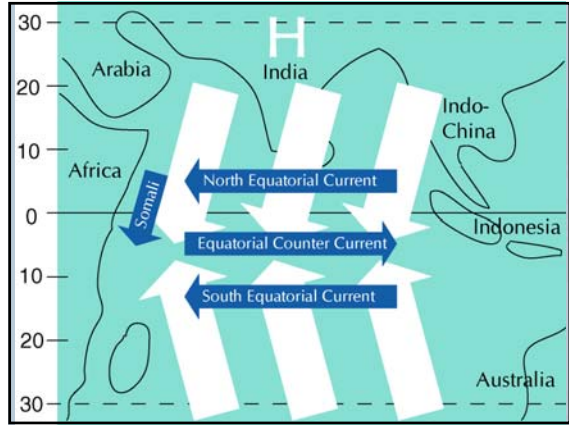
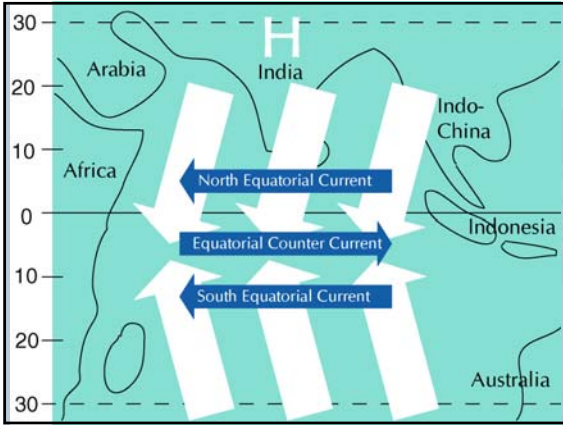
Equatorial Pacific

- Draw the Winds that you would expect to see from 30° N to 30° S.







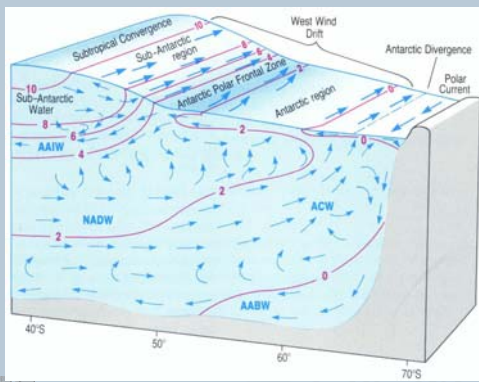
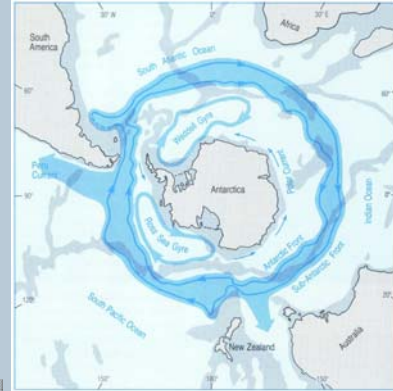


Indian Ocean Currents

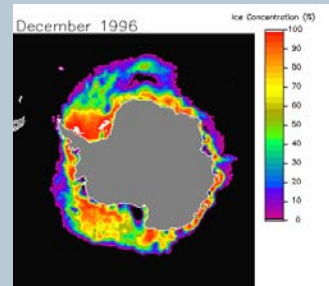
The summary diagram shows two panels: 'NORTH-EAST MONSOON' for January and 'SOUTH-WEST MONSOON' for July. The January panel shows the Somali current flowing southward along Africa and the monsoon current flowing northward along India. The July panel shows the monsoon current flowing southward along Africa and the Somali current flowing northward along India. Both panels also show the South Equatorial Current and the Equatorial Counter Current. A legend identifies the currents: Somali, Monsoon, South Equatorial, and Equatorial Counter.

Antarctic Currents

- Down to 60° S, the winds are predominantly from the west.
- Ekman transport to the *left* of the wind causes a sea-surface slope. This slopes up away from Antarctica to the North.
- The sea-surface slope induces geostrophic flow to the East, causing the Antarctic Circumpolar current. 24,000 km of continuous current around Antarctica.
- Similarly but oppositely, South of 60° S, winds from the east off the high pressure of the Antarctic drive the Polar Current to the west.



Antarctic Sea Ice



(USNA)