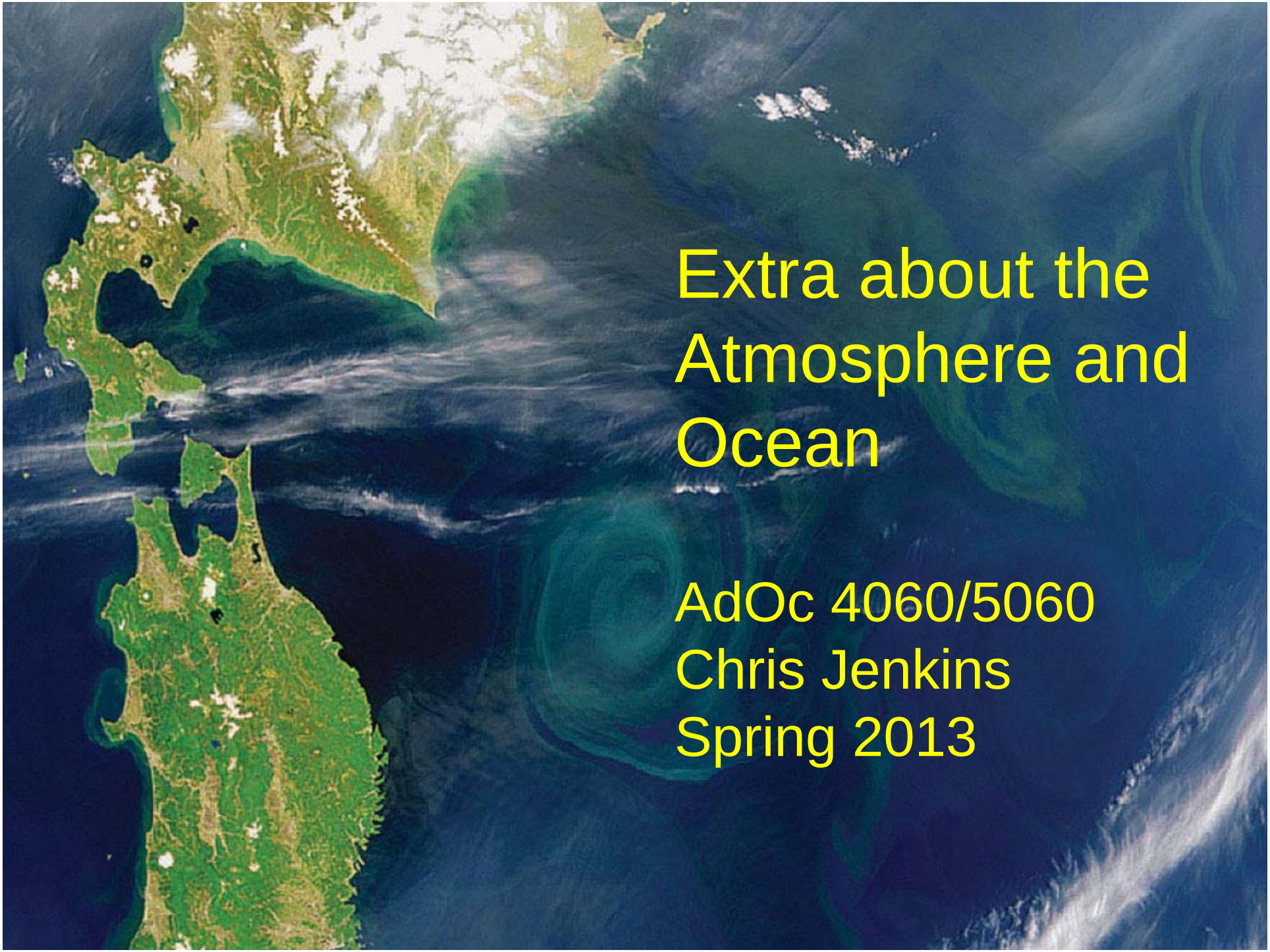
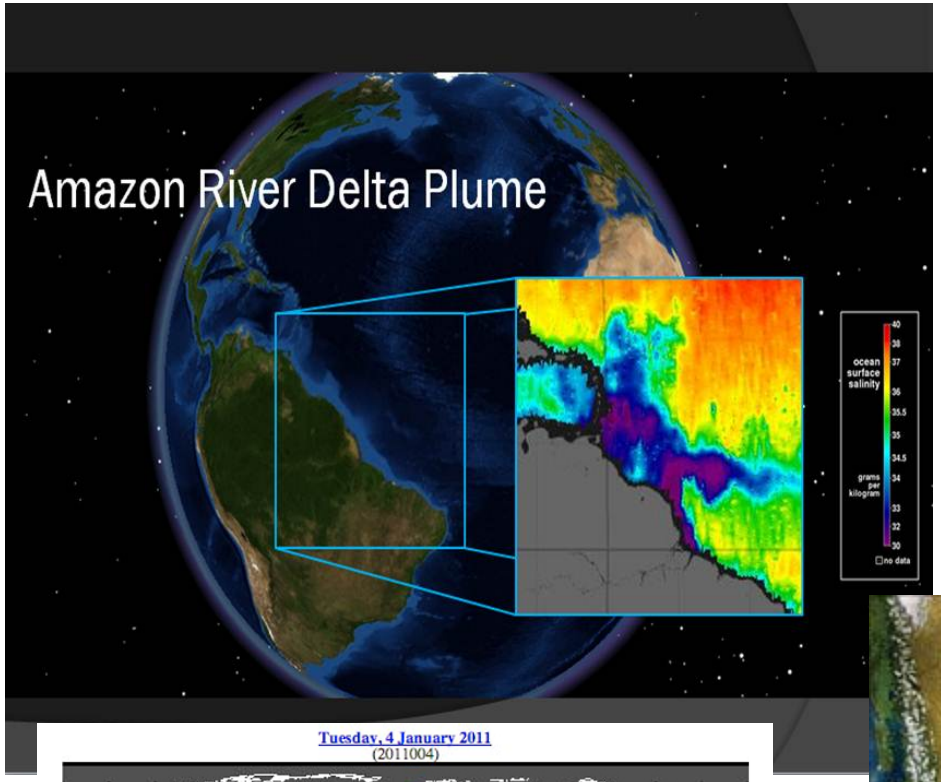
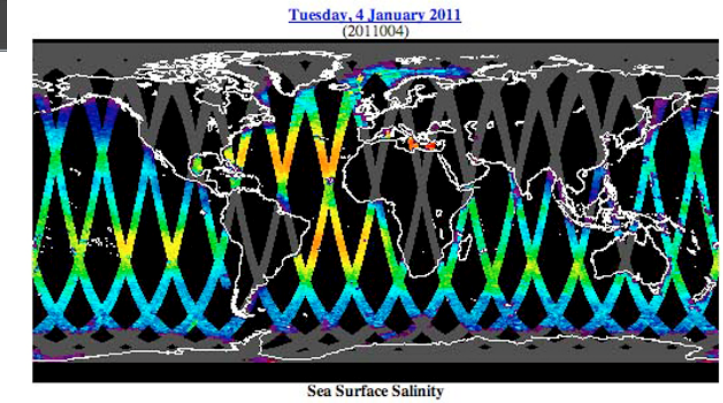


Extra about the Atmosphere and Ocean

AdOc 4060/5060
Chris Jenkins
Spring 2013

Salinity - Aquarius Mission



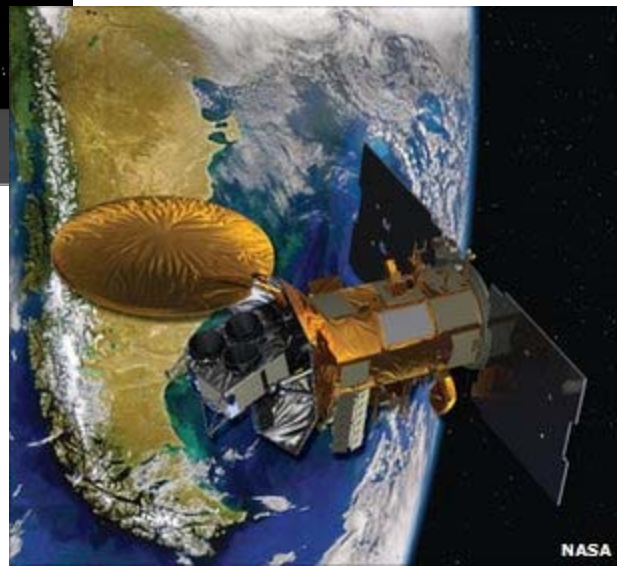


Objectives for Sea Surface Salinity (SSS) Remote Sensing

1. Improving seasonal to interannual [ENSO] climate predictions: …, and to study and model the role of freshwater flux in the formation and maintenance of barrier layers and mixed layer heat budget in the tropics.

2. Improving ocean rainfall estimates and global hydrologic budgets …

3. Monitoring large-scale salinity events: This effort may include ice melt, major river runoff events, or monsoons …



Coriolis effect

• affects moving objects and fluids with little frictional contact with the Earth, especially air and ocean currents

• the Coriolis “force” associated with a moving fluid is perpendicular to that fluid’s horizontal motion (*90° to the right in NH*) with a magnitude of:

$$f = 2\Omega \sin\phi \, V$$

Ω = Earth’s angular velocity
ϕ = latitude
V = fluid’s horizontal velocity
Coriolis parameter, f

• the “force” therefore increases with latitude and the fluid’s velocity

Rossby number

• the degree to which Coriolis matters for a moving fluid can be evaluated using the ratio between its *inertial force* ($\sim V^2/L$) and its *Coriolis force* (fV), approximated using the Rossby number (R_o):

$$R_o = V/Lf$$

V = characteristic velocity (m/s)
L = characteristic length scale (m)
f = Coriolis parameter = $2\Omega\sin\phi$ (s^{-1})

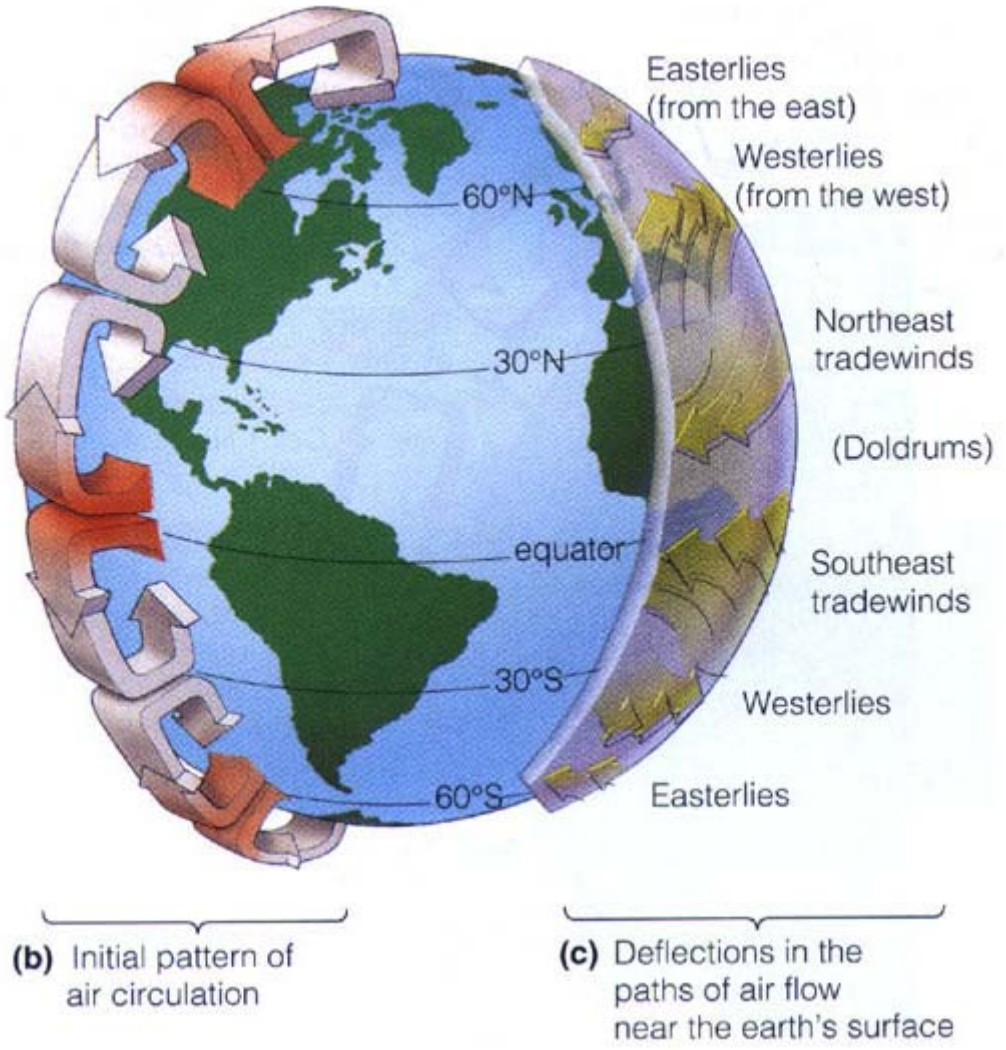
• Coriolis matters at small [O(1)] Rossby numbers but not large ones

Hurricane ~0.1-1 (yes, affected)
Toilet flush >1000 (no)

Atmospheric Cells

Coriolis leads to the development of three convection cells in each hemisphere (in the troposphere, lower ~10 km)

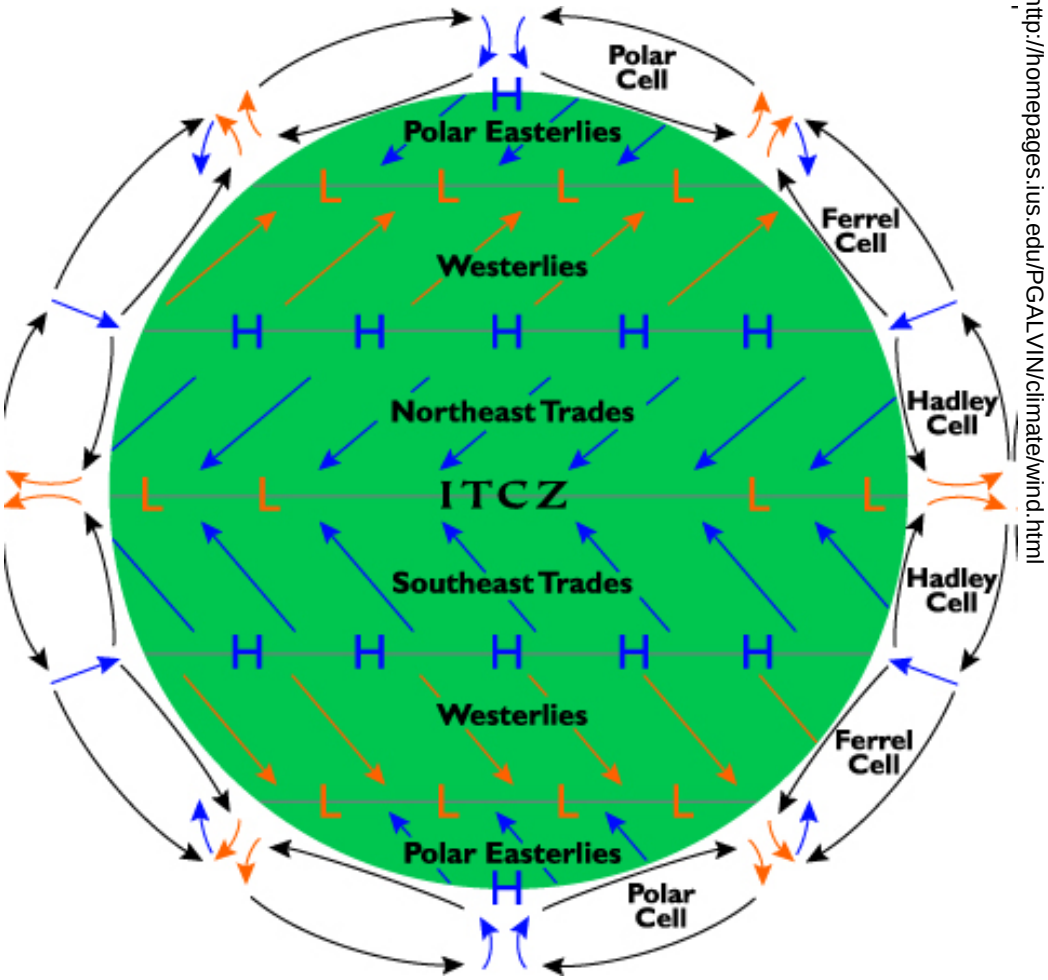
- Hadley (~0-30°)
- Polar (~60-90°)
- Ferrel (~30-60°)



http://homepages.ius.edu/PGALVIN/climate/wind.html

Prevailing Winds

- surface manifestation of the atmospheric cells
- Trade Winds (~0-30°)
- Westerlies (~30-60°)
- Polar Easterlies (~60-90°)



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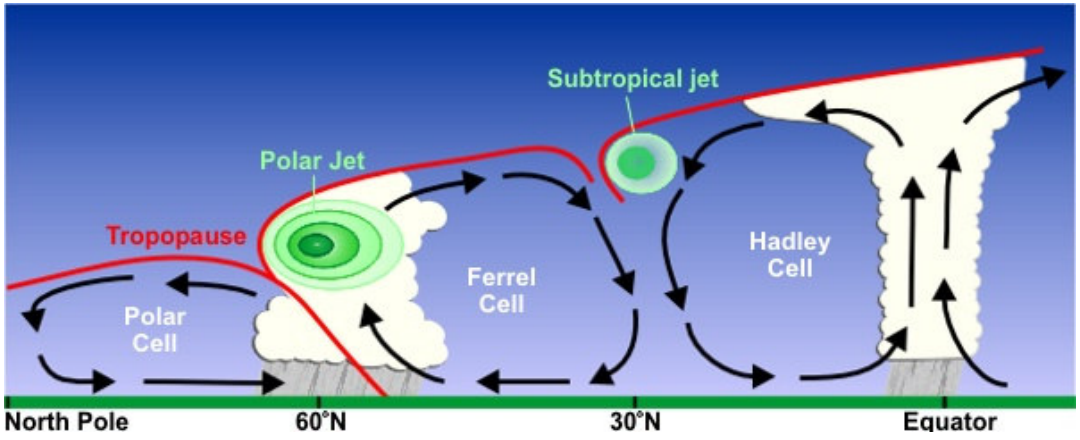
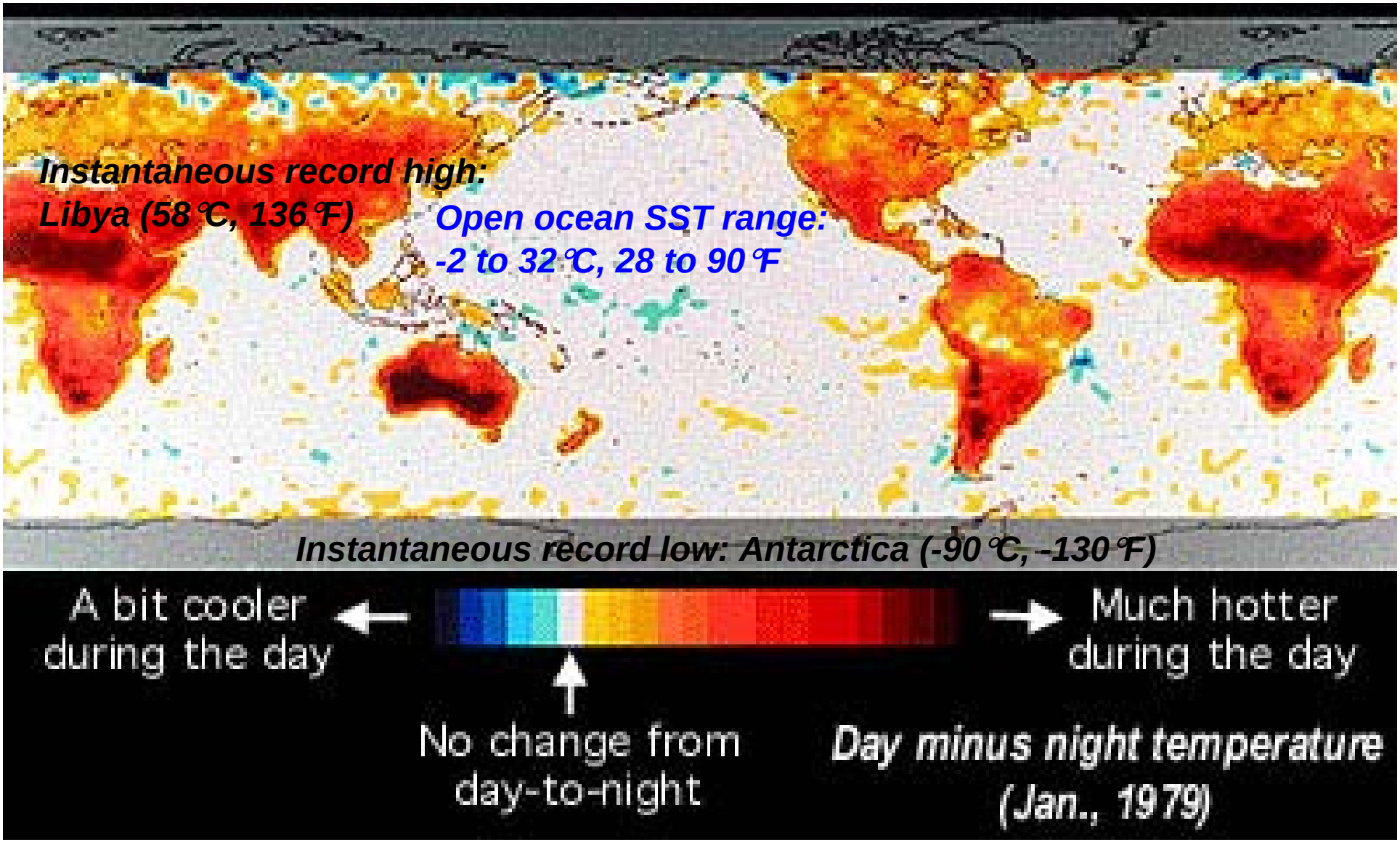


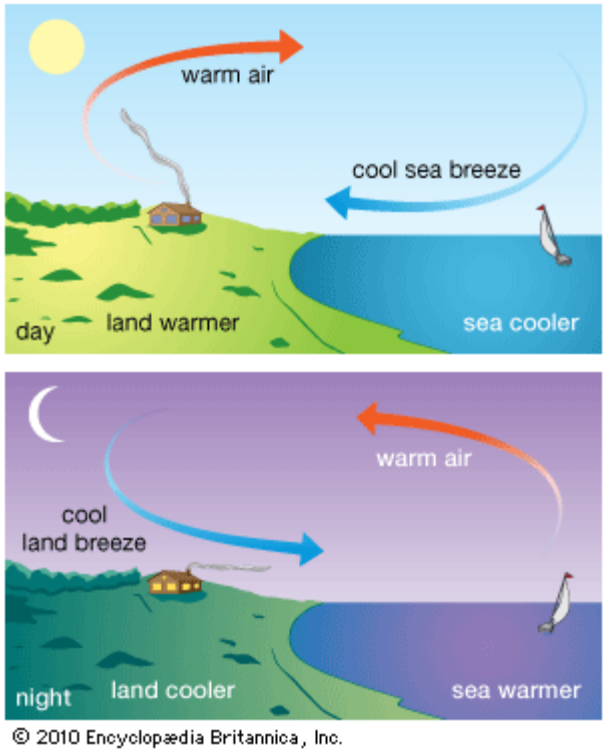
http://www.srh.noaa.gov/jetstream//global/images/jetstream3.jpg

Day – night air temperature change

Land: up to 30°C Ocean: ~1°C



Land-sea heating



Morning Glory, Gulf of Carpentaria

Marine layer

Atmospheric Water vapor

http://www.youtube.com/watch?v=Mpyr6QWKEq4

This data is from the Goddard Earth Modeling System, a coupled land-ocean-atmosphere model which uses earth and satellite-based observations to simulate the Earth's physical system during events such as La NiÃ±a.
This visualization shows the total precipitable water in the atmosphere, indicated by the gray to white cloud-like structures, and predicted precipitation, indicated by gold, during the 1998-1999 La NiÃ±a.

- Set question / puzzle:

When water droplets/rain condense from a volume of air will the remaining air rise or fall ?

Present your logical arguments in point form.

Avogadro