

EAPS 10000 Y01
Online Course
Planet Earth

Prof. Lawrence Braile

Welcome to the EAPS 10000 Y01 online course
Planet Earth (also known as EAPS 100)!

Professor Lawrence Braile

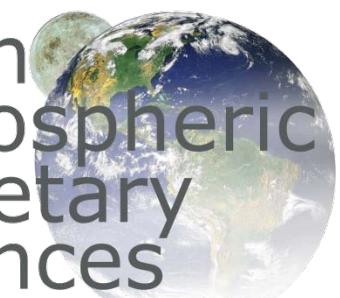
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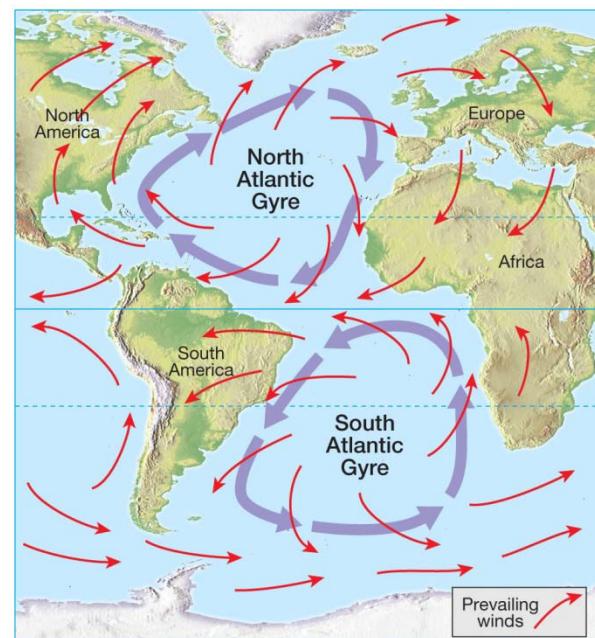
Earth
Atmospheric
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Sciences



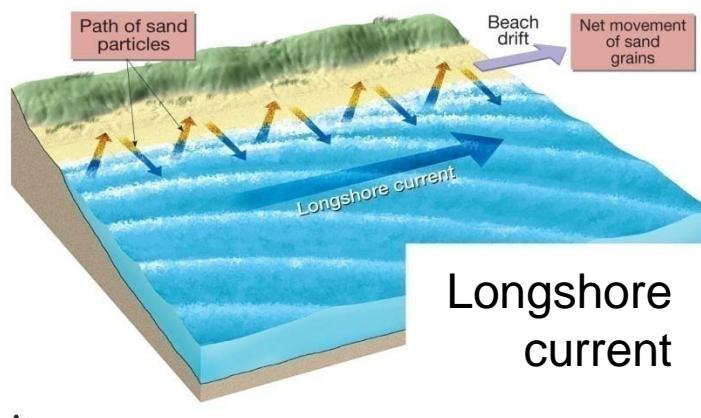
EAPS 10000 Y01 - *Planet Earth* (online course)

Week 5, Chapter 10 (pages 320-351, text)

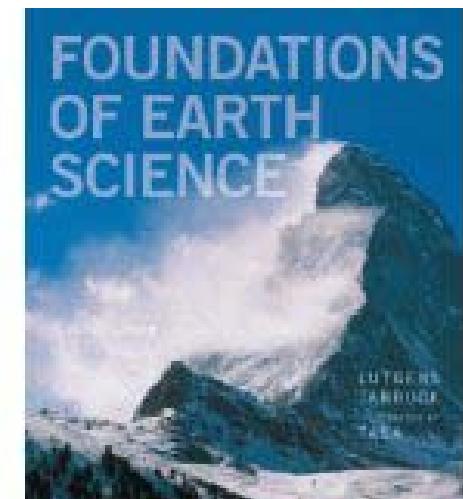
Week	Chapter	Assigned Pages	Major Concepts	Important Terms
5	10 – Restless Ocean	320 – 351	Ocean circulation, currents, causes of currents, waves, shoreline processes, longshore current	Beaches, tides, Coriolis effect



Ocean currents



Longshore current



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Week 5, Chapter 10 (pages 320-351)

When you have finished reading Chapter 10 and viewing the weekly PowerPoint file for Chapter 10, take the weekly quiz (Quiz9; be sure to read the Syllabus for more information on quizzes). You can use your book, notes, etc., during the quiz.

The PPT files (converted to PDF files) are best viewed with the Full Screen view in browsers.

The following slides illustrate some of the important concepts and topics of Chapter 10:

Causes of Ocean Currents:

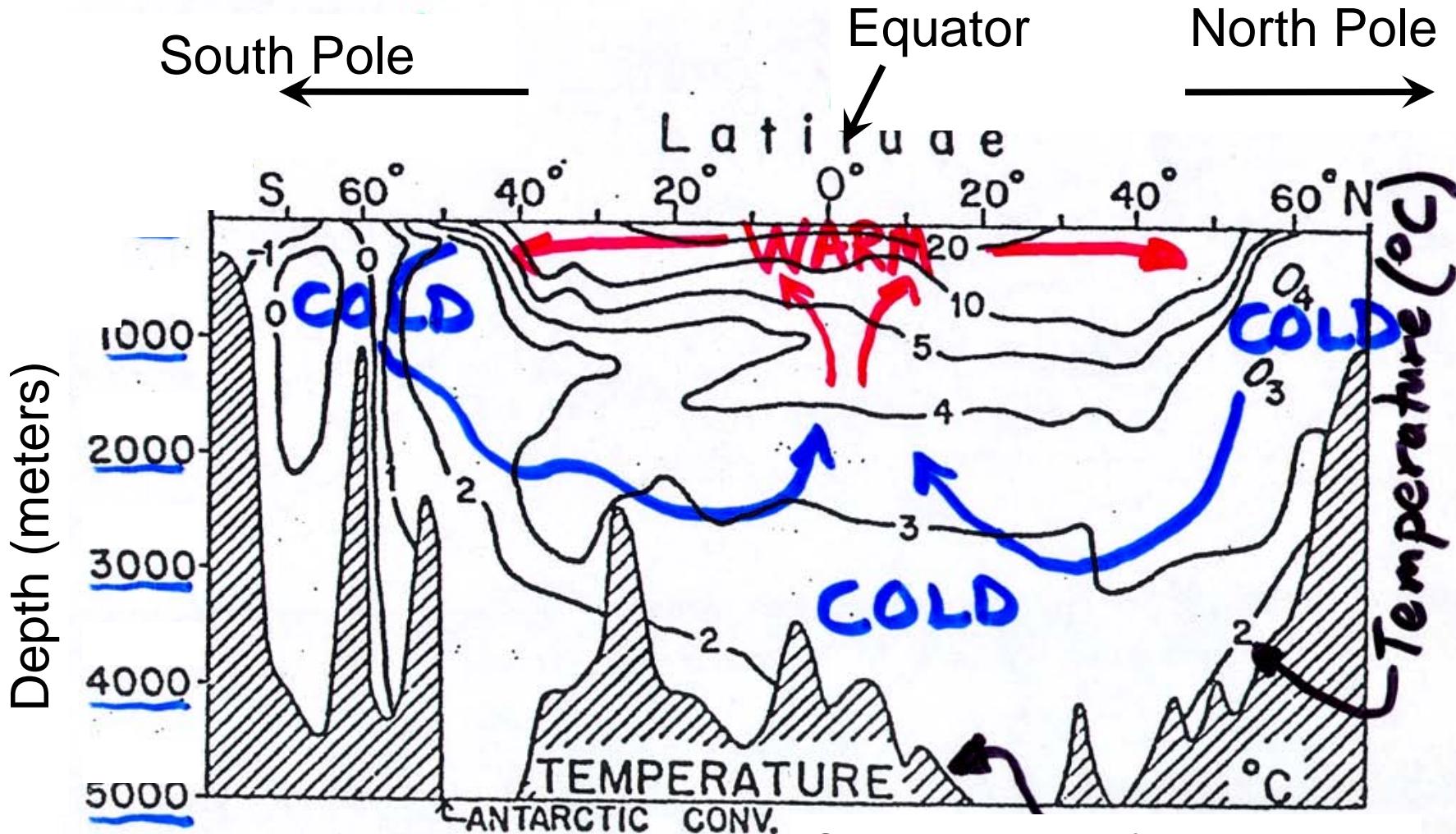
1. **Tides** (Earth, Moon, Sun gravitational attraction) cause surface waters to move
2. **Trade winds** (surface friction at ocean/atmosphere interface) cause surface currents
3. **Density Driven Currents**
 - Temperature variations
 - Warm waters rise, cool waters sink due to density variations. Heating and cooling of waters related primarily to location (polar, mid-latitude, equatorial), climate, seasons and weather
 - Salinity variations
 - Excess evaporation in some locations leads to increased salinity, and therefore density, and sinking waters

Causes of Ocean Currents (continued):

Results: Once water is moving, direction of the current is influenced by the ***Coriolis Effect*** (deflection to the right in N. hemisphere), the shape of the ocean basin and changes in one or more of the three causes of currents.

Currents cause mixing, dispersal, and sometimes, concentration of ocean waters and the chemicals that they contain (normal ocean waters with variable salinity as well as natural and human-caused pollution – chemicals, plastics, sewage, etc).

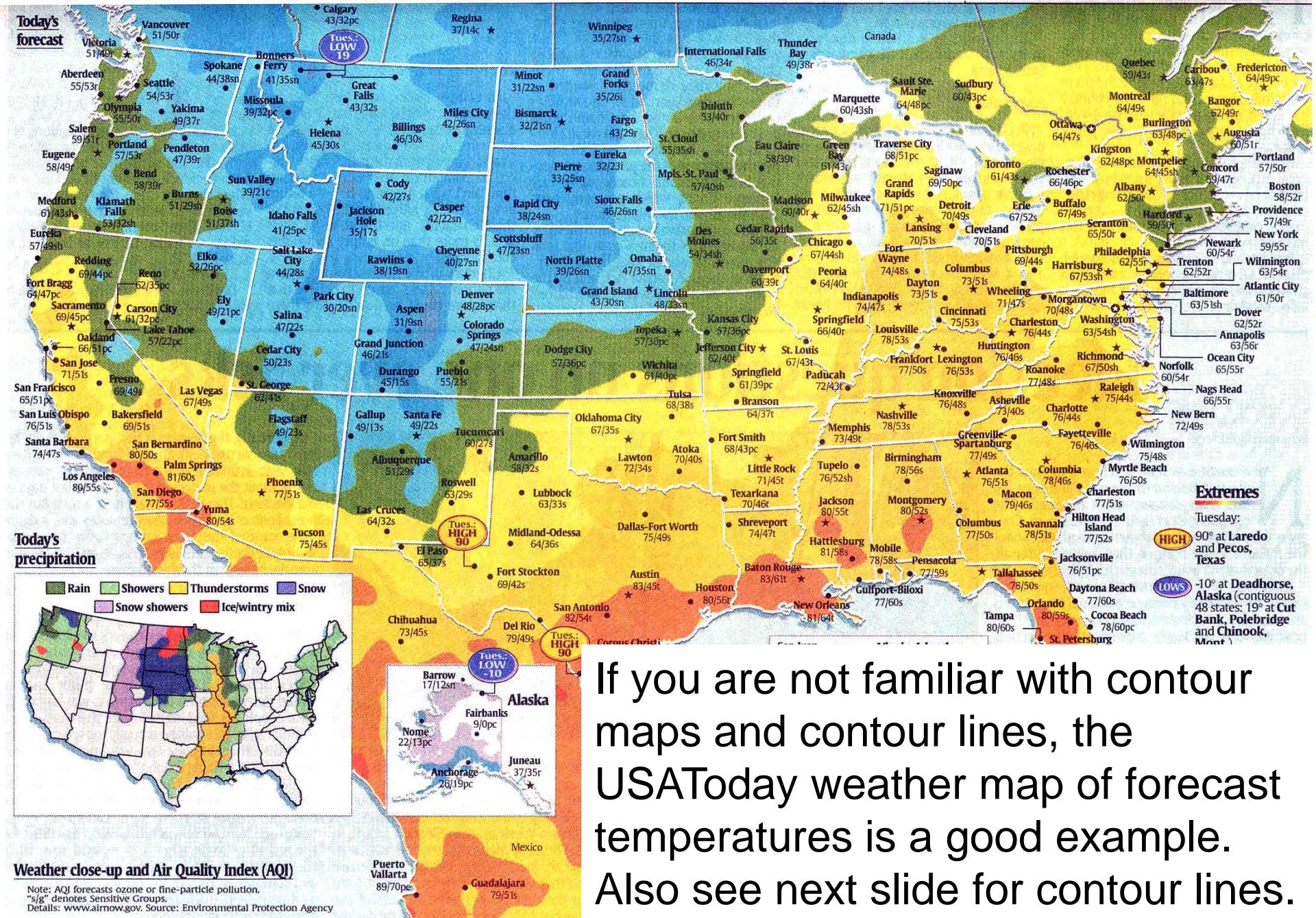
Example of temperature-driven convection (density current, cold waters in polar regions sink, warm waters in equatorial region tend to stay on surface due to buoyancy) on next slide....



Atlantic Ocean

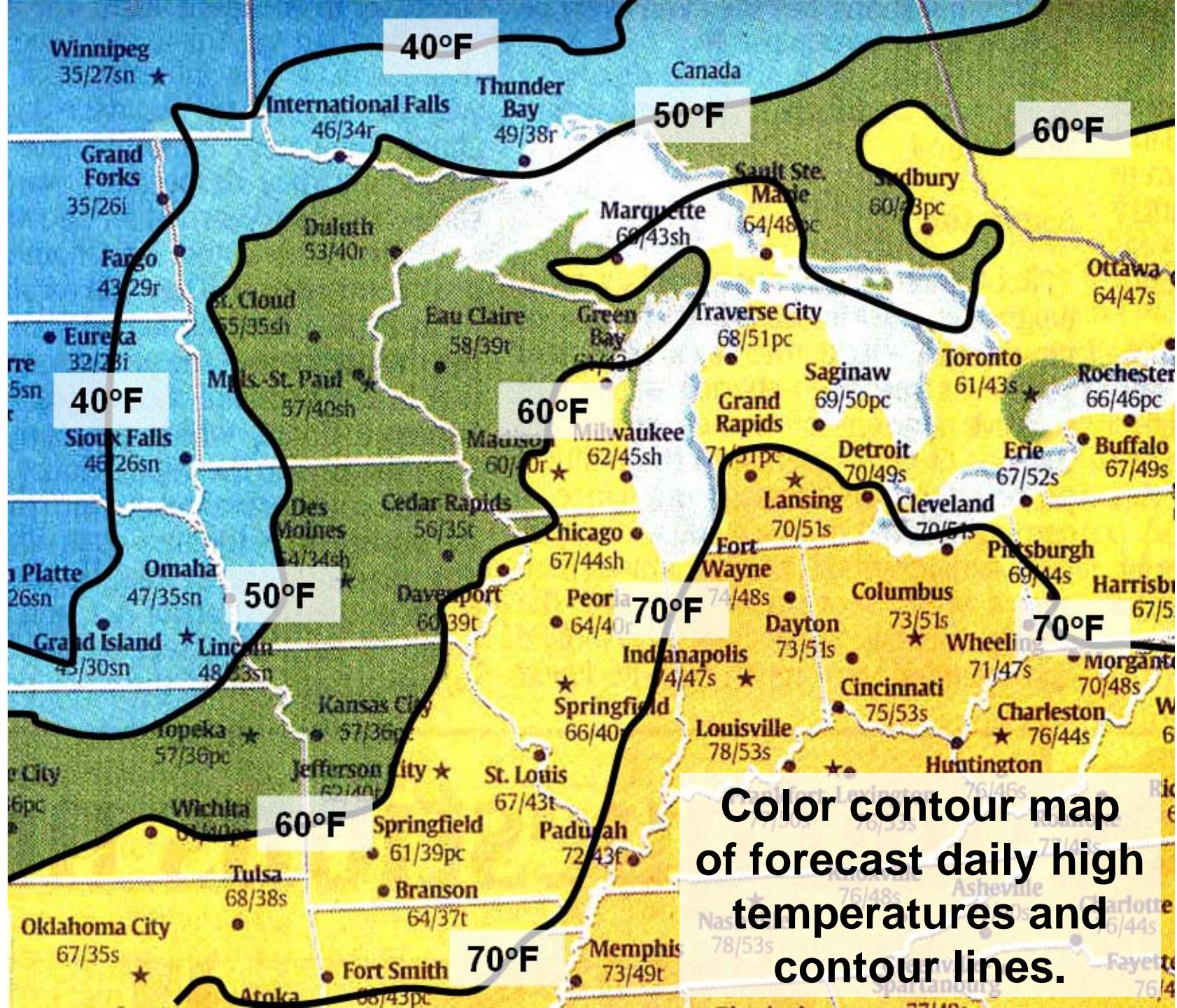
Ocean bottom (large vertical exaggeration)

South to North bathymetric profile of the Atlantic Ocean and temperature **contour lines** (degrees C) . Note that resulting currents (arrows) cause “pole-ward” surface current. The pole-ward currents are then deflected by the Coriolis effect.



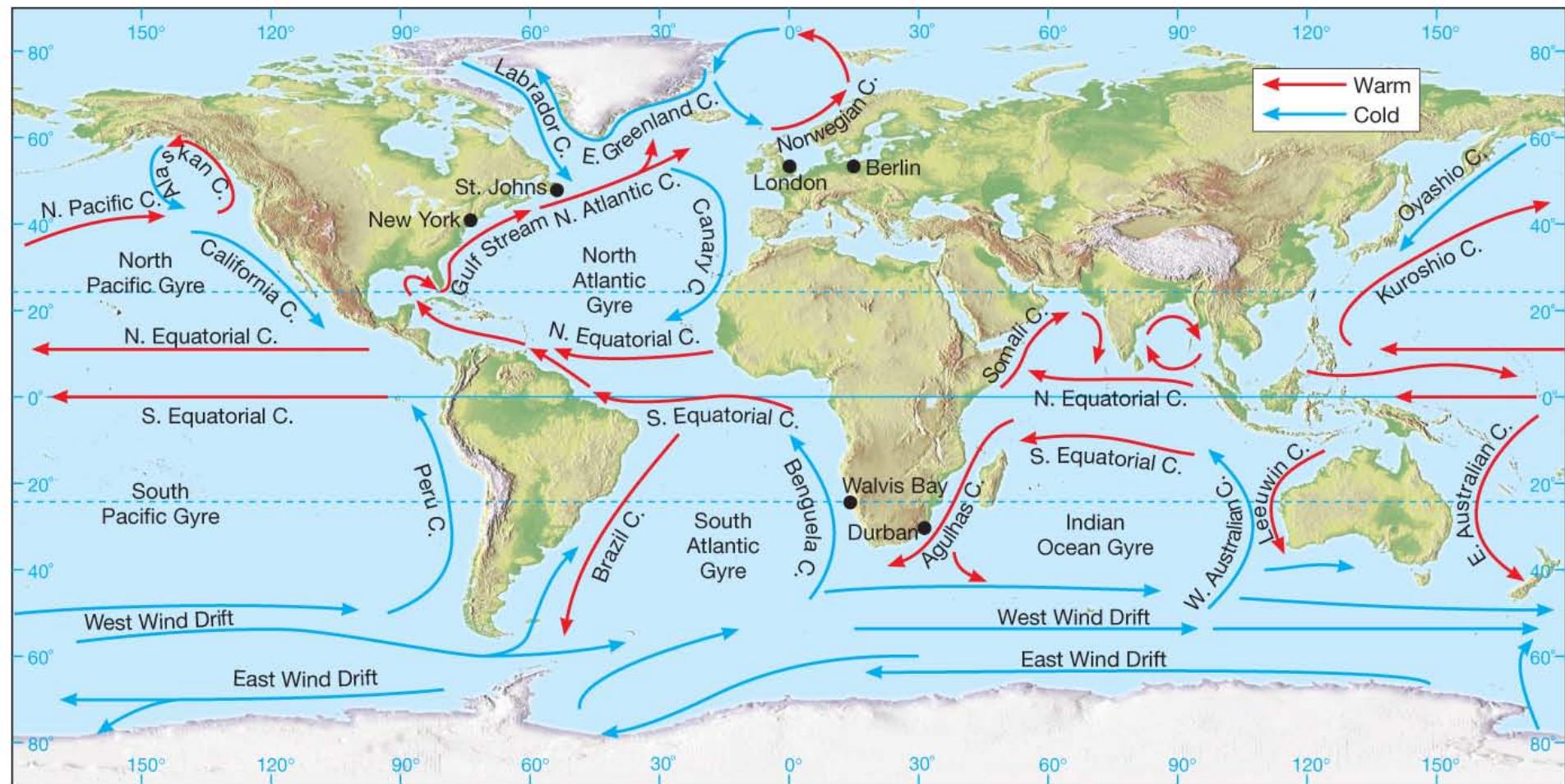
If you are not familiar with contour maps and contour lines, the USA Today weather map of forecast temperatures is a good example. Also see next slide for contour lines.

Color contour map of forecast daily high temperature

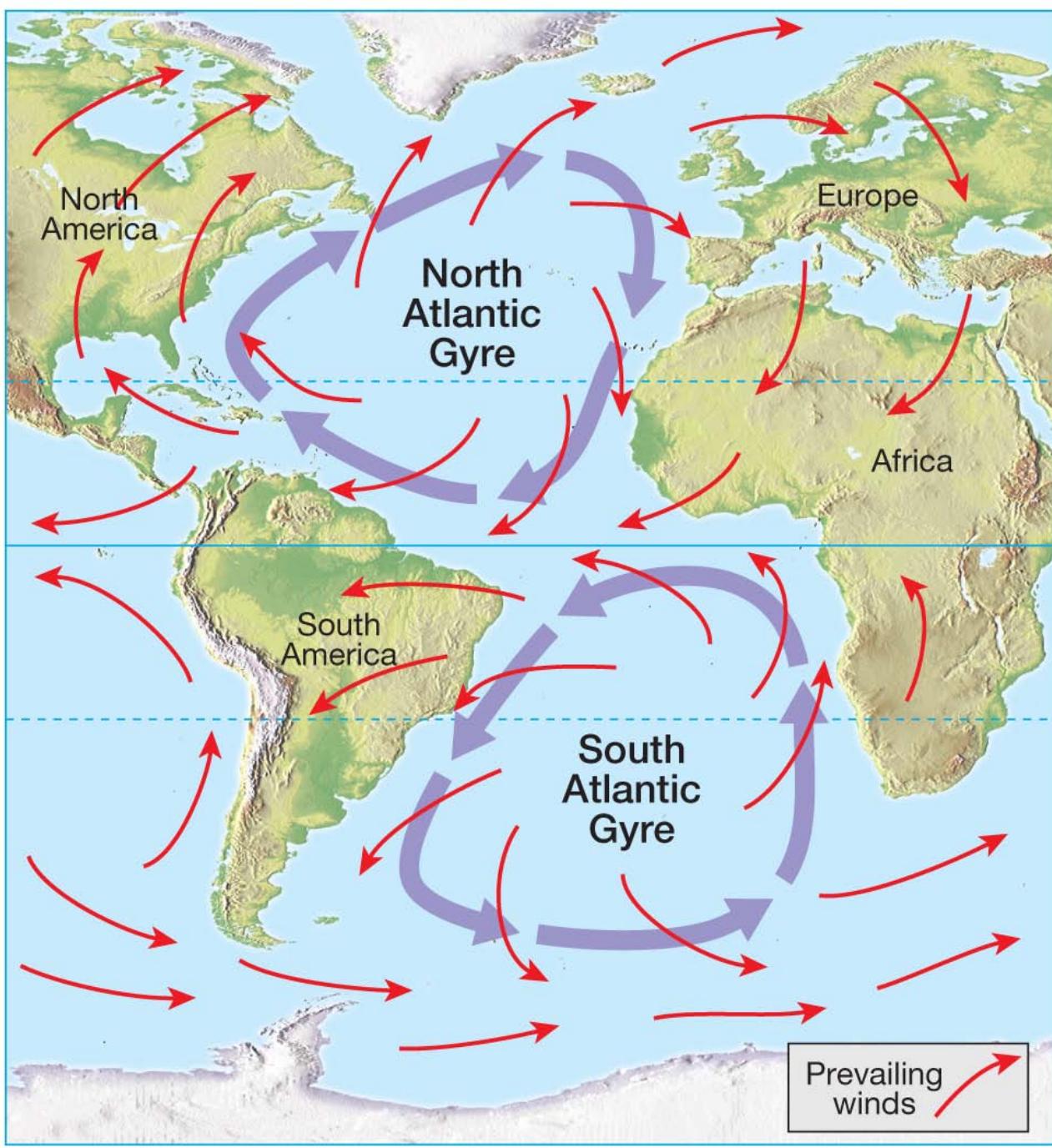


Color contour map
of forecast daily high
temperatures and
contour lines.

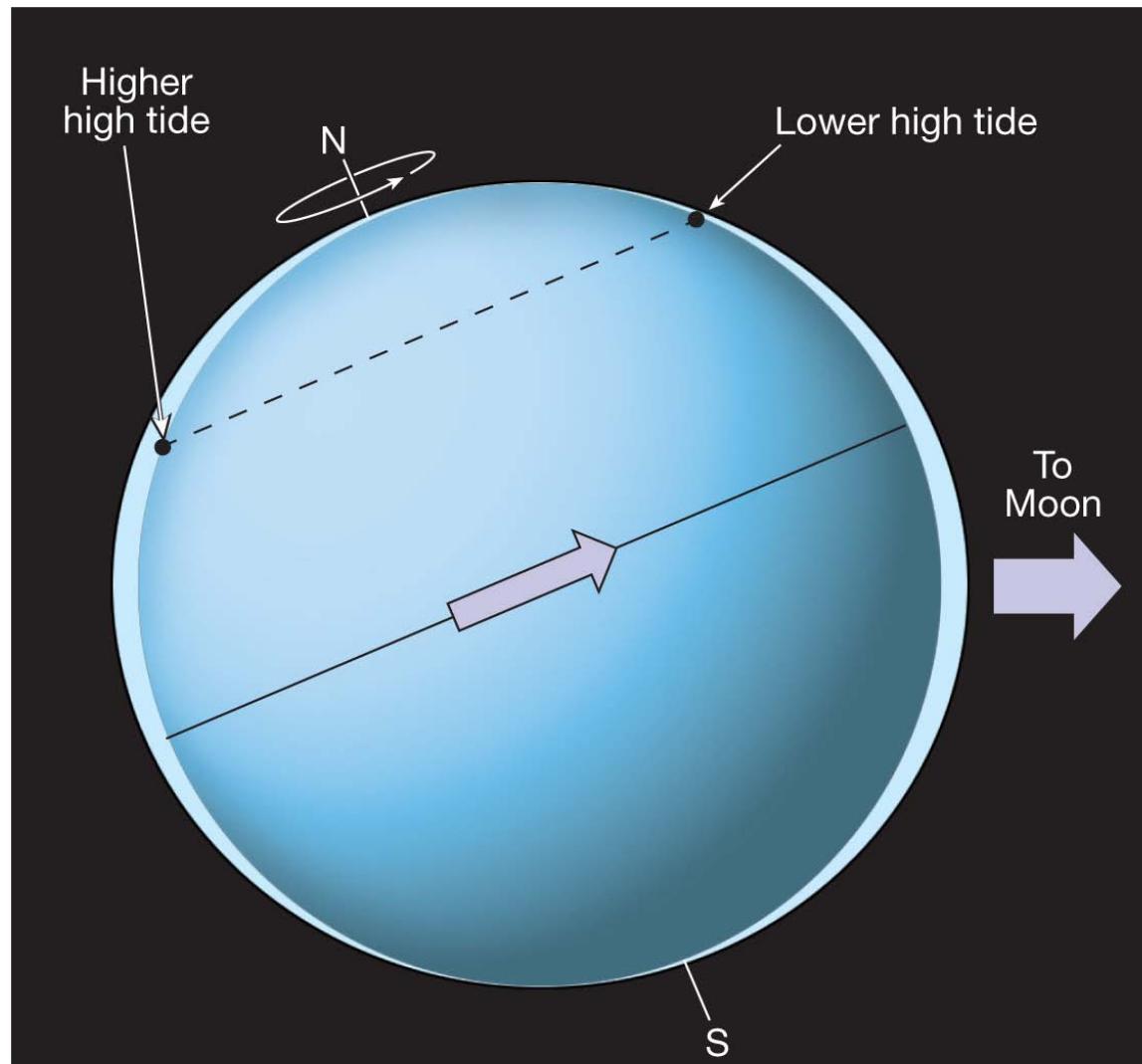
Major Ocean Currents – red arrows show warm currents, blue arrows show cold currents (text, Figure 10.2)



Major Ocean Currents
(wind-driven surface currents) – note that
Coriolis effect causes
clockwise circulation in
the northern
hemisphere and
counter clockwise in
the southern
hemisphere (Text,
Figure 10.2)

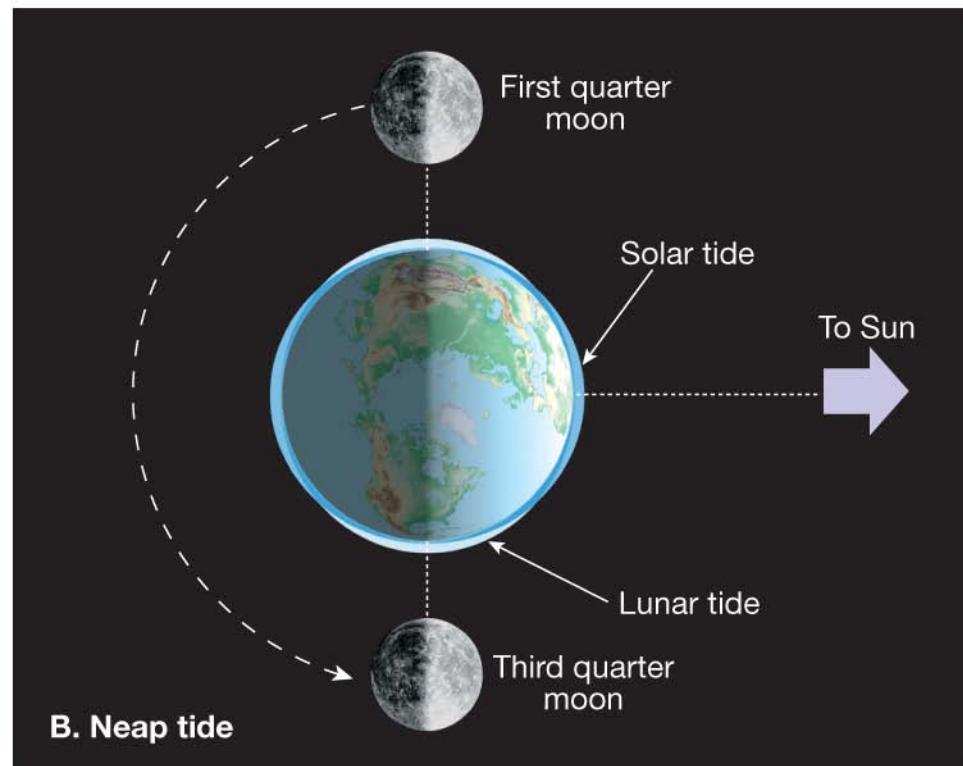
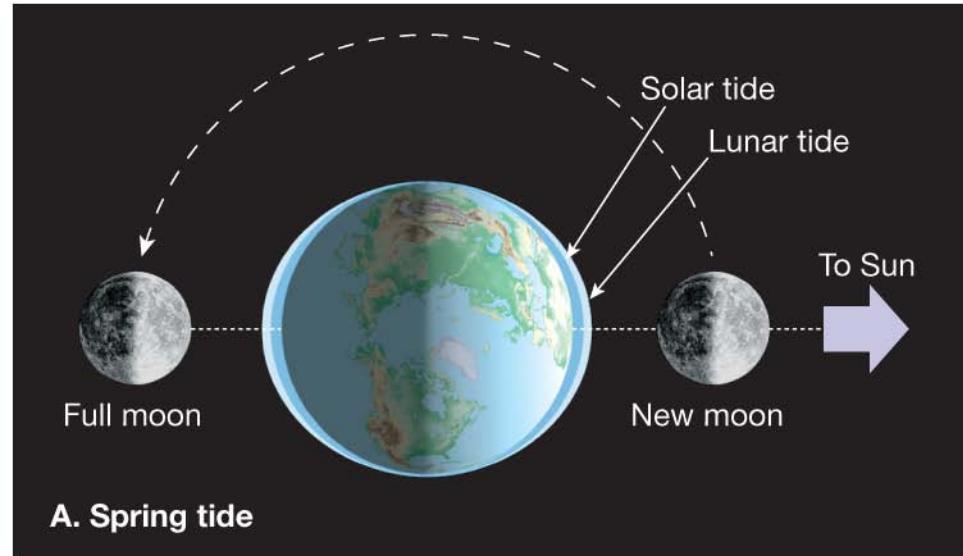


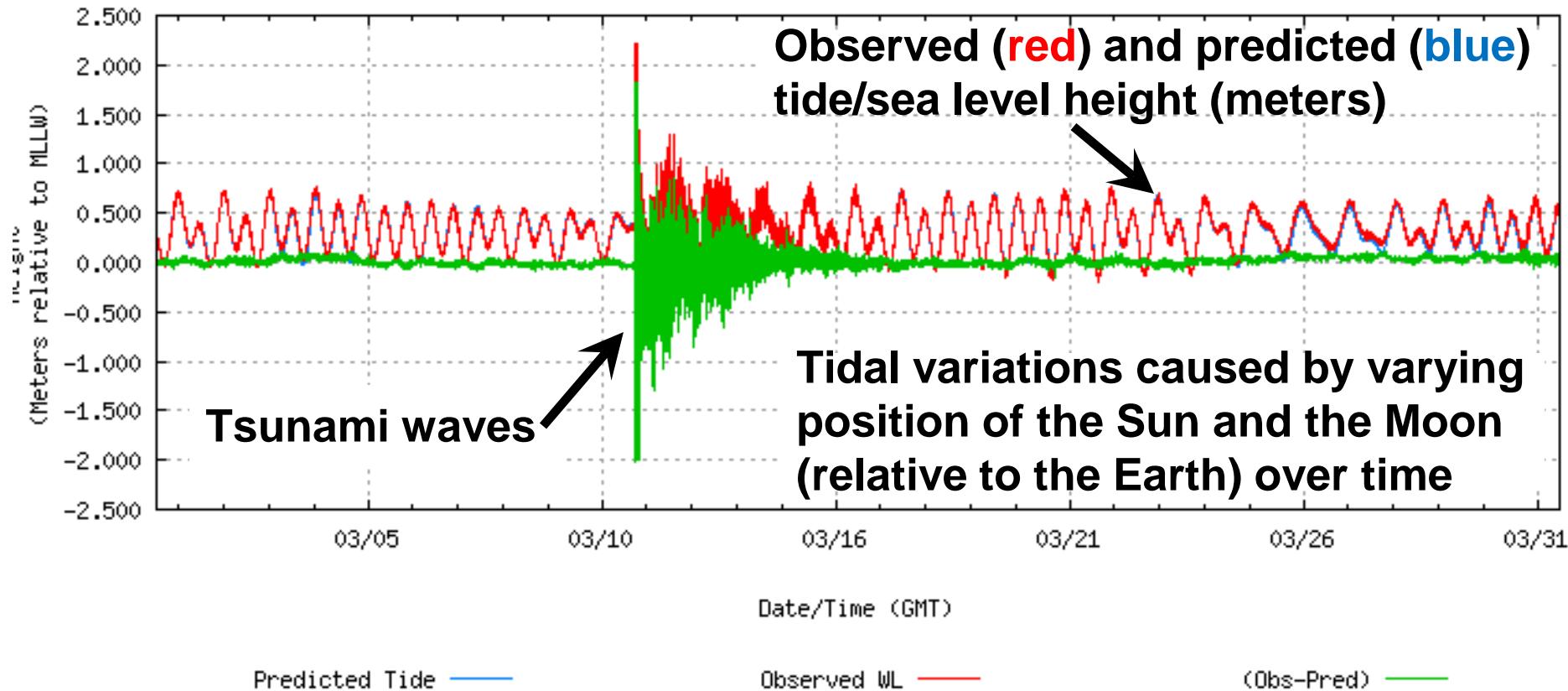
Tides cause currents in surface waters (and therefore some upwelling of deeper waters) due to the changing gravitational attraction of the Sun and the Moon as the Earth rotates on its axis (24 hours) and revolves around the Sun and the Moon orbits the Earth, Text, Figure 10.29



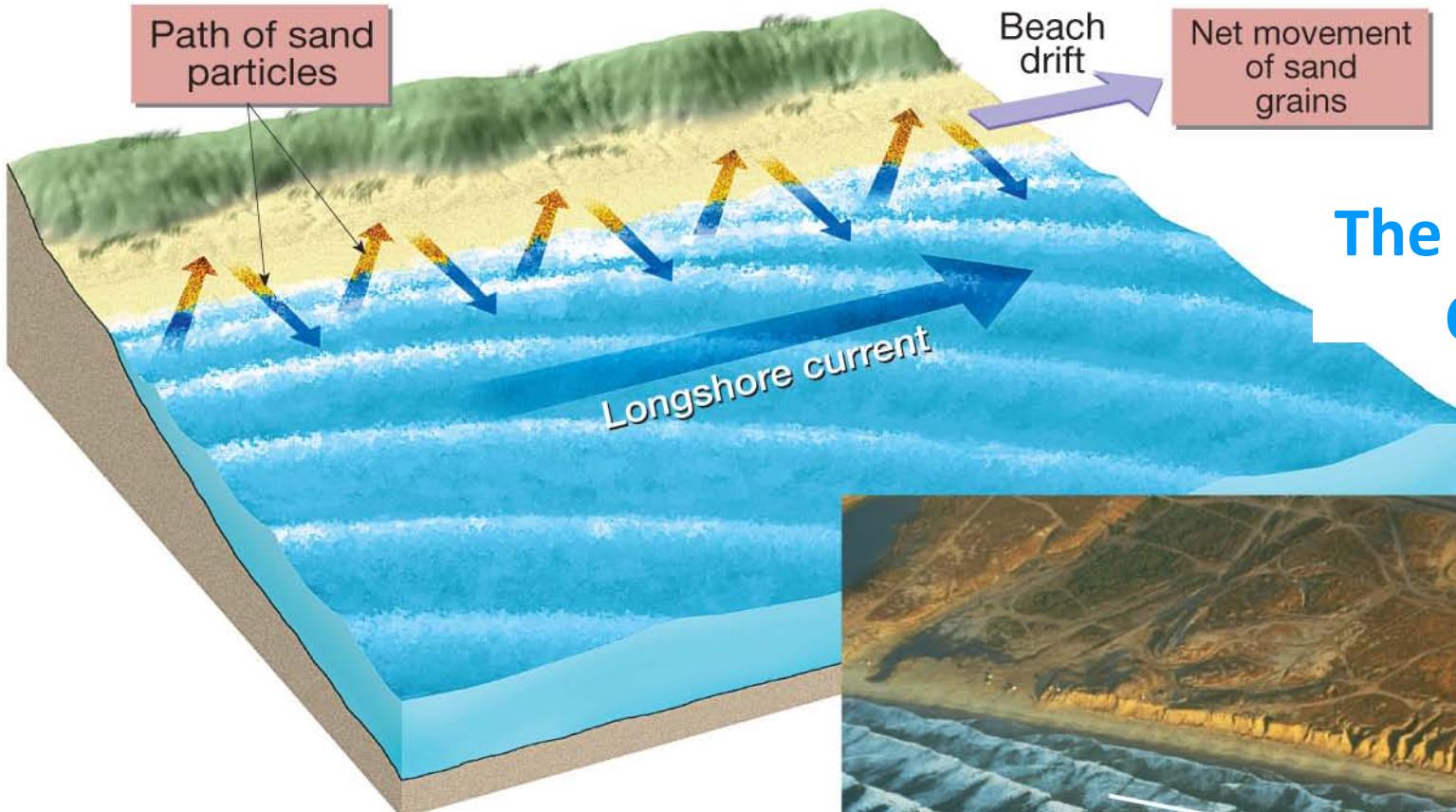
Spring and Neap Tides.
Gravitational attraction of
the Moon and the Sun
cause ocean tides. Earth's
rotation every 24 hours
causes ~ two high and two
low tides in a day at any
location.

Revolution of the Moon
(~28 day period), ~23
degree tilt of the Earth, and
irregular coastlines result in
variations in tidal
amplitudes. (Text, Figure
10.30)





Tide gauge data for Kahului, Maui harbor for the month of March, 2011. Note that, except for the tsunami (Japan earthquake, M9.0, March 11, 2011 – a very interesting and devastating event), the predicted (from gravitational attraction equations) tide (blue line) almost perfectly matches the observed tide (red line; water level).



The Longshore Current

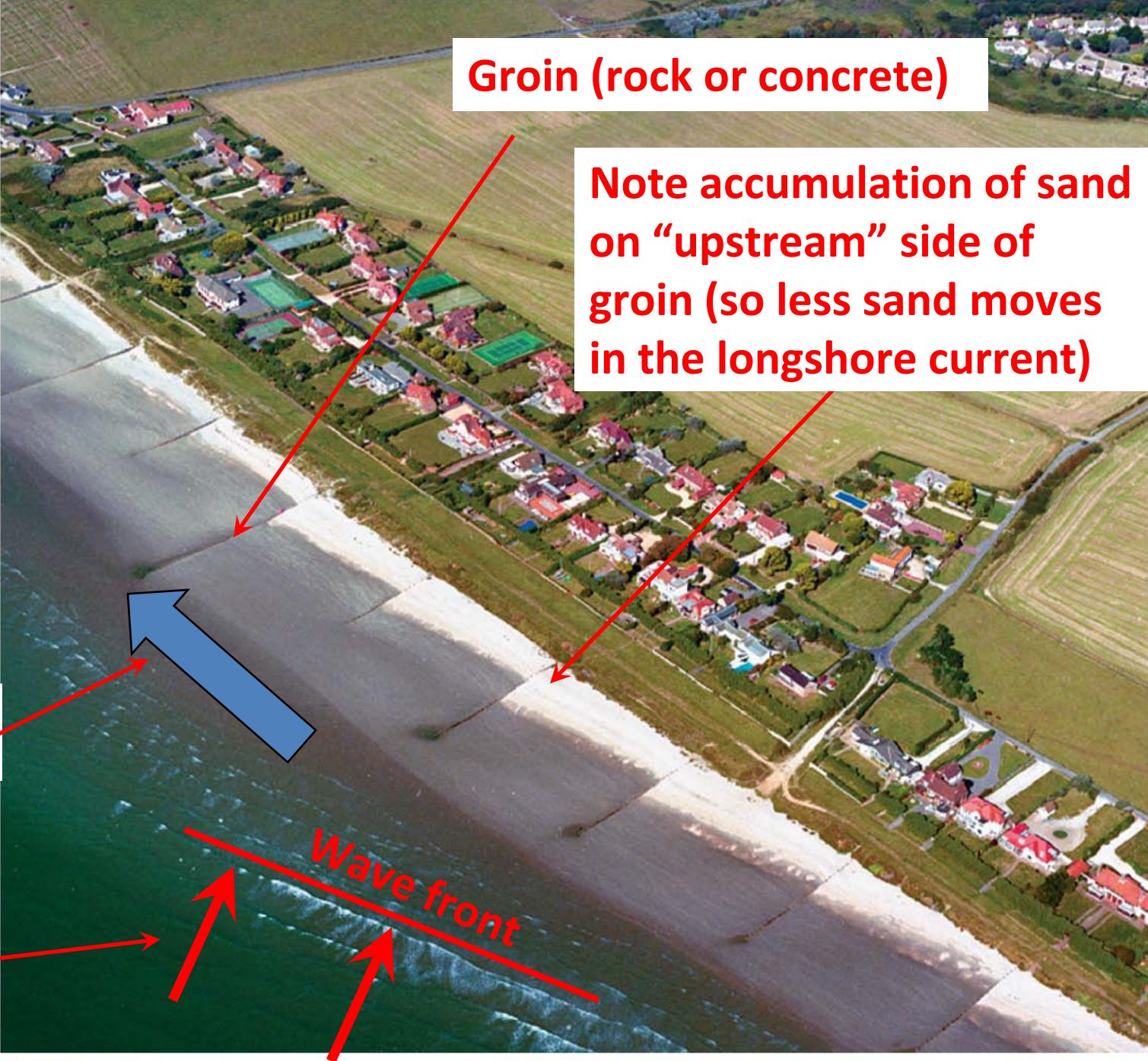


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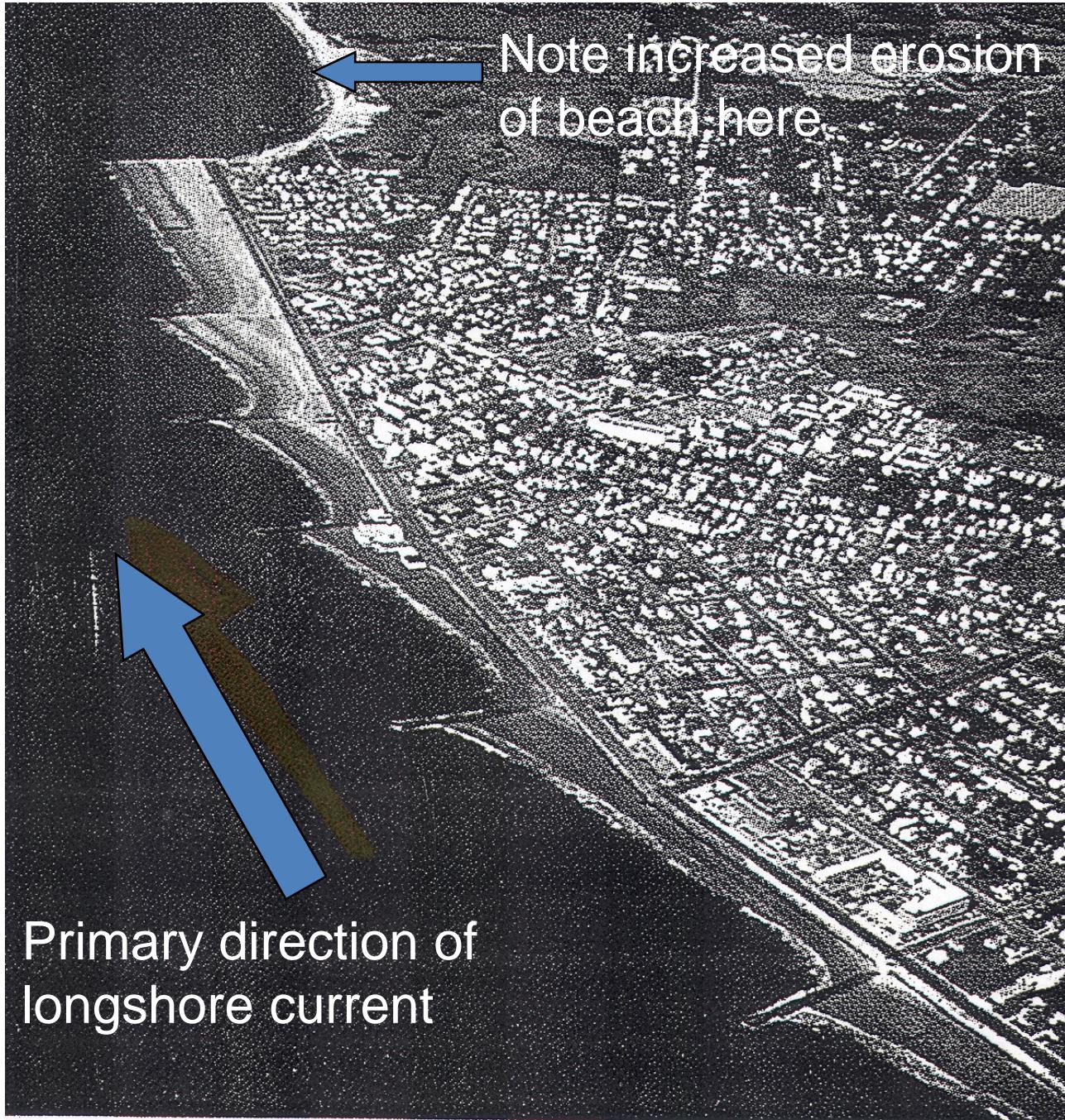
Longshore current – caused by waves hitting the beach at an oblique angle. Water and sand move onshore at an angle from wave action, then as energy of the wave is expended, the water and sand flow back downslope (usually along a line perpendicular to the shoreline) resulting in a net movement of sand along the beach (text, Fig. 10.16).

Series of groins protecting beach near Chichester, Sussex, England (Figure 10.22, text).

Longshore Current
Wave Propagation Direction



Cape May, NJ, view looking south; groins protect the shoreline in front of buildings but cause increased erosion to south. So,... protection of the beach in one area causes increased erosion in adjacent areas resulting in need to “protect” beach along additional shoreline!



Barrier island, Ocean City
Maryland – storms
("nor'easters") caused break in
barrier island early in the 20th
century. The gap became a
useful route for boat traffic, so
they built groins to protect the
channel. Increased erosion to
the south from the longshore
current has resulted in
migration of the island to west.

