Ocean Waves and Surf Forecasting

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Announcements (1/11/06)

• Geog 20 BBS:
  Register for Geography Forum first (choose username and pw). Next access GEOG 20 with password: makaha.
  http://bbs.geog.ucsb.edu
  pw: makaha

• ERes: Geog 20 readings
  http://eres.library.ucsb.edu/
  pw: chord

Overview

• Ocean regions
• Global Circulation Patterns
• Characterizing and describing ocean waves
• Wave theory, propagation, and dispersion
• Refraction, shadowing, and bathymetry
• Wind and wave measurement
• Forecasting

Ocean Regions

• Oceans
  • 71% of earth surface
  • 400,000 km (250,000 miles) exposed coastline (?)
• Coastline allocation:
  ❖ 20% poor exposure, cold water
  ❖ 20% inconsistent
  ❖ 40% mediocre, frequency [monthly, weekly]
  ❖ 20% score!! frequency=daily (southern hemi)
• Regions: Atlantic, Indian, Pacific
Ocean Regions

**Atlantic (22% sea area)**
- North
  - upper lat: extreme winds, winter westerly 55+ kmh (35 mph)
  - seas > 15 ft (Nova Scotia to UK)
  - 30°N, NE trade winds
  - equatorial zone: doldrums
- South
  - small, no tropical storms
  - Andes disrupt flow

**Indian (20% sea area)**
- (low westerlies→ ← polar easterlies): roaring 40s.
- average wave height: 15’+
- little seasonal variation

**Pacific (45% sea area)**
- North
  - upper lat: winter westerly 55+ kmh (35 mph)
  - seas > 15 ft (Bering Sea, Aleutian Islands)
  - Western N. Pac. Asian Monsoon, E trade winds
  - Eastern equatorial zone: calm
- South
  - Strong westerlies 35° to 60° (NZ to Cape Horn)
**Overview**

What are waves?

**Global Circulation Patterns**

**Landless, stationary earth**
- Equator (warm), Poles (cold)
  - Increasing air temp. → lower density
  - Decreasing air temp. → higher density
  - Convection
- Hemispheric flow
  - surface air → equator
  - upper atmos → poles

**Landless, rotating earth**
- Coriolis force
  - Air diverted from N-S path
  - Six spiraling wind-bands
- …with seasons
  - 23.5 degree obliquity of ecliptic
  - effect on polar temp. differential
- … and land
  - specific heat capacity – water >> land
  - hemispheric differences (land mass, consistency, etc.)

**Coriolis force**
- N-S movement
  - Velocity= f(latitude)
  - Relative velocity
- W-E movement
  - Rotational speed
  - Centrifugal force

Global Circulation Patterns

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Source: Butt et al. (2004) Surf Science, Univ. of Hawai'i Press