REVIEW

Wave Dynamics Investigation in Scope of Coastal Processes

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ARTICLE INFO

Article history
Received: 12 December 2018
Accepted: 26 February 2019
Published: 5 March 2019

Keywords:
Coastal

ABSTRACT

In this research it is established a classification system by which to characterize atmospheric conditions, specifically those related to winter extra tropical storms and fair weather. Numerous classification schemes have been proposed to categorize atmospheric conditions in a variety of environments-however, since meteorological processes are inherently complicated, these are of necessity based on criteria that suit a particular purpose. The system employed in this project was ultimately designed to differentiate between: 1. fair weather and storm conditions; 2. different phases of extratropical storms; 3. extratropical storms of different intensities and synoptic types.

1. Introduction

It is useful to establish a classification system by which to characterize atmospheric conditions, specifically those related to winter extra tropical storms and fair weather. Numerous classification schemes have been proposed to categorize atmospheric conditions in a variety of environments-however, since meteorological processes are inherently complicated, these are of necessity based on criteria that suit a particular purpose. The system employed in this project was ultimately designed to differentiate between: 1. fair weather and storm conditions; 2. different phases of extratropical storms; 3. extratropical storms of different intensities and synoptic types. As such, it draws upon several classification systems suggested in the literature, as well as criteria specific to the research, and employs both hourly wind velocity data and daily national weather maps [1,2].

2. Wave Dynamics and Wind Waves

2.1 Wave Dynamics and Classifying Waves

The transfer of energy from water particle to water particle in the circular paths, or orbits, transmits wave energy across the ocean surface and causes the waveform to move. This kind of wave is known as an orbital wave which is a wave in that particles of the medium (water) move in closed circles as the wave passes. Orbital sea waves occur at the boundary between two media, between air and water and between layers of water of different densities. These waves are a type of progressive wave, because the waveform moves forward. Sea waves have distinct parts. The wave crest is the highest part of the wave above average water level; the wave trough is the valley between wave crests below average water level. Wave height is the vertical distance between a wave crest and the adjacent trough, while wavelength is the horizontal distance between two successive wave crests. The time it takes for two successive wave crests or troughs to pass a fixed point, usually measured in seconds, is known as the wave period. Wave frequency is the number of waves...
passing a fixed point per second. Frequency is the inverse of period. The circular motion of water particles at the surface of a wave continues underwater. Water particles move diminishes rapidly with depth. For all practical purposes, wave motion in deep-water waves is negligible below a depth of one-half the wavelength. Since most sea waves have moderate wavelengths, the circular disturbance of the ocean that propagates these waves affects only the uppermost layer of water\textsuperscript{[3-6]}.

Sea waves are classified by the disturbing force that creates them, the extent to which the disturbing force continues to influence the waves once they are formed, the restoring force that tries to flatten them, and their wavelength\textsuperscript{[7]}.

Energy that causes sea waves to form is called a disturbing force. Wind blowing across the sea surface provides the disturbing force for wind waves. Arrival of a storm surge or seismic sea wave in an enclosed harbour or bay, or a sudden change in atmospheric pressure is the disturbing force for the resonant rocking of water known as a seiche. Landslides, volcanic eruptions, and faulting of the seafloor associated with earthquakes are the disturbing forces for seismic sea waves which is also known as tsunami. The disturbing forces for tides are changes in the direction of gravitational forces among the Earth, moon, and sun, combined with Earth’s rotation\textsuperscript{[8-11]}.

A wave that is formed and then propagates across the sea surface without the further influence of the force that formed it is known as a free wave. When wind waves move away from the storm that created them, or when the storm ceases, they continue without the injection of additional wind energy. Likewise, the tsunami waves caused by submerged landslides or earthquakes continue to move across the ocean surface long after the movement of the landslide or earthquake has stopped\textsuperscript{[12]}.

Restoring force is the dominant force trying to return the water surface to flatness after a wave has formed in it. If the restoring force of a wave were quickly and fully successful, a disturbed sea surface would immediately become smooth, and the energy of the embryo wave would be dissipated as heat. Waves continue after they form because the restoring force overcompensates and causes oscillation. There are also capillary waves and gravity waves. The capillary waves are the first waves to form when the wind blows. These small ripples are important in transferring energy from air to water to drive sea currents. Since the circular motion of water molecules in a wave is nearly friction free, gravity waves can travel across thousands of miles of ocean surface without disappearing, eventually to break on a distant shore\textsuperscript{[13]}.

Wavelength is a direct measure of wave size. There is the relation between disturbing and restoring forces, period, and the relative amount of energy present in the ocean’s surface for each wave type. More energy is stored in wind waves than in any of the other wave types\textsuperscript{[14]}.

![Figure 1. The Distribution of wind power](image1)

![Figure 2. The distribution of wind velocity occurrence](image2)

![Figure 3. Results for Signal Processing Toolbox of Water Level at 7. month at Gulf of Mexico](image3)
and positions of its continents, and its life-forms. The Earth's climate has changed with time, as has its atmospheric composition, its seawater chemistry, the size and positions of its continents, and its life-forms. The story of the Earth is the story of change and chance; its history is written in the rocks, the water, and the genes of the millions of organisms that have evolved on land and in sea. Change is now progressing at an unnatural rate, and these human-induced changes are imposing stress on natural systems. In the last century the human beings have developed the physical, chemical, and biological processes to destroy the world ocean and the atmosphere. We need to act to moderate the negative effects of the destroying environmental. This is the reason for investigating the coastal processes like hydro dynamical forces and atmospheric circulations and other processes involving the sea physics.

4. Conclusion

As researcher it is needed also some new innovation about Earth Structure and Plate Tectonics, Sediments, Sea Physics, Atmospheric Circulation, Wave Dynamics and Wind Waves, Hydrodynamic Forces, Offshore and Onshore Structures, Tsunami, Seiches, and Tides, Coasts, Simulation Theory, Modelling and Experimental Tests and Environmental Concerns

Appendix

Data for Coastal Processes as an Example

| Nord- | Densi- | Eleva- | Drift- | Nord- | Densi- | Eleva- | Drift- | Nord- | Densi- | Eleva- | Drift- | Nord- | Densi- | Eleva- | Drift- | Nord- | Densi- | Eleva- | Drift- | Nord- | Densi- | Eleva- | Drift- | Nord- | Densi- | Eleva- |
|-------|--------|--------|--------|-------|--------|--------|--------|-------|--------|--------|--------|-------|--------|--------|--------|-------|--------|--------|--------|-------|--------|--------|--------|-------|--------|--------|
| 5000  | 5000   | 100    | BM     | 5000  | 5000   | 100    | BM     | 5000  | 5000   | 100    | BM     | 5000  | 5000   | 100    | BM     | 5000  | 5000   | 99    | BM     | 5000  | 5000   | 99    | BM     | 5000  | 5000   | 99    | BM     |
| 4999, | 4999   | 01    | BM     | 4999, | 4999   | 01    | BM     | 4999, | 4999   | 01    | BM     | 4999, | 4999   | 01    | BM     | 4999, | 4999   | 01    | BM     | 4999, | 4999   | 01    | BM     | 4999, | 4999   | 01    | BM     |
| 4998, | 4998   | 03    | BM     | 4998, | 4998   | 03    | BM     | 4998, | 4998   | 03    | BM     | 4998, | 4998   | 03    | BM     | 4998, | 4998   | 03    | BM     | 4998, | 4998   | 03    | BM     | 4998, | 4998   | 03    | BM     |
| 4997, | 4997   | 05    | BM     | 4997, | 4997   | 05    | BM     | 4997, | 4997   | 05    | BM     | 4997, | 4997   | 05    | BM     | 4997, | 4997   | 05    | BM     | 4997, | 4997   | 05    | BM     | 4997, | 4997   | 05    | BM     |
| 4996, | 4996   | 07    | BM     | 4996, | 4996   | 07    | BM     | 4996, | 4996   | 07    | BM     | 4996, | 4996   | 07    | BM     | 4996, | 4996   | 07    | BM     | 4996, | 4996   | 07    | BM     | 4996, | 4996   | 07    | BM     |
| 4995, | 4995   | 09    | BM     | 4995, | 4995   | 09    | BM     | 4995, | 4995   | 09    | BM     | 4995, | 4995   | 09    | BM     | 4995, | 4995   | 09    | BM     | 4995, | 4995   | 09    | BM     | 4995, | 4995   | 09    | BM     |
| 4994, | 4994   | 11    | BM     | 4994, | 4994   | 11    | BM     | 4994, | 4994   | 11    | BM     | 4994, | 4994   | 11    | BM     | 4994, | 4994   | 11    | BM     | 4994, | 4994   | 11    | BM     | 4994, | 4994   | 11    | BM     |
| 4993, | 4993   | 13    | BM     | 4993, | 4993   | 13    | BM     | 4993, | 4993   | 13    | BM     | 4993, | 4993   | 13    | BM     | 4993, | 4993   | 13    | BM     | 4993, | 4993   | 13    | BM     | 4993, | 4993   | 13    | BM     |

Figure 4. Results for Signal Processing Toolbox of Water Level at 6. month at Gulf of Mexico [16]

3. Result for the Coastal Processes

The Earth's climate has changed with time, as has its atmospheric composition, its seawater chemistry, the size and positions of its continents, and its life-forms. The story of the Earth is the story of change and chance; its...
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