

'Significant Wave Height'

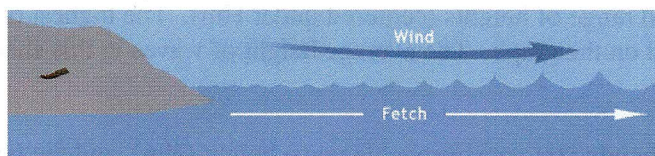
A closer look at wave forecasts

Tom Ainsworth, NWS Juneau, Alaska



NOAA's National Weather Service (NWS) marine weather forecasts include information about prevailing wind speed and direction, and significant wave height. The term "significant wave height" is not as well understood as the wind information. Anyone using marine weather information should have a clear understanding of what significant wave height means. Let's review basic ocean wave characteristics so that you can interpret marine weather forecasts as NWS forecasters intended.

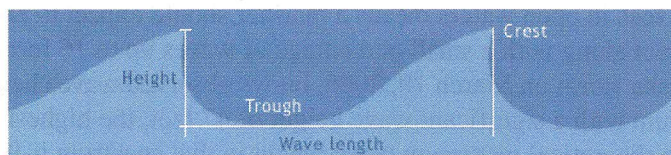
Wave Formation: Waves are formed by wind blowing along the water's surface. Wave height is dependent on a) wind speed; b) fetch length; and c) duration of time the wind blows consistently over the fetch. Wind 'fetch' is the distance the wind blows over water with similar speed and direction. High wind speeds blowing for long periods of time over long stretches of water result in the highest waves. Waves caused directly by the local wind are called wind waves. Wind waves are short, choppy, and tend to break (white cap) when winds reach approximately 15 knots. These are the most common waves on lakes, ponds and in the confined, narrow stretches of southeast Alaska's inner channels.



Graphic courtesy of Tammy Pelletier, WA State Dept of Ecology

Wave patterns become more complex in the open ocean. Waves are still formed by the local wind but once formed ocean waves continue to travel for thousands of miles. Waves that travel outside of their generation area, and are no longer the result of the local wind, are called 'swell'. Compared to wind waves, swell are longer waves with smoother crests. Over time, swell travel great distances, converge with other waves caused by distant storms and traveling in different directions, and refract off coastlines. Therefore, ocean surfaces are comprised of *thousands* of interacting waves that originated in different places and traveled in different directions at different speeds. This is known as a "wave spectrum": a combination of waves with different heights, frequencies and direction of movement.

Wave Dimensions: The magnitude of a wave is determined by three components: height; length; period (or frequency). A fourth wave component is steepness. Wave height is the distance measured from the trough to the crest of the wave. Wave length is the distance between successive crests (or troughs). Wave period is the time that elapses between the passing of successive crests (or troughs). Wind waves tend to have smaller heights and have shorter periods than swell.



Graphic courtesy of Tammy Pelletier, WA State Dept of Ecology

Wave steepness is the slope determined by the ratio between wave height and wave length. Wave steepness can be inferred from buoy measurements of wave height and period. When wind wave heights and periods are close to the same value (e.g., six foot seas every six seconds) wave steepness is severe. Pitch poling and capsizing becomes real possibilities for smaller vessels when wave steepness is severe. As waves move farther away from their source region, their wave length and period gradually increase. Therefore, waves with long periods, greater than 10 or 12 seconds, are arriving from a distant source and are considered swell.

