**Resonance effects between the ocean and atmosphere**

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**ABSTRACT**

Atmosphere ocean interactions is one of the most critical processes in the global climate system. When a system is forced with a frequency that is equal or close to its natural frequency, a resonance condition occurs with the response of the receiving system being more energetic than expected. Under the conditions of resonance condition, energy transfer from the atmosphere to ocean is at a maximum with the oceanic response abnormally higher than that would be expected. Transfer of energy from the atmosphere to the ocean could be considered as a forced oscillator (e.g. a mass on a spring). If an oscillator is forced at a frequency of 0, this is analogous to simply displacing the oscillator to a fixed position, or an atmospheric forcing that is stationary (e.g. inverted barometric effect). In contrast, if an oscillator is forced at the natural frequency, there is a resonant response with increased amplitude. Three different examples of atmosphere ocean resonance, with examples from Western Australia and the Baltic Sea, are presented although these conditions occur globally: (1) Proudman resonance generating meteorological tsunamis; (2) Diurnal-inertial resonance; and, (3) generation of continental shelf waves by tropical storms. In all of these examples, the oceanic response due to resonance is multiplied many times to what would be expected. For example, a change in atmospheric pressure of 3.4 hPa resulted in change in the water level by 0.60m: a ~15 fold increase to that expected from the inverted barometric factor alone. Similarly, wind driven circulation is generally expected to be limited to depths ~100m: the diurnal resonance results in inertial motions extending to water depths >400m. These phenomena are presented using field measurements and numerical modelling.