Experimental investigation of change of energy of infragavity waves in dependence on spectral characteristics of an irregular wind waves in coastal zone

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An infragravity waves are long waves with periods of 20 - 300 s. Most essential influence of infragarvity waves on dynamic processes is in a coastal zone, where its energy can exceed the energy of wind waves. From practical point of view, the infragravity waves are important, firstly, due to their influence on sand transport processes in a coastal zone. For example, interacting with group structure of wind waves the infragravity waves can define position of underwater bars on sandy coast. Secondly, they are responsible on formation of long waves in harbors. Main source of infragravity waves is wave group structure defined by sub-nonlinear interactions of wind waves (Longuet-Higgins, Stewart, 1962). These infragravity waves are bound with groups of wind waves and propagate with wave group velocity. Another type of infragravity waves are formed in a surf zone as a result of migration a wave breaking point (Symonds, et al., 1982). What from described above mechanisms of formation of infragravity waves prevails, till now it is unknown. It is also unknown how energy of infragravity waves depends on energy of input wind waves and how it changes during nonlinear wave transformation in coastal zone.

In our work on the basis of the analysis of data of field experiment and numerical simulation a contribution of infragravity waves in total wave energy in depending on integral characteristics of an irregular wave field in the conditions of a real bathymetry was investigated. For analysis the data of field experiment "Shkorpilovtsy-2007" (Black sea) and data of numerical modeling of Boussinesq type equation with extended dispersion characteristics (Madsen et al., 1997) were used.

It was revealed that infragravity waves in a coastal zone are defined mainly by local group structure of waves, which permanently changes due to nonlinearity, shoaling and breaking processes. Free infragravity waves appearing after wave breaking exist together with bound infragravity waves. There are no clear total dependences of energy of infrragravity waves from energy of wind waves and mean period of infragravity waves from mean period of wind waves. But significant wave height of infragravity waves depends on relative water depth (wave height of wind waves divided on water depth). There are different types of this dependence for breaking and non-breaking waves. The influence of peak period, significant wave height and directional spreading of initial wave spectrum on these dependences are discussed. The peculiarities of spectra of infragravity waves for non-breaking, breaking and multibreaking wind waves are shown.

References:
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