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Observational and Dynamical Wave Climatologies. VOS vs Satellite Data

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The understanding physics of wind-driven waves is crucially important for fundamental science and practical applications. This is why experimental efforts are targeted at both getting reliable information on sea state and elaborating effective tools of the sea wave forecasting.

The global Visual Wave Observations and satellite data from the GLOBWAVE project of the European Space Agency are analyzed in the context of these two viewpoints. Within the first "observational" aspect we re-analyze conventional climatologies of all basic wave parameters for the last decades [5]. An alternative "dynamical" climatology is introduced as a tool of prediction of dynamical features of sea waves on global scales. The features of wave dynamics are studied in terms of one-parametric dependencies of wave heights on wave periods following the theoretical concept of self-similar wind-driven seas [3, 1, 4] and recently proposed approach to analysis of Voluntary Observing Ship (VOS) data [2].

Traditional "observational" climatologies based on VOS and satellite data collections demonstrate extremely consistent pictures for significant wave heights and dominant periods. On the other hand, collocated satellite and VOS data show significant differences in wave heights, wind speeds and, especially, in wave periods. Uncertainties of visual wave observations can explain these differences only partially. We see the key reason of this inconsistency in the methods of satellite data processing which are based on formal application of data interpolation methods rather than on up-to-date physics of wind-driven waves. The problem is considered within the alternative climatology approach where dynamical criteria of wave height-to-period linkage are used for retrieving wave periods and constructing physically consistent dynamical climatology.

The key dynamical parameter – exponent R of one-parametric dependence $H_s \sim T^R$ shows dramatically less pronounced latitudinal dependence as compared to observed H_s and T of conventional climatology in both satellite and VOS data collections. It can be treated as an effect of interaction of wind-driven seas and swell on global scales as it was stated in [2]. Further study combining the alternative and conventional climatologies can help to detail this important dynamical effect of global wave dynamics. The progress in satellite data processing and their physical interpretation is of great value for such study.

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