EGU2020-7851
https://doi.org/10.5194/egusphere-egu2020-7851
EGU General Assembly 2020

Exploring future wave climate changes from directional spectra: Implications for coastal impacts

Hector Lobeto, Melisa Menendez, Moises Alvarez, and Ottavio Mazzaretto
Environmental Hydraulics Institute, Universidad de Cantabria, Spain (info@ihcantabria.com)

Climate change may alter wave climate along most of world's coasts (Morin et al., 2019). This could have implications on coastal impacts such as flooding and erosion (Wong et al., 2014). Traditional approaches to assess coastal impacts due to wind waves rely on, among other variables, the bulk sea-state parameters (e.g. significant wave height, peak period, mean wave direction). In this work, we analyse projected changes in wave climate considering the full directional spectra, particularly focusing on the added information this approach could offer. The analysed wave database consists of directional spectra and sea-state parameters at several coastal locations worldwide and in the western Mediterranean basin. Multi-model ensemble wave climate projections are obtained using WaveWatchIII model forced with surface wind fields and ice marine coverage outputs from several global and regional climate models (CMIP5 and CORDEX projects, respectively). Hourly spectra are stored with a discretization of 32 frequencies and 24 directions.

Results for sea-state parameters are coherent with previous studies about global wave climate changes (Camus et al., 2017; Collins et al., 2019), showing a wave height increase in the Southern Ocean and tropical eastern Pacific and a decrease in the North Atlantic and Mediterranean Sea. Nevertheless, the spectral analysis of wave climate changes provides new insights about the wave climate change signal. Thus, while projected changes of sea-state parameters provide an averaged information (both in magnitude and sign), the use of the full directional spectra makes it possible to study the projected change of each individual wave system. Also, this approach helps to note displacements of wave energy to higher or lower periods at each direction, which is especially relevant due to the important role that wave period and direction plays in coastal impacts such as dune erosion (Van Gent, 2008). The main conclusions reached in this study are the expected general increase of wave height in swells generated in the Southern Hemisphere that can travel north beyond the equator, and the decrease of wave systems generated in the Northern Hemisphere.

Finally, a comparison between the results from a coastal erosion assessment using estimated changes of sea-state parameters and climate change information from spectral wave data is shown.