Experiments on modeling the interaction of the atmospheric air flow with the surface of the hydrosphere in the boundary layer were performed on a unique laboratory facility Heidelberg Small-Scale Air-Sea Interaction Facility:
• 60 cm width, 2.4 m height, circumference of 27.3 m at the inner wall
• Water depth during experiments 1.0 m, volume 18.0 m³
• Air space volume 24 m³
• Wind is generated by two axial fans mounted into the ceiling
• Annular wind-wave facility, wind speeds up to \( u_{\text{ref}} = 10.5 \, \text{m/s} \) (\( U_{\text{ws}} = 16 \, \text{m/s} \))

High-speed video records (up to 8000 fps) were made in the vertical direction (from top to bottom) in a shadowgraph configuration with backlight located under the channel. On the annular channel, regimes with an abrupt start of wind under an unperturbed surface condition were implemented, including the case of butanol presence in water simulating salinity. At the same time, the wave parameters varying depending on the time elapsed after the wind was turned on, made it possible to study the characteristics of the generation of spray at various effective fetches.

Number of bag-breakup events
As a result of semi-automatic processing of image sequences using specially developed software that allows marking the moment and position of the bag-breakup formation on the videos, the dependences of the frequency of occurrence of these phenomena per unit surface area versus time after turning on the wind were obtained similar to [Troitskaya et al. (2017)].

The values of the whitecap coverage area were obtained from the same shadowgraph images, using the developed software for automatic detection of areas of wave breaking. In this case, automatic image processing was performed using morphological analysis in combination with manual processing of part of the frames for tweaking the algorithm parameters: for each mode (water characteristics and wind speed), manual processing of several frames was performed, based on the results of which automatic algorithm parameters were selected to ensure that the resulting whitecap coverage corresponded.

Results
The statistics of occurrence of events leading to the spray generation and the dependences of the whitecap coverage on time after turning on the wind were obtained for the same set of high-speed surface images for each regime: fan frequencies and chemical composition of water. Dependencies for all records collapsed to one universal dependency of number of fragmentation events per unit area on the whitecapping area. For investigated conditions the dependency on the whitecapping coverage area appeared to be more universal than the dependence on the windsea Reynolds number.