The speed factor and deflection angle of a wind-driven Ekman flow has been discussed for more than a century. However, these parameters remain quite uncertain because of large measurement errors and noise. Recently developed HF radar, however, can measure surface velocity with good spatial and temporal resolutions without significant noise. To quantify the speed factor and deflection angle, a total of seven HF radar is used in this study, which is included in an intensive monitoring system that have been developed in the Tsushima strait for the last decade.

The surface ageostrophic velocities were estimated by subtracting geostrophic velocities estimated from sea level differences from detided surface velocities estimated with HF radar. The speed factor and deflection angle were then estimated by comparing the surface ageostrophic velocities and the winds. Large seasonal variations of both the speed factor and the deflection angle were found; The speed factor is 1.1-1.3 % in winter (November - February) and 1.5-2.0 % in summer (May - August), while the deflection angle is 15-27 deg in winter and 41-65 deg in summer. Difference in turbulent convective mixing processes in summer and winter is the most important factor for these seasonal variations. It was also found that the speed factor increases with wind speeds (or friction velocities). Dependence of the depth of the wind-driven Ekman flow on wind speeds is likely cause for this increase. These results demonstrate high potential of HF radar for studies of ocean surface physical processes.