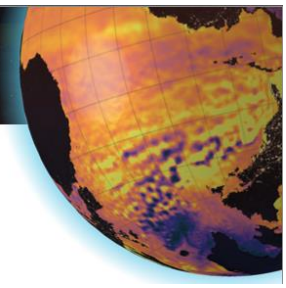

Summer advection of warm surface water from the East China Sea to the southern coast of Korea

In the summer of 2017, sea surface temperature on the southwestern coast of Korea experienced a sudden increase. This rapid temperature rise coincided with a shift in wind direction in the Korea Strait from northwesterly to southeasterly due to the approach of Typhoon Noru. To determine the causes of this abrupt temperature rise, variations in surface currents and temperature were examined using a three-dimensional ocean circulation model. Warm and less saline surface water—a mix of Changjiang Diluted Water and saline water from a branch of the Kuroshio in the East China Sea (ECS)—flowed northeast to the west and south of Jeju Island, then eastward through the Jeju and Korea Straits. Under prevailing westerly winds, wind-driven ageostrophic currents moved the surface water southeastward, away from the southern coast of Korea, due to Ekman transport, filling the shallow coastal region with cool and saline surface water ($T < 22°C$, $S > 32.5$ psu). However, when the wind shifted to an easterly direction, surface ageostrophic currents reoriented northwestward, bringing warm and less saline water into the shallow coastal region. In a passive tracer dispersal experiment, dyes injected from the ECS traveled to the west of Jeju Island and through the Jeju Strait via geostrophic currents. These dyes did not affect the shallow southern coastal region of Korea under westerly winds but were advected toward the coast by coastward Ekman transport during easterly winds. Analysis of 16 years of temperature data observed at Cheongsando on the southern coast of Korea and the tracer experiment indicated that the abrupt temperature rise in the summer of 2017 was a marine heatwave caused by the advection of warm and less saline surface water from the ECS to the southwestern coast of Korea through the Jeju Strait.

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