SECONDARY FLOW DUE TO CURVATURE IN THE MARSDIEP INLET

Contributors: Maarten Buijsman & Herman Ridderinkhof

Acoustic Doppler Current Profiler (ADCP) data collected with the TESO (Texels Eigen Stoomboot Onderneming) Ferry "Schulpengat" reveals strong secondary flow. Secondary flow is the deviation of the depth-averaged main flow, as caused by the effects of curvature and Coriolis acceleration. These effects cause the horizontal velocity vector to rotate over the vertical. This is clearly illustrated in the figure. The figure shows the current component perpendicular to the depth-averaged current at maximum flood (flowing into the plane of the figure) during one ferry crossing. The ADCP is mounted underneath the ferry at 4.3 m below the water surface. In these observations, the secondary flow is mainly caused by the cyclonic (counter clockwise) curvature of the main flow. The curvature forces the near-surface flow outward (towards Den Helder) and the near-bottom flow inward (towards Texel). Maximum secondary velocities of approximately 0.2 m/s occur between 3 and 3.5 km, coinciding with maximum flood current velocities of approximately 1.6 m/s. Secondary flow may be important for the formation and migration of large sand dunes in the Marsdiep inlet. These dunes have a wavelength of O(100 m), an amplitude of O(1 m), and a migration speed of O(25 m/yr) in northeastern direction. The observed migration directions of these dunes are similar to the directions of the primary axes of long-term time series of the flow near the bottom.

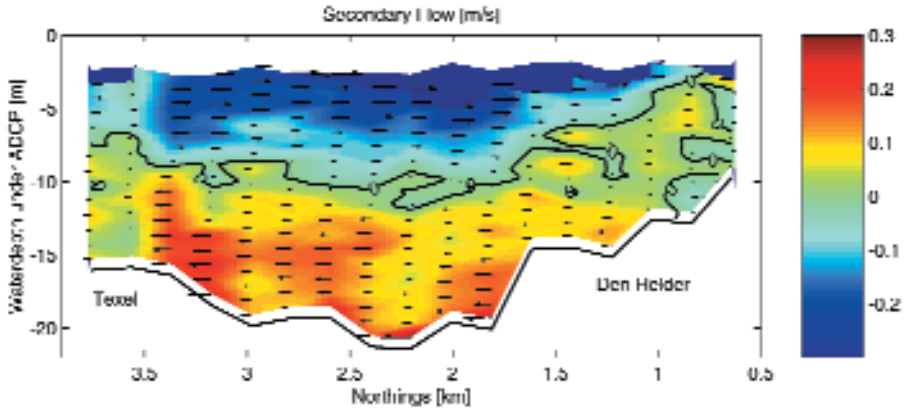

Photo: Bert Aggenbach