Streaky structures of narrow (8-9 km) high wind belts have been observed from SAR images above the Baltic Sea during stably stratified conditions with offshore winds from the southern parts of Sweden. Case studies using the WRF model and in situ aircraft observations indicate that the streaks originate from boundary layer rolls generated over the convective air above Swedish mainland, also supported by visual satellite images showing the typical signature cloud streets. The simulations indicate that the rolls are advected and maintained at least 30–80 km off the coast, in agreement with the streaks observed by the SAR images. During evening when the convective conditions over land diminish, the streaky structures over the sea are still seen in the horizontal wind field; however, the vertical component is close to zero. Thus advected feature from a land surface can affect the wind field considerably for long times and over large areas in coastal regions. Although boundary layer rolls are a well-studied feature, no previous study has presented results concerning their persistence during situations with advection to a strongly stratified boundary layer. Such conditions are commonly encountered during spring in coastal regions at high latitudes.