

**Figure S1:** Here we show a sample common swift flight track from the dataset which includes a long section where the swift appears to, with occasional interruptions, circle and rise in a thermal. Panel (A) provides an overhead and (B) a side view of ground reference frame position. The swift silhouette (not to scale) marks the start in each panel. Flight speed is shown by colour in the wider ribbon, with a black line overlaid when the bird was flapping. Note that the flight speed colour range is specific to this figure and not identical to Fig. 2.

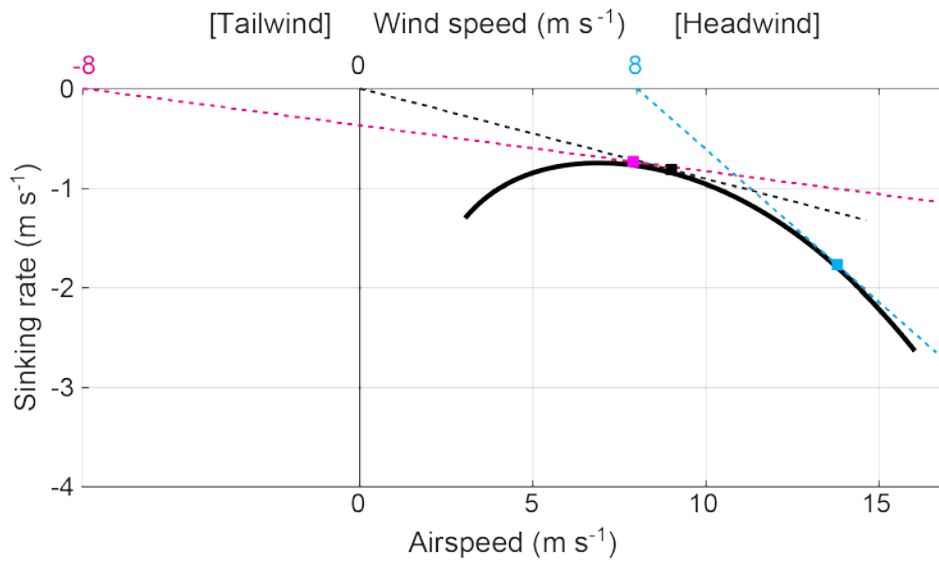


Figure S2: Here we use the glide polar (thick black line) from Figure 5 to show the effect of an  $8 \text{ m s}^{-1}$  headwind or tailwind on the predicted maximum range speed, shown as a square on the glide polar for each case. For the tailwind, this analysis predicts an optimal airspeed of  $7.9 \text{ m s}^{-1}$  for the tailwind and  $13.8 \text{ m s}^{-1}$  for the headwind, resulting in respective ground speeds of  $15.9 \text{ m s}^{-1}$  and  $5.8 \text{ m s}^{-1}$ . Based on the analysis in Fig. 3, the actual swift responses under these conditions were to fly at airspeeds of  $7.9 \text{ m s}^{-1}$  and  $13.1 \text{ m s}^{-1}$ .



Movie 1: This supplementary video shows the source video image of the swift, cropped from the original recording to show detail and overlaid with many of the kinematic and behavioural quantities computed during our analysis. The right side panels show the overhead and lateral view, colour-coded to indicate flight speed and flapping activity. Video playback is at half of live speed.