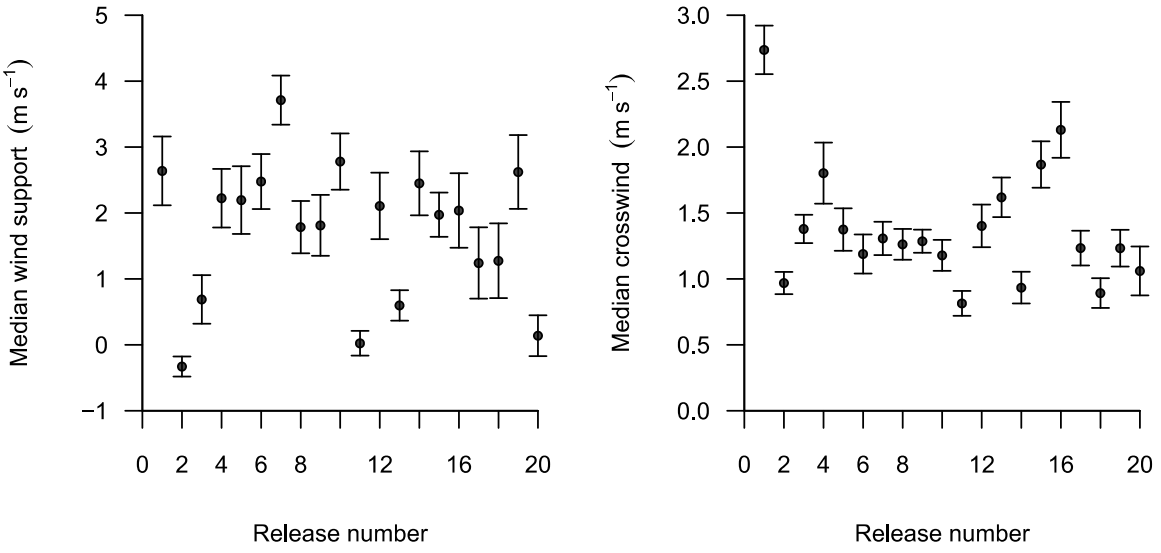

Fig. S1. (A) Median wind support (mean ± s.e.m.) and (B) median crosswind (mean ± s.e.m.) as a function of release number.

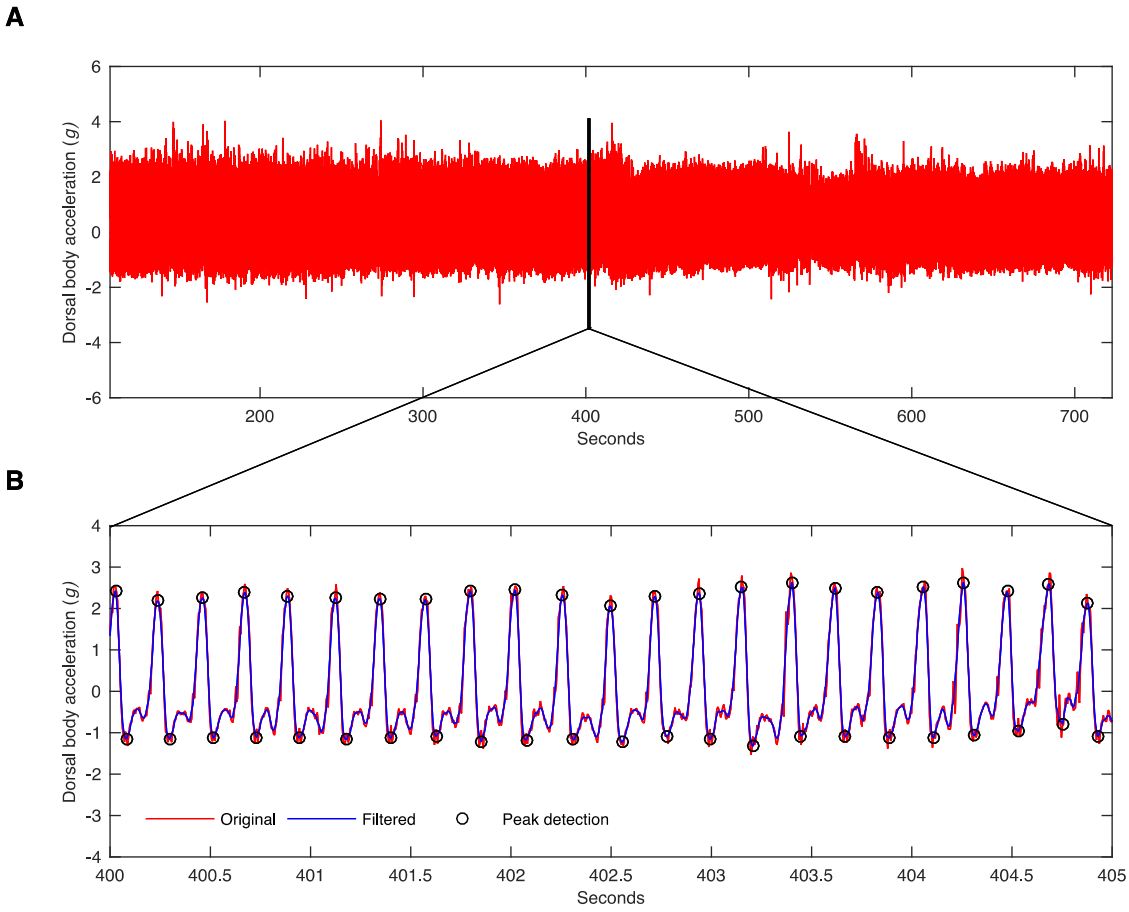

Fig. S2. (A) Example of a dorsal acceleration trace for the first flight of bird B67 recorded on an Axivity AX3 accelerometer logging at 200 Hz (route can be seen in Fig. 1; panel (A); red line). The black rectangle positioned at 400 s refers to the zoomed section displayed in (A), which shows the original data (red) and the data filtered using a running mean over five data points (blue). The circles highlight the position of the maximum and minimum peaks identified using our peak detection analysis (see Methods). Gravity, which is calculated by a running mean over 15 wingbeat cycles, is removed from all data.

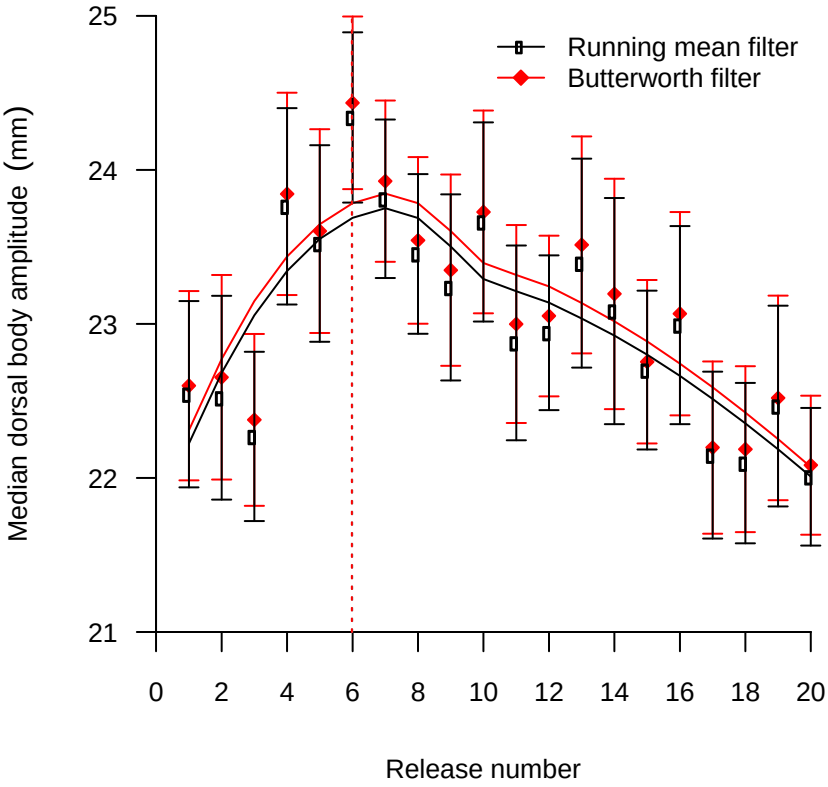

Fig. S3. Comparison of the running mean and Butterworth filter for the calculation of dorsal body amplitude (mean ± s.e.m.). Dotted lines indicate computationally optimised piecewise linear mixed model breakpoints denoting a change in response function in respect to release number, with the running mean breakpoint at 5.99 and the Butterworth filter at 5.98.

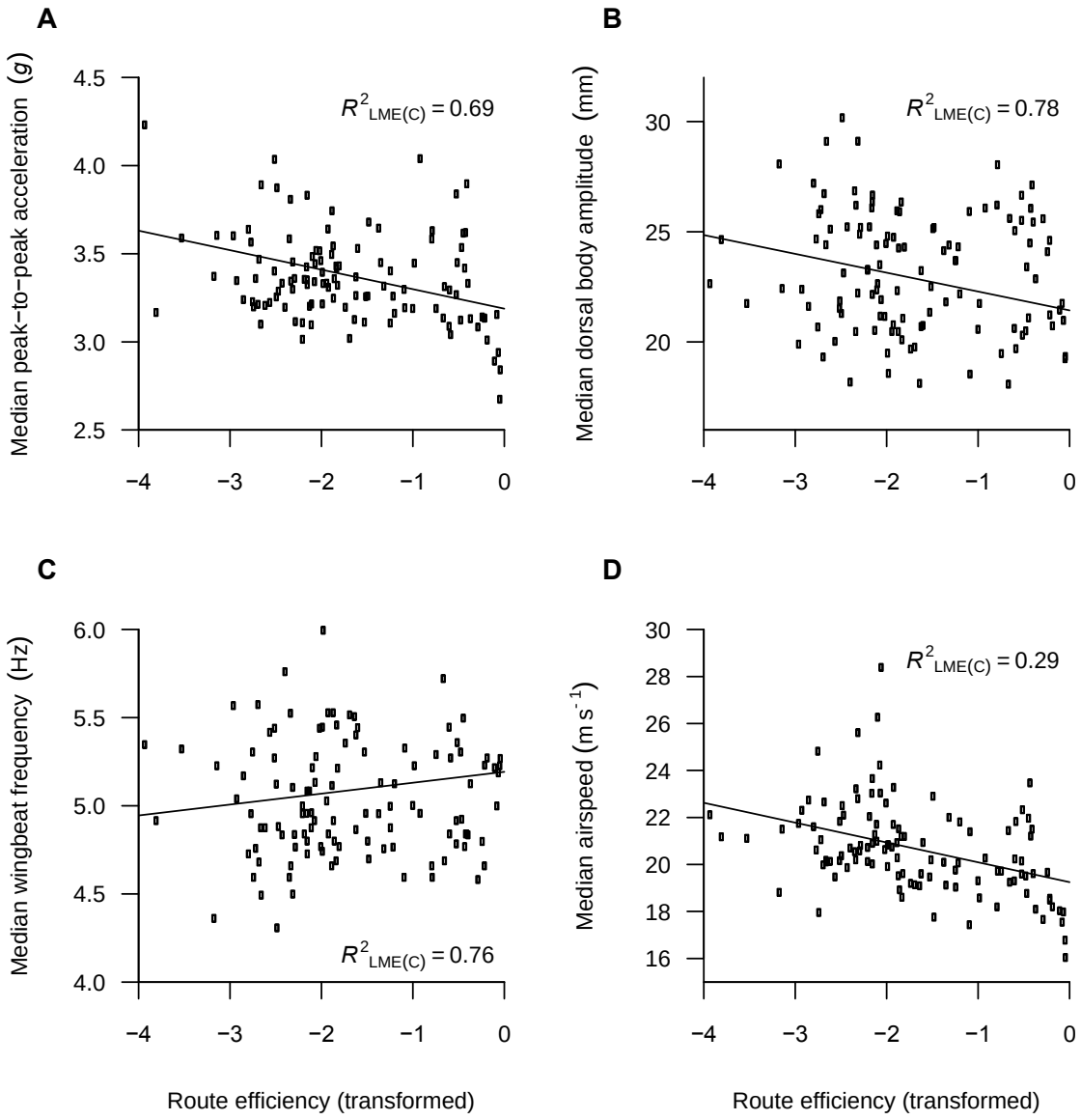

Fig. S4. Relationship between (A-C) Wingbeat characteristics and (D) airspeed and route efficiency. Solid lines correspond to linear mixed effects model fit. Conditional *R*-squared values ($R^2_{LME(C)}$) are calculated using the methods described in Nakagawa and Schielzeth (2013). Note: negative transformed route efficiency corresponds to higher actual route efficiency.

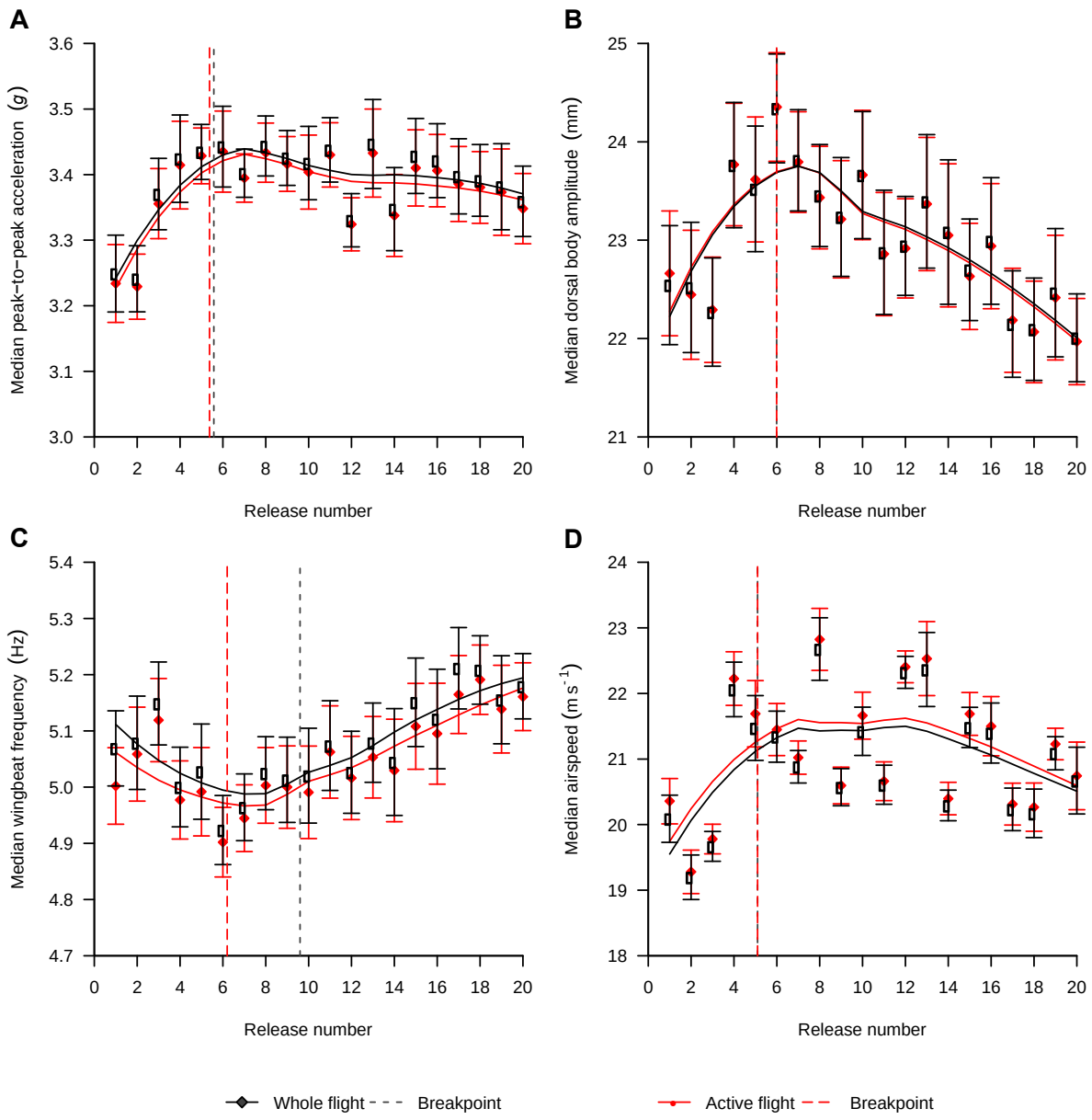

Fig. S5. Comparison of the (A-C) wingbeat characteristics and (D) airspeed (mean ± s.e.m.) as a function of release number for the whole flight and for the active straight-line flight. Dotted lines indicate computationally optimised piecewise linear mixed model breakpoints denoting a change in response function in respect to release number. Solid lines correspond to local polynomial regression fitting.

Table S1. Comparison of the linear mixed effects models directly relating route efficiency to wingbeat characteristics and airspeed for releases 1-6. The fixed-effects with *P*-values and parameter estimates (Est.) denoted in **bold** are included in the final model. Conditional *R*-squared values ($R^2_{LME(C)}$) are calculated using the methods described in Nakagawa and Schielzeth (2013).

	Route efficiency (transformed)		Wind support		Crosswind		Group		$R^2_{LME(C)}$
	P-value	*Est.*	*P-value*	*Est.*	*P-value*	*Est.*	*P-value*	*Est.*	
Median peak-to-peak DB acceleration (*g*)	**<0.001**	**-0.111**	0.184	-	0.201	-	0.472	-	0.69
Median DB amplitude per wingbeat (mm)	**<0.001**	**-0.855**	**<0.001**	**0.240**	0.266	-	0.877	-	0.78
Median wingbeat frequency (Hz)	**0.004**	**0.062**	**<0.001**	**-0.04**	0.211	-	0.966	-	0.76
Median airspeed (m s^{-1})	**<0.001**	**-0.845**	N/A	-	N/A	-	0.652	-	0.29