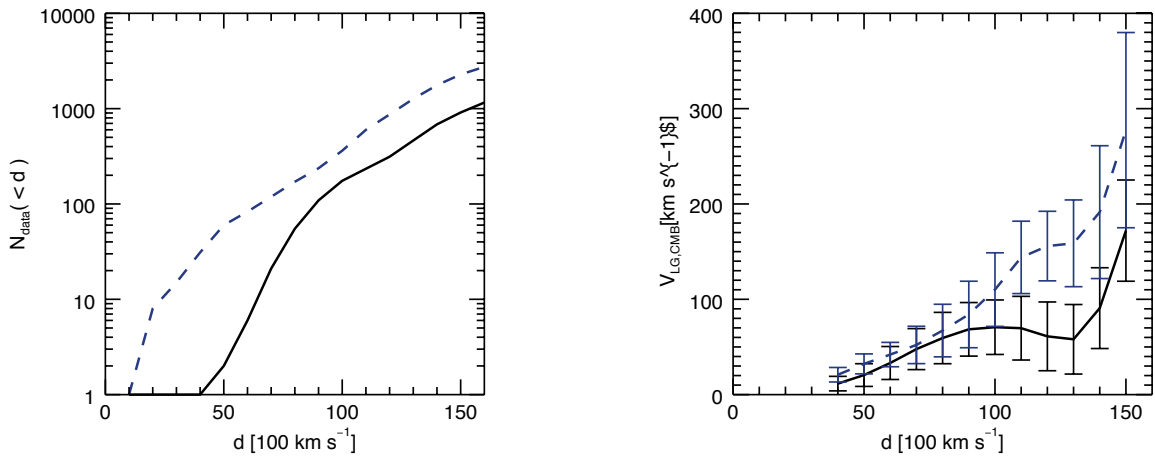


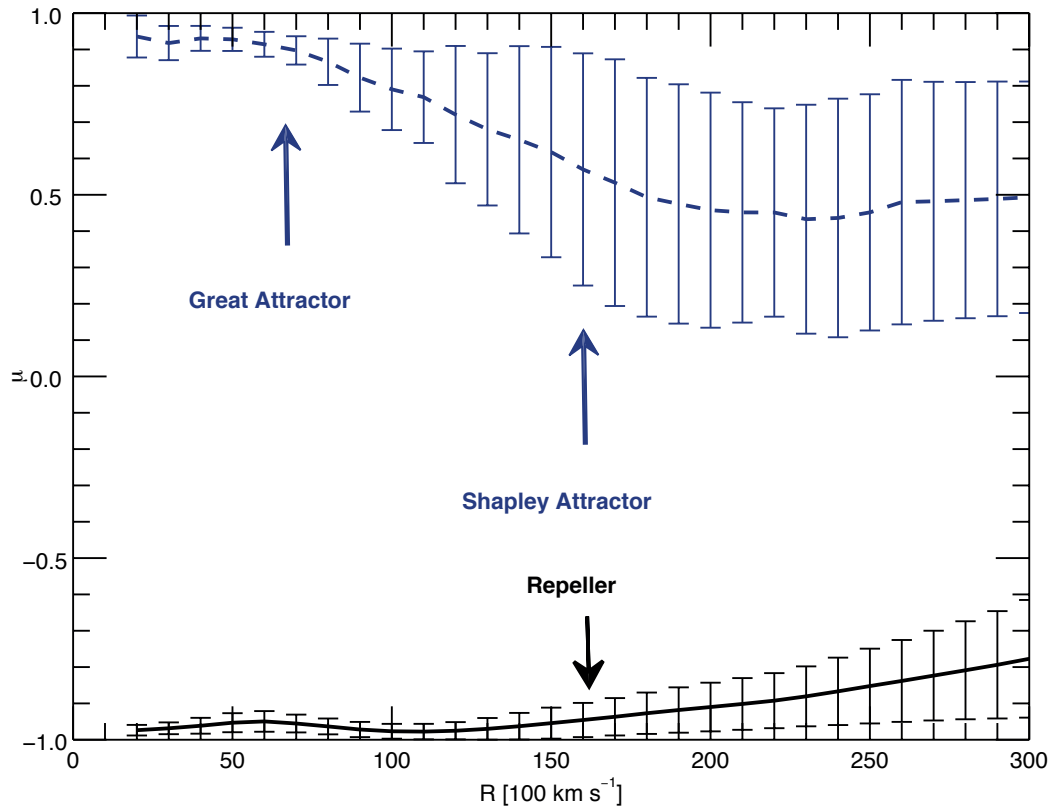
In the format provided by the authors and unedited.

The dipole repeller

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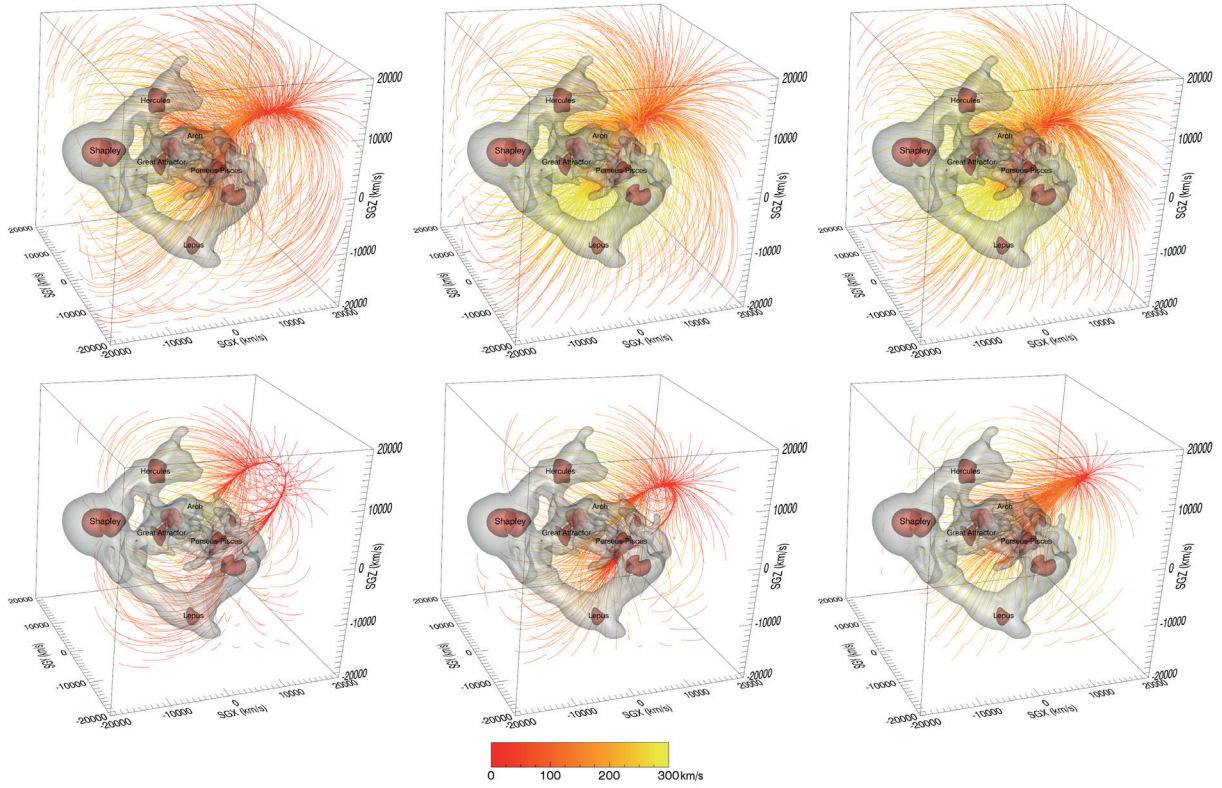


Supplementary Figure 1. Main actors of the flow. Left panel: The cumulative number of the Cosmicflows-2 groups of galaxies as a function of distance from the Repeller (solid line) and Attractor (dashed line). Right panel: The contribution of the density field within the Repeller and Attractor-centric spheres to the component of the velocity of the Local group in the direction of the CMB dipole as a function of the radius of the sphere. The mean and scatter are calculated over an ensemble of 20 CRs.



Supplementary Figure 2. Alignment of the bulk velocity with the direction of the Repeller.

In the lower set of curves and of the $\hat{e}_3$ eigenvector with the Attractor in the upper set of curves. The alignment is presented by the mean and standard deviation calculated over an ensemble of 20 constrained realizations. The alignment with the Attractor is expressed by $\mu_{e1}(R)$ (dashed blue) and with the Repeller by $\mu_{\text{bulk}}(R)$ (solid black). The downward black arrow marks the distance to the Dipole Repeller and the right and left blue arrows indicate the distances to the Great and Shapley Attractors, respectively. One should note that the 'data points' of the plot are correlated and therefore their associated errors are not independent.



Supplementary Figure 3. The anti-flow streamlines of the WF reconstruction of different Cosmicflows-2 data cuts. Full data (upper-left), TF-only single data points (upper-middle), all single data points (upper-right), distance cuts at $R = 6,000$ (lower-left), $8,000$ (lower-middle) and $10,000 \text{ km s}^{-1}$ (lower-right panel). Supplementary Table 1 records the location, distances from the Local Group and from the Repeller and alignment with CMB dipole of the repellers of the sub-samples. In some case two repellers are found. The filaments and knots of the full data V-web are shown in all plots for the sake of reference.

data cut	% of data	[SGX, SGY, SGZ] [km s ⁻¹]	R _{LG} [km s ⁻¹]	d _{DR} [km s ⁻¹]	alignment
TF-singles	47	[10,000, 5,000, 4,500]	12,000	12,300	-0.50
all singles	51	[6,000, -5,000, 7,700]	11,000	5,600	-0.99
		[10,700, 4,700, 4,000]	12,300	12,300	-0.50
< 6,000 km s ⁻¹	49	[12,500, 2,600, 9,800]	16,100	8,700	-0.74
		[10,000, -11,600, 10,500]	18,500	5,700	-0.99
<8,000 km s ⁻¹	67	[10,600, -5,800, 10,000]	15,600	500	-0.98
<10,000 km s ⁻¹	82	[10,900, -2,100, 8,100]	13,700	4,300	-0.90
full	100	[11,000, -6,000, 10,000]	16,000	0	-0.98

Supplementary Table 1. Cosmicflows-2 subsamples and their corresponding repellers. Data cuts = TF singles (row 1), all singles (rows 2-3), distance cut of 6,000 km s⁻¹(rows 4-5), cut of 8,000 km s⁻¹(row 6), cut of 10,000 km s⁻¹(row 7) and the full CF2 data (row 8). The fraction of the TF-singles and the "all singles" number of data points is calculated relative to the number of galaxies in the ungrouped CF2 databaset. R_{LG} and d_{DR} are the distance of the sub-sample repeller from the Local Group and the Repeller found from the full data. The alignment is the cosine of the angle between the radius vector of the sub-sample repellers and the CMB dipole.

Supplementary Video: The Dipole Repeller video. The video¹ commences with the presentation of the large scale structure by means of the surfaces that define the filaments and knots of the V-web. The motion of the Local Group with respect to the CMB is displayed by a yellow arrow. The growth of streamlines through integration steps from a regular array of seeds are illustrated. The fully developed streamlines clearly show a pattern dominated by a single repeller and a single attractor. The growth of the streamlines of the anti-flow is shown in a similar manner - the anti-flow is being repelled by the Attractor and attracted by the Repeller. A different presentation of the flow and anti-flow streamlines is obtained by confining the seeds of the flow lines to the neighbourhood of the Repeller (in blue-black) and those of the anti-flow to the vicinity of the Attractor (in orange-red). The attractive flow develops mainly in a plane containing the major over-densities: Perseus-Pisces, Lepus and Hercules. The repulsive anti-flow develops in the orthogonal plane that corresponds roughly to the supergalactic equator. The video reveals the almost exact alignment of the Local Group velocity vector with the Dipole Repeller and the much poorer alignment with the Shapley Attractor. The Repeller and Attractor constitute local maxima and minima of the gravitational potential.

¹<http://vimeo.com/pomarede/dipolerepeller>