1 Table X : Advantages and drawbacks of three different camera technologies for acquisition with a kite for photogrammetry. (*) a lens with the zoom ring scotch-tapped is a decent workaround if no prime lens is available (**) including the possibility to switch off the autofocus and the image stabilizer, which both make autocalibration difficult.

	Criteria	importance	compact	hybrid	DSLR
3	Criteria	importance	compact	hybrid	DSLR
4	Prime lens	medium (*)	No	Yes	Yes
5	weight	high	+++	++	-
6	Lens with no moving parts	high	No	Yes	Yes
7	Control on camera settings(**)	high	+/-	+	++
8	Image quality	medium	+/-	+++	+++
9	Cost	medium	++	+	-

13 Table 1. Flight conditions for kite characterisation and image acquisition flights and characteristics of the photogrammetric survey. The first flights did not aimed at acquiring images and only at characterising the kites behaviour.

	Flight type	Kites characterisation	Image acquisition
15	Flight type	Kites characterisation	Image acquisition
17	Estimated Beaufort	3 to 7	4-5
18	Kite used	4 m2 & 10 m2	10 m2
19	Line lengths (m)	150 to 700	150, 360, 600
20	Flying heights (m)	120 to 600	120, 300, 500
21	GCPs	-	8
22	Validation points	-	469
23	Focal length (mm)	-	18
24	Sensor size (mm)	-	23.4x15.6
25	Images used	-	752
26	Max pixel size (m)	-	0.13
27	Total covered surface	-	318 ha

31 Proposed revised section 2.5 : Gullies detection

33 As stated in introduction, our method for automatic gullies detection is a combination of existing methods. As said above, a gully is a portion of the hydrological network characterized by a sharp depression which is discordant with the smoothness of the surrounding topography. As others, we hence exploit the fact that erosion can be numerically detected by comparing the actual landscape to a landscape represented by a filtered digital elevation model. Gully border is then the limit between the zone with smooth topography and the steep slopes of the gully edges.

34 At first, we tested two-steps methods such as the one proposed by Passalacqua et al. (2010). The two steps are (i) localisation of gully heads and (ii) network delineation from these heads. As said above, gully heads localisation is the part which presents most issues. Very broadly, a pixel is considered as a network head if it is concave and its concavity is beyond a threshold automatically calculated from the statistics of the entire landscape. The threshold can also be manually tuned. This automatic detection is most problematic for small-scale features (Orlandini et al. 2011) such as the ones targeted by our work. Indeed, when applying the Passalacqua et al. (2010) algorithm, different threshold values resulted either in missing several gully heads or in categorizing as gully heads many anthropogenic depressions, such as streets in villages or spaces between trees in orchards. We then decided to digitize manually the gully heads on a shaded view of the DEM, with the same kind of expertise as one would use on the field. The noticeable difference is that the entire digitalisation process on the DEM was achieved in a few tens of minutes instead of hours or days that would have been necessary on the field.

35 Once the gully heads digitized the algorithm follows the flowchart of figure X. The raw DEM (a) is convoluted with a gaussian filter (b), resulting in the smoothed DEM (c). This smoothed DEM (c) is subtracted to the raw DEM to create a depth map (d), which therefore is the depth of the natural surface below the smoothed surface. (e) is a step of thresholding the depth map and cleaning up

the result. The threshold consists in discarding pixels that are not at least 25cm deep (see figure 3). The cleaning consists in discarding patches that are less than one cubic meter in volume. Operations (e) result in the (f) map.

36 The right side of the flow chart corresponds to the extraction of the hydrological network. As already described, gully heads (g) are digitized manually. A depression-free DEM (i) is generated from the raw DEM by filling gaps (h). The hydrological network (j) is generated by descending the depression-free DEM from gully heads along the maxima descent. A binary map (k) of the areas located at less than 15 meters of the network is computed. Intersecting the binary maps (f) and (k) produces, the final gully map (m).