UAS applications for soil degradation assessment

Manuel Seeger, University of Trier

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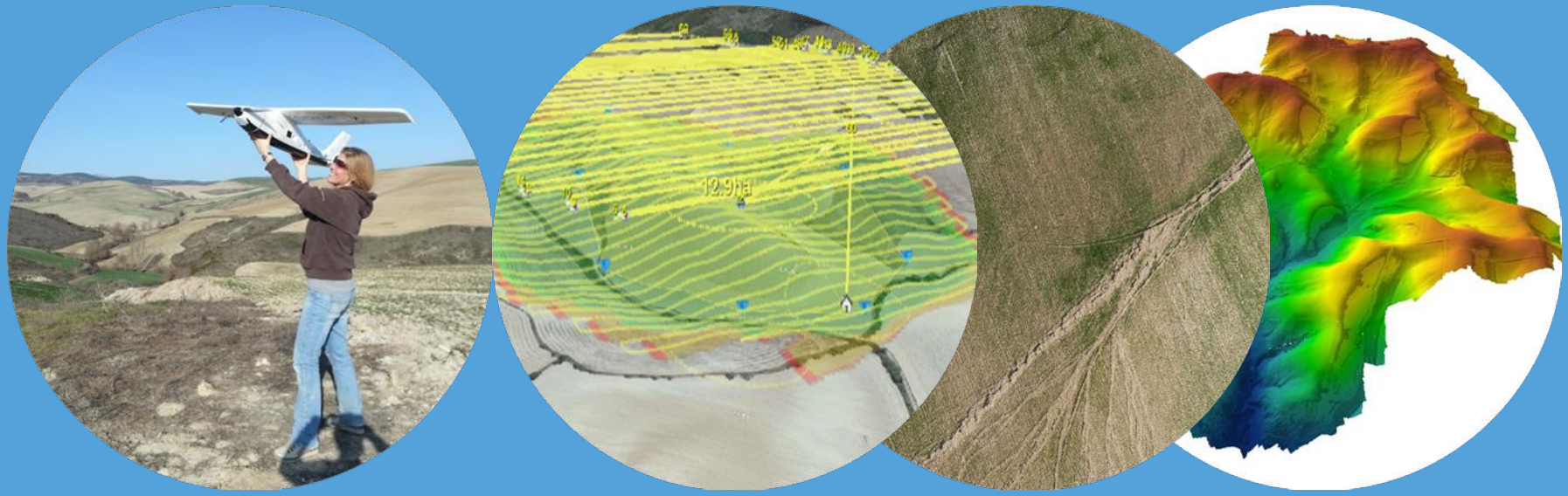

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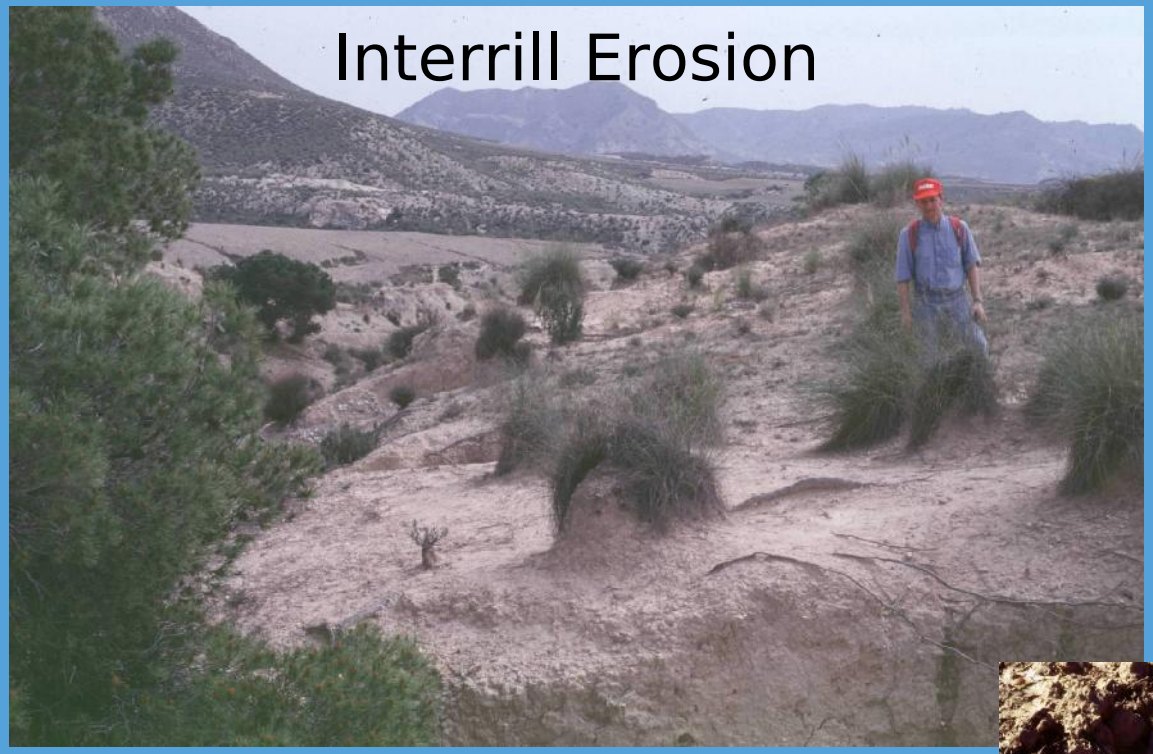
Content:

- What do we want to know about soil degradation
- Previous experiences with UAS
- What we think is possible now
- Where we want to continue

Research questions:

- Where do specific types of soil erosion occur?
- How much is it?
- Can we predict where soil erosion will occur in the future?
- What is the effect of land management strategies to soil?

Soil Erosion

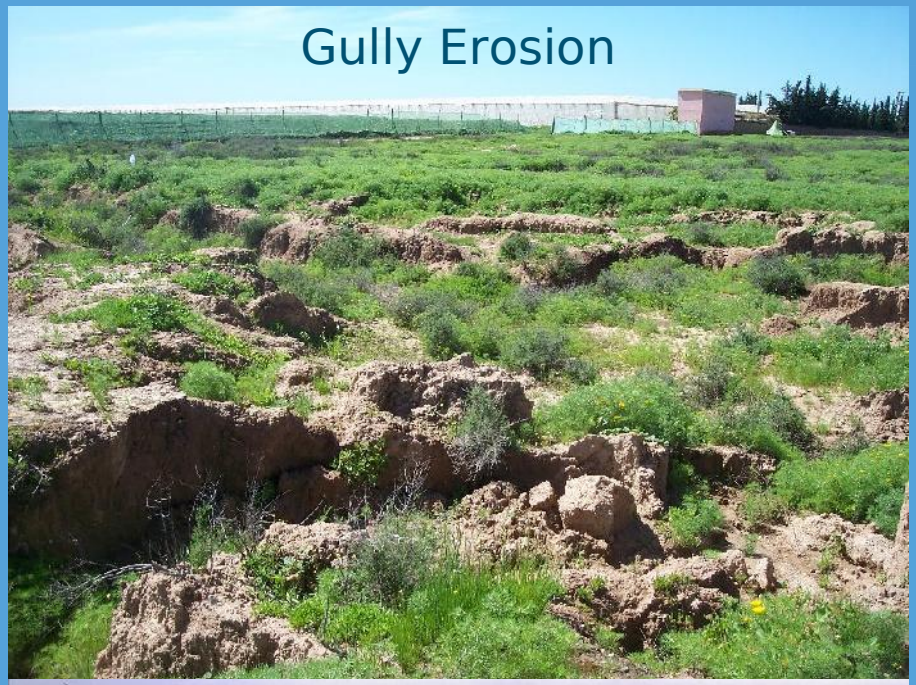


Soil Erosion

Rill Erosion

Soil Erosion

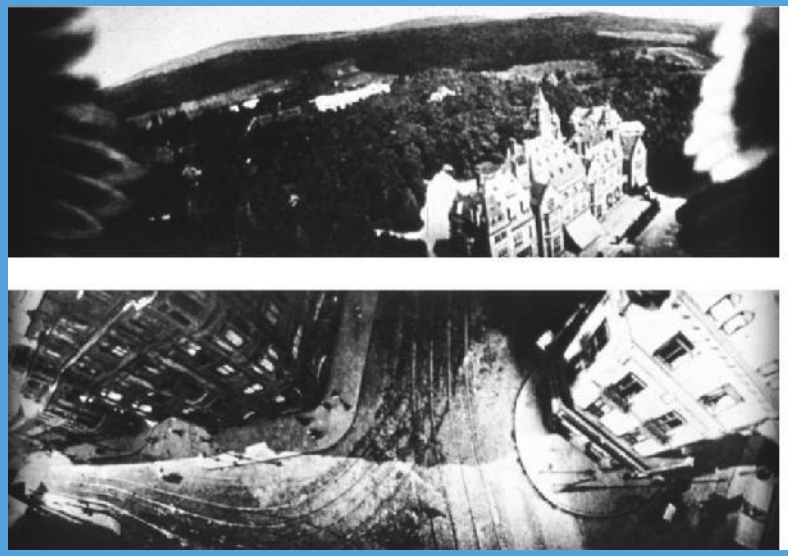
Gully Erosion



Where does it occur? - And how much?

High Resolution Aerial Photography

High Resolution Aerial Photography Carrier



High Resolution Aerial Photography Carrier

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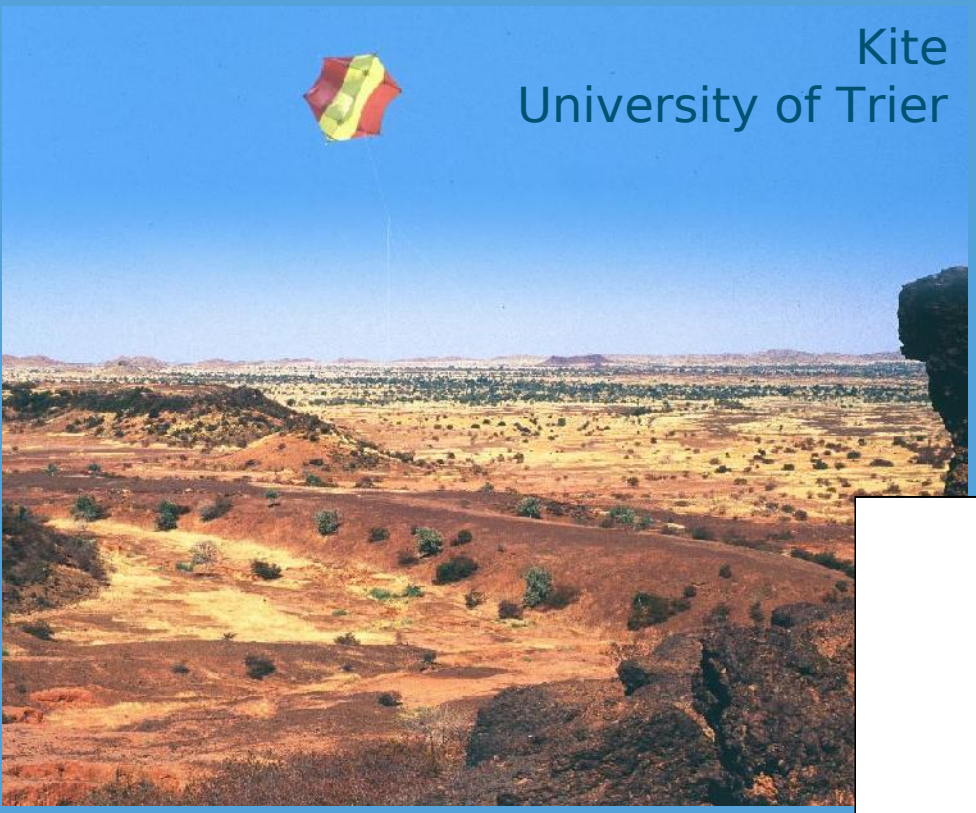
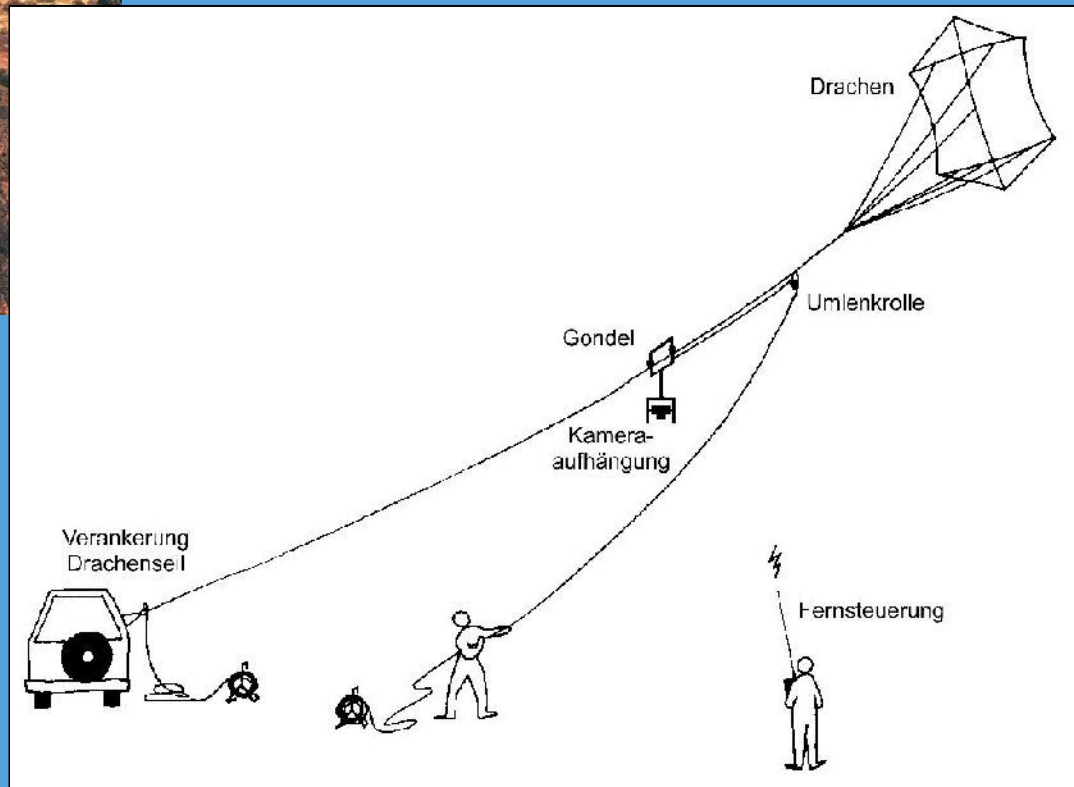
High Resolution Aerial Photography Carrier

High Resolution Aerial Photography Carrier





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High Resolution Aerial Photography Carrier

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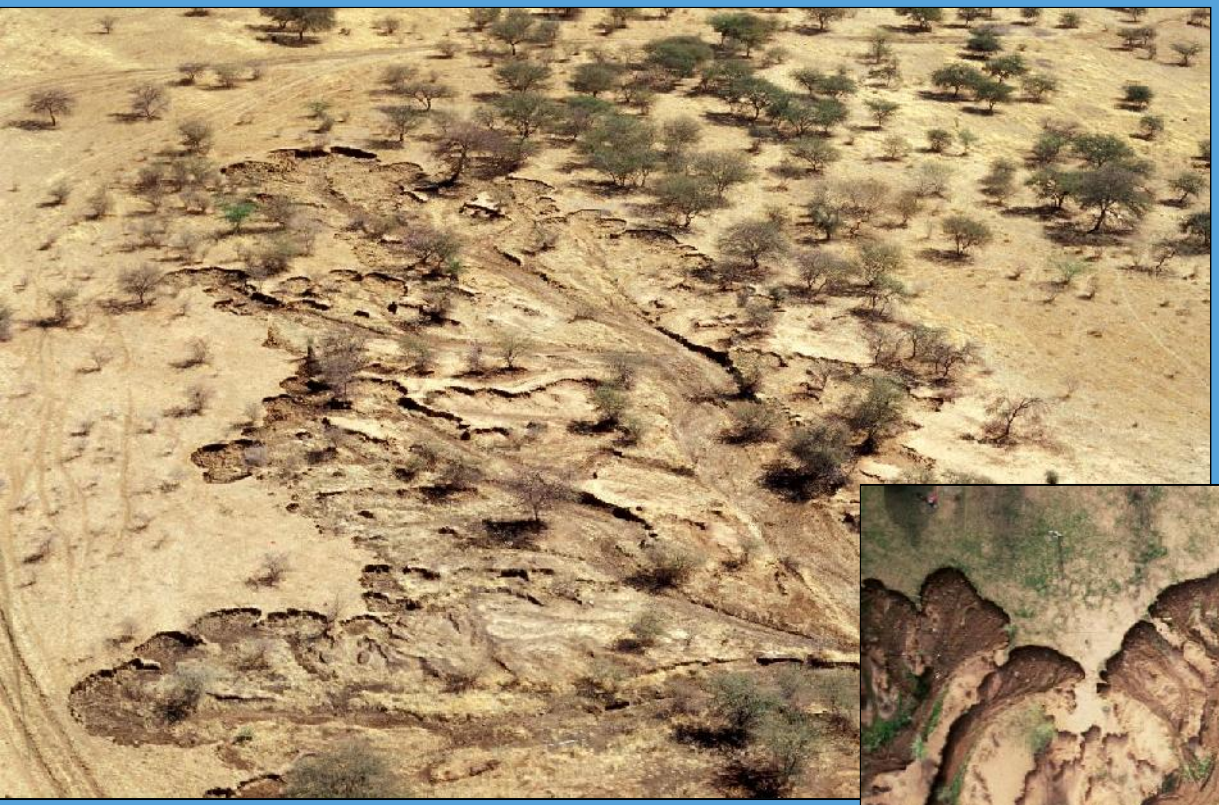

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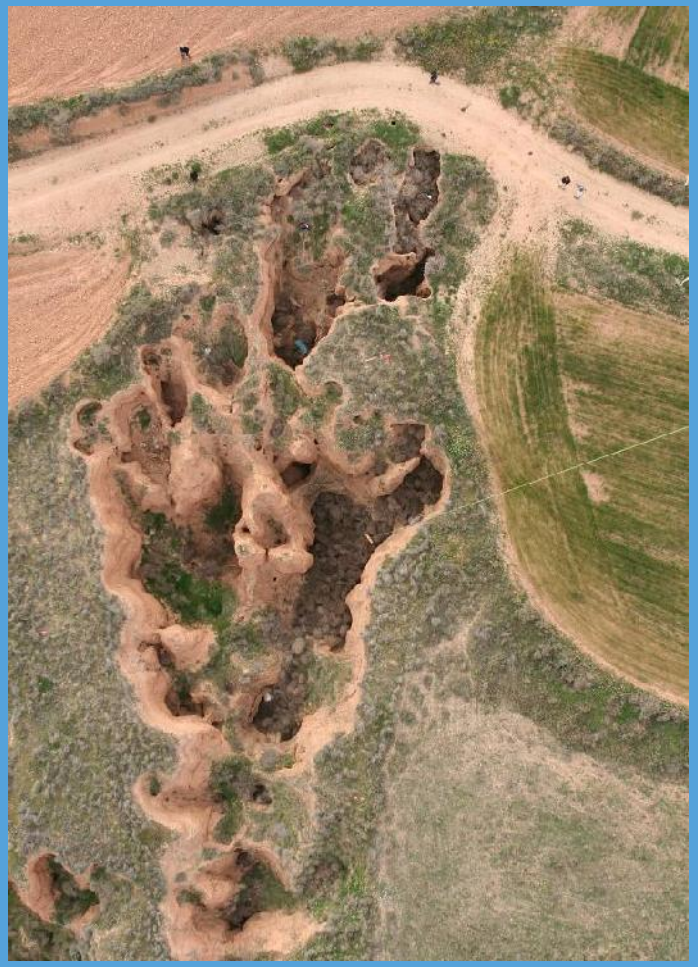

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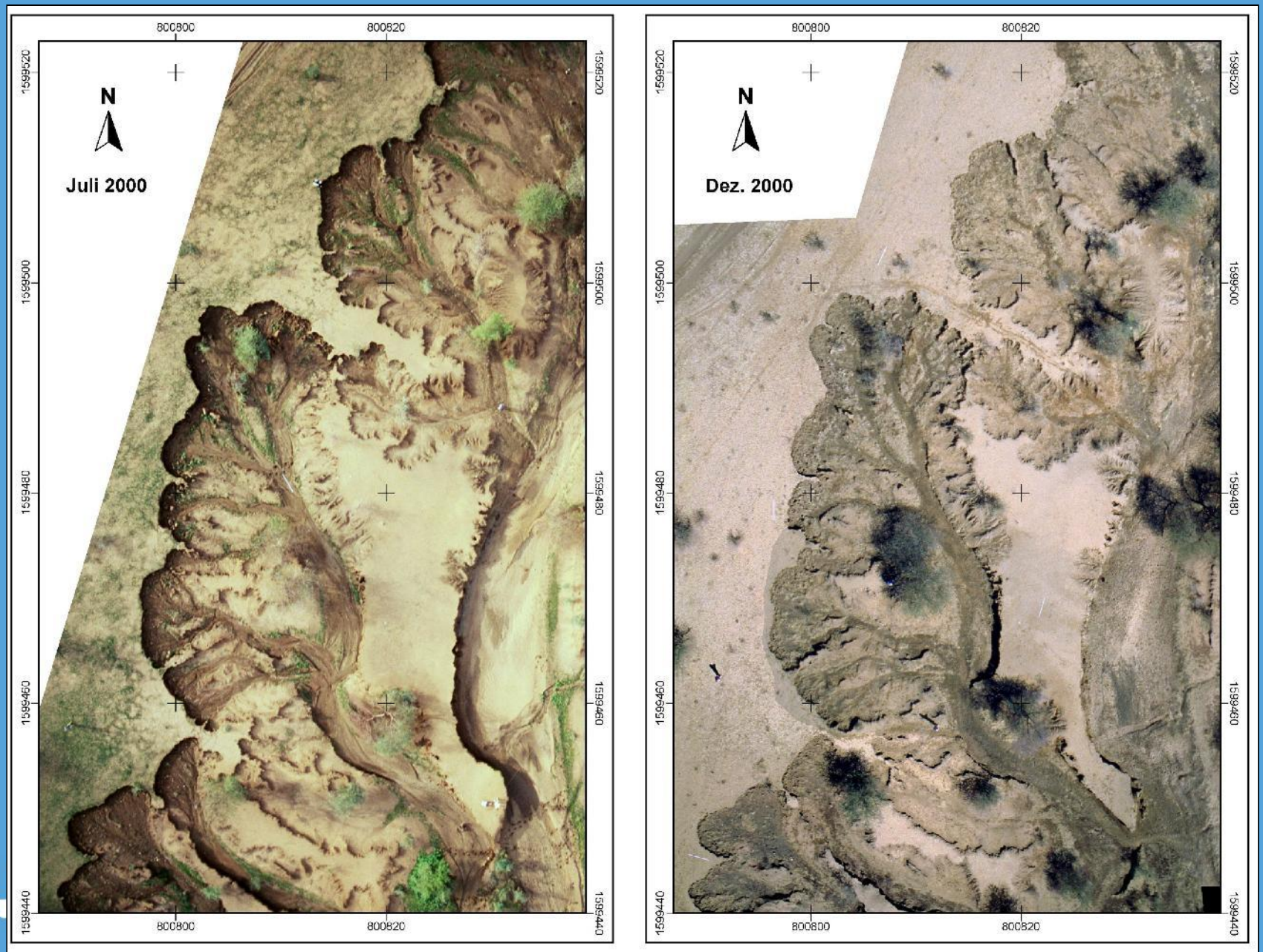

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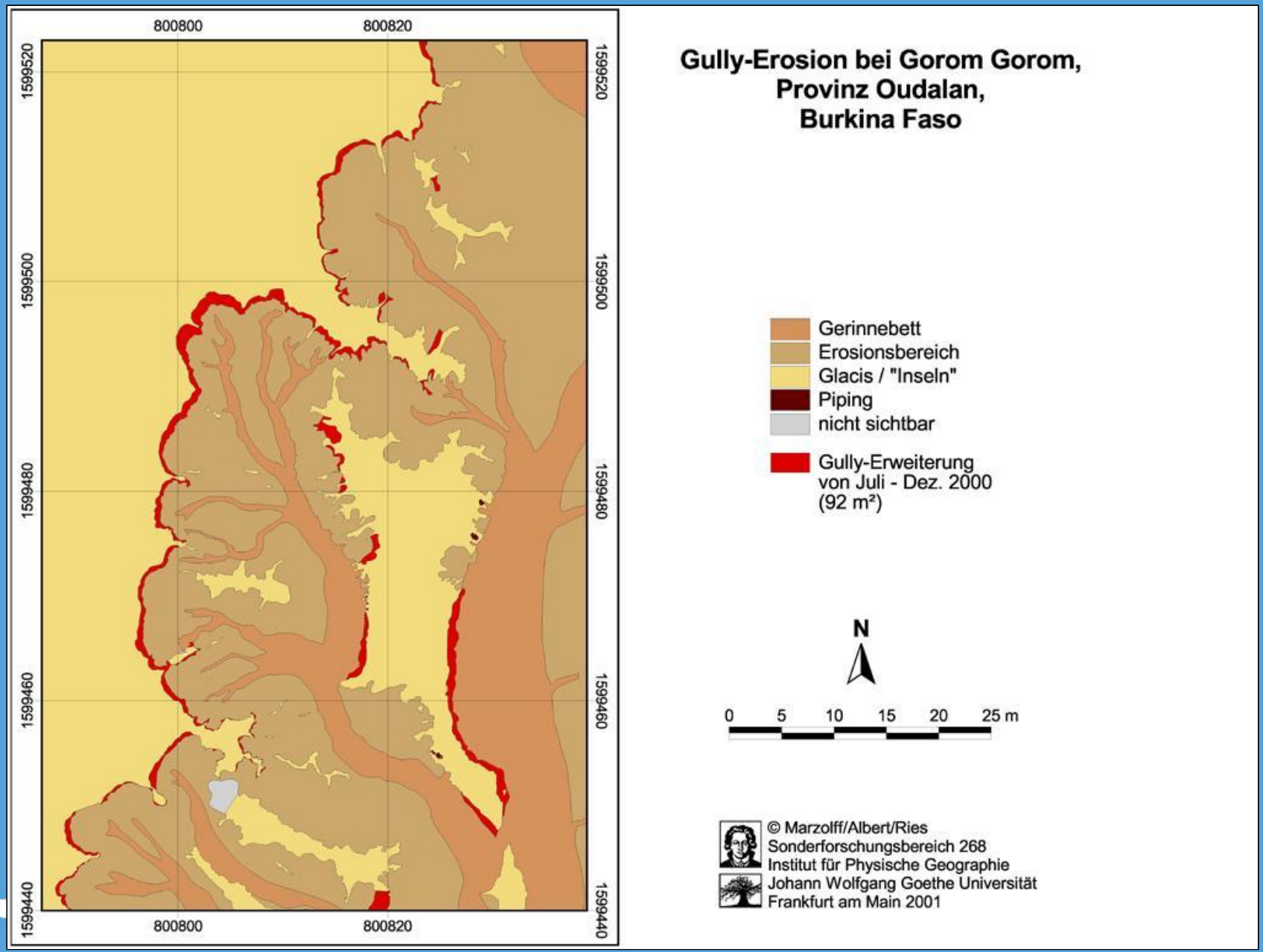


High Resolution Aerial Photography

Testfeld María de Huerva 1

Barranco de las Lenas, María de Huerva (Zaragoza)

Vegetationsbedeckung

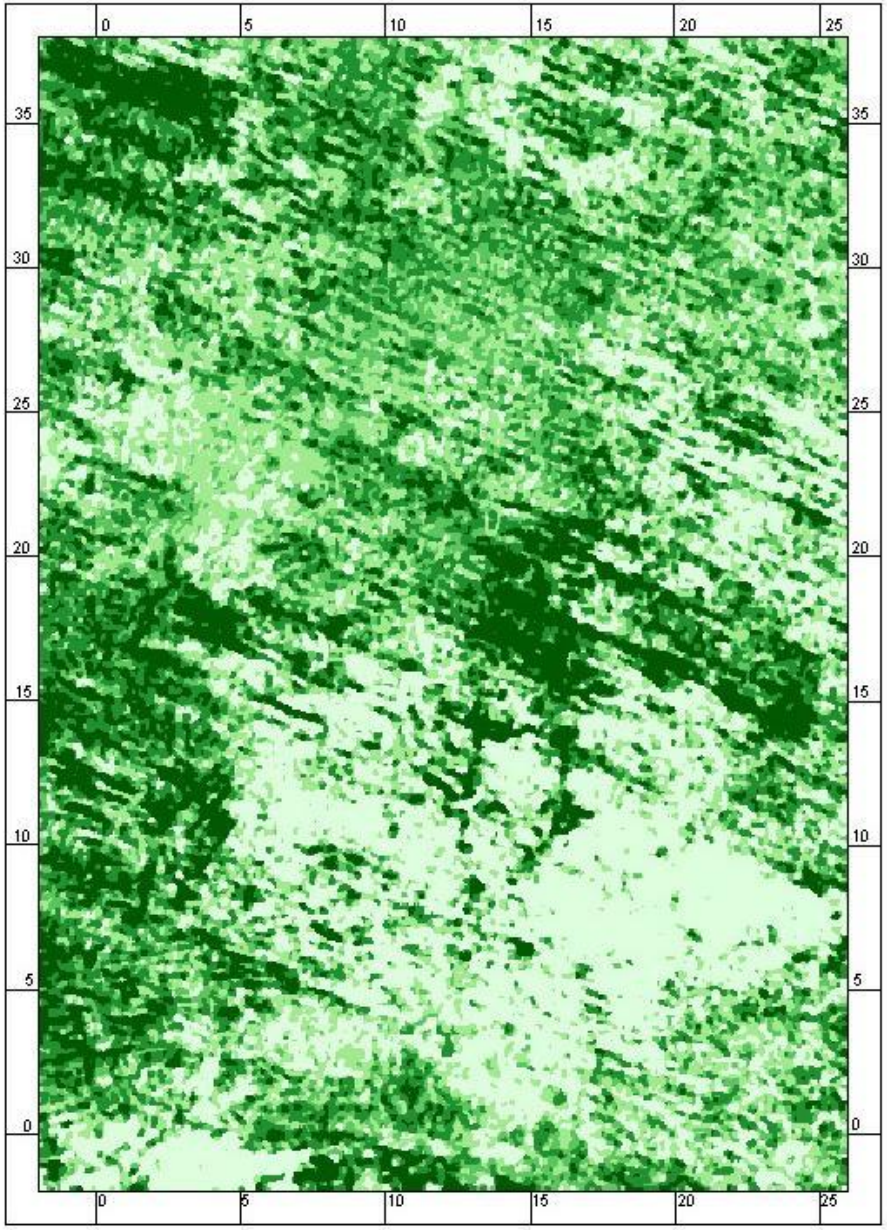
April 1997

- 0 - <5%
- 5 - <30%
- 30 - <60%
- 60 - <90%
- 90 - 100%

N

0 5 10 15 20 m

Quelle: EPRODESERT-Luftbildaufnahmen
Bildverarbeitung und Kartographie: I. Marzolff



High Resolution Aerial Photography

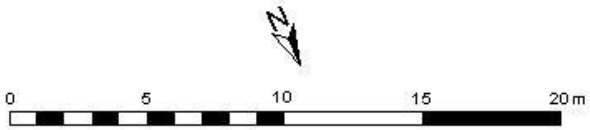
Testfeld María de Huerva 1

Barranco de las Lenas, María de Huerva (Zaragoza)

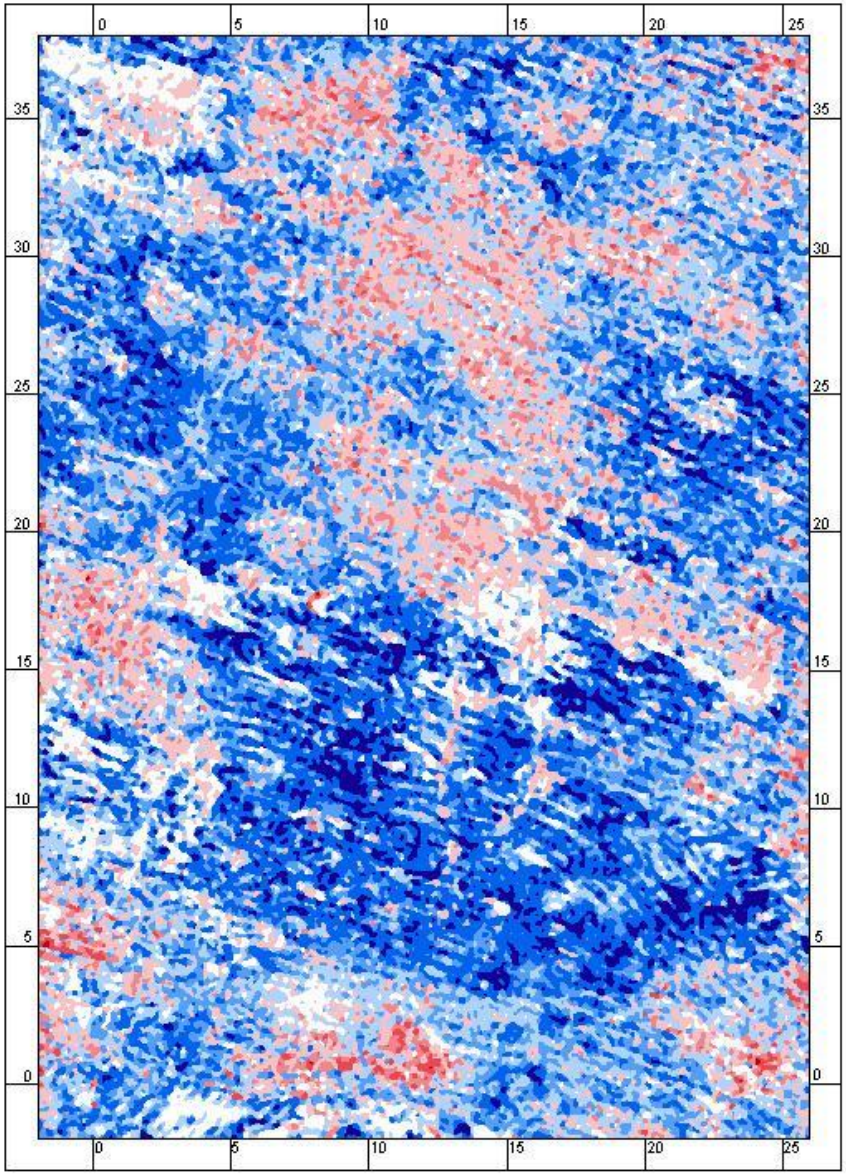
Vegetationsbedeckung -

Veränderung April 1997 - April 1998

- 100 - >90 % Abnahme
- 90 - >60 % Abnahme
- 60 - >30 % Abnahme
- 30 - >5 % Abnahme
- 5 % Abnahme - <5 % Zunahme
- 5 - <30 % Zunahme
- 30 - <60 % Zunahme
- 60 - <90 % Zunahme
- 90 - 100 % Zunahme



Quelle: EPRODESERT-Luftbildaufnahmen
Bildverarbeitung und Kartographie: I. Marzolff



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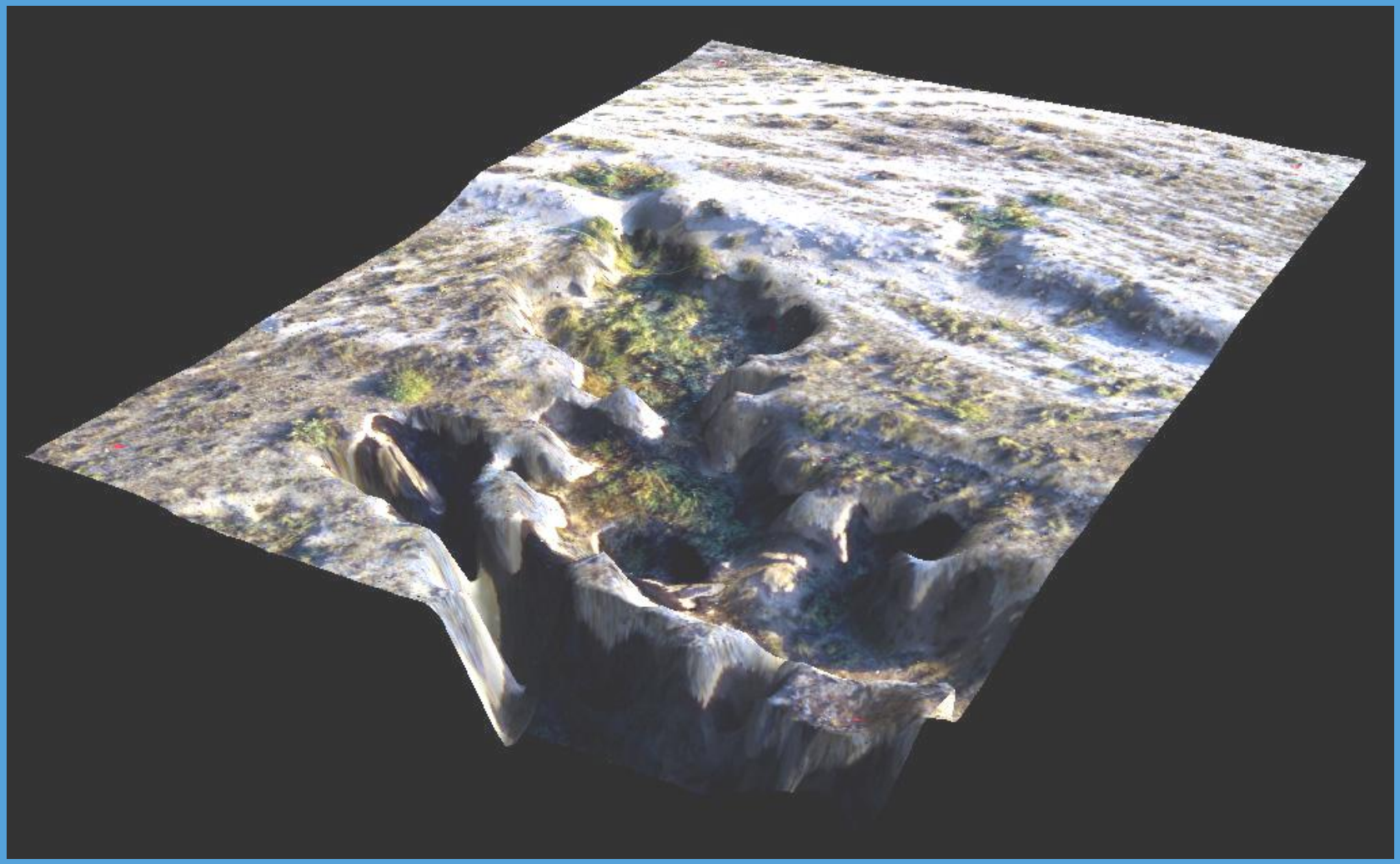

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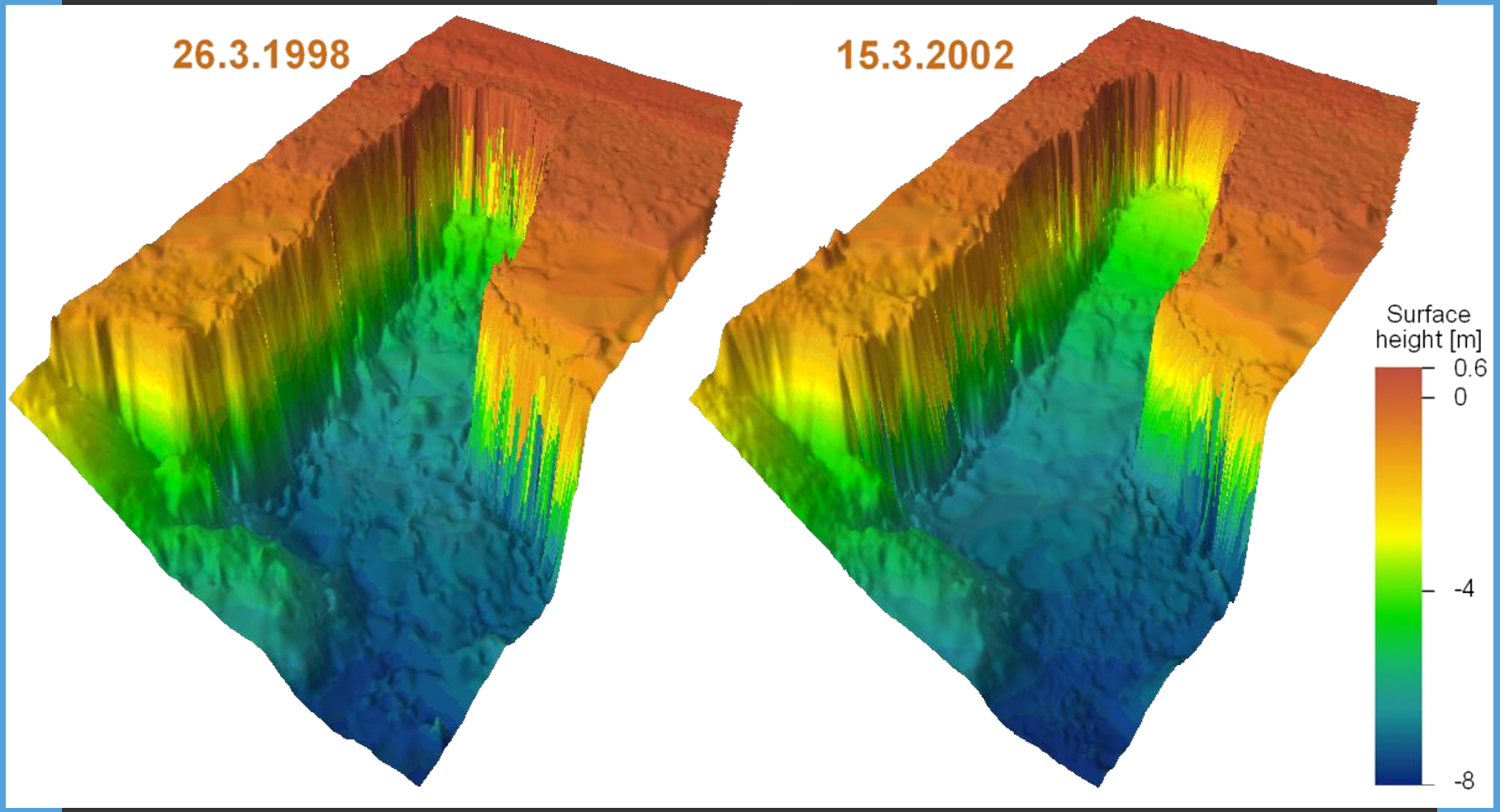

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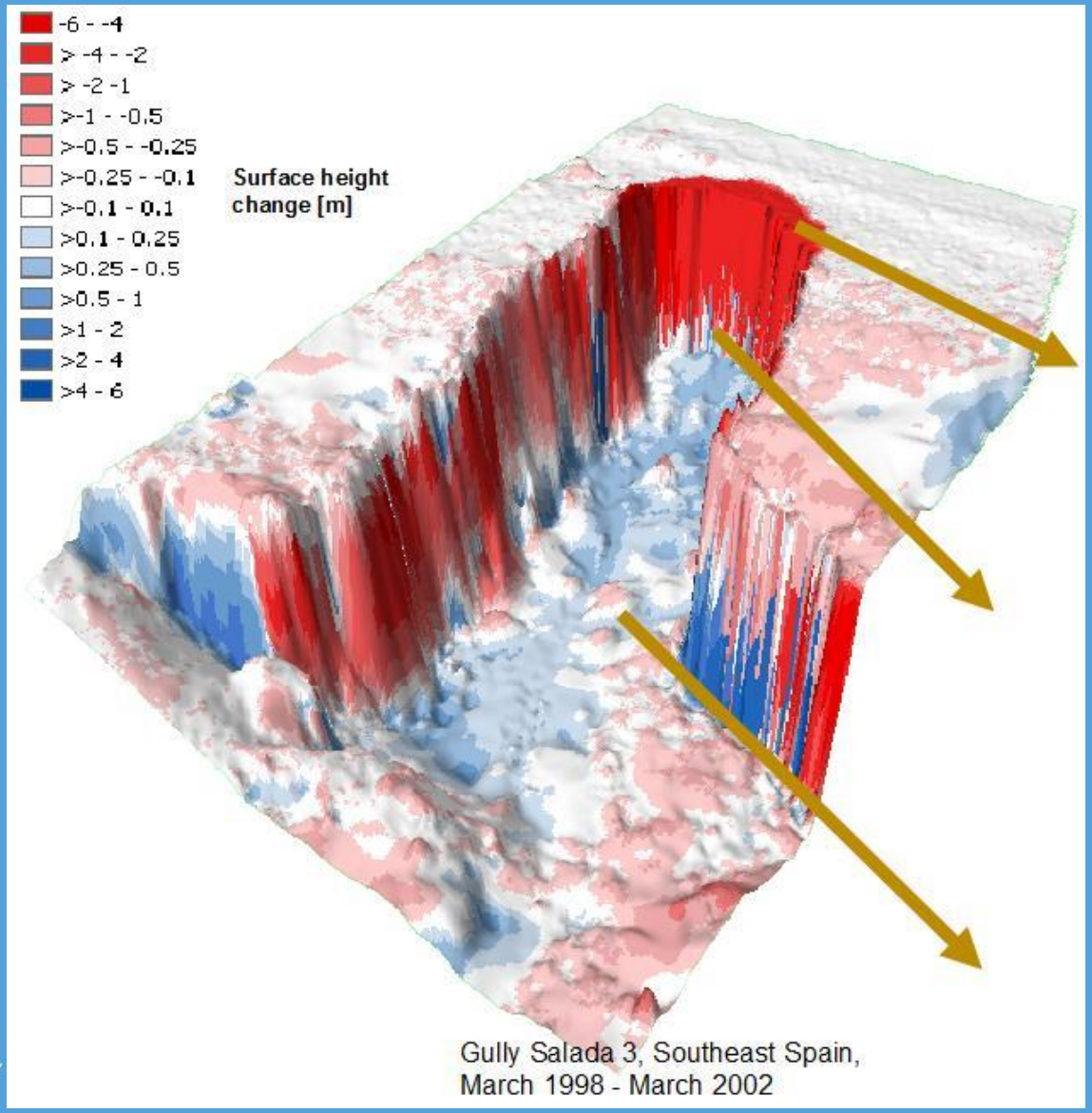

WAGENING
For quality

High Resolution Aerial Photography

- Detailed monitoring of surface processes
- High spatial and temporal flexibility

But

- Limited survey area
- work-intensive

HRAP – UAS-carrier

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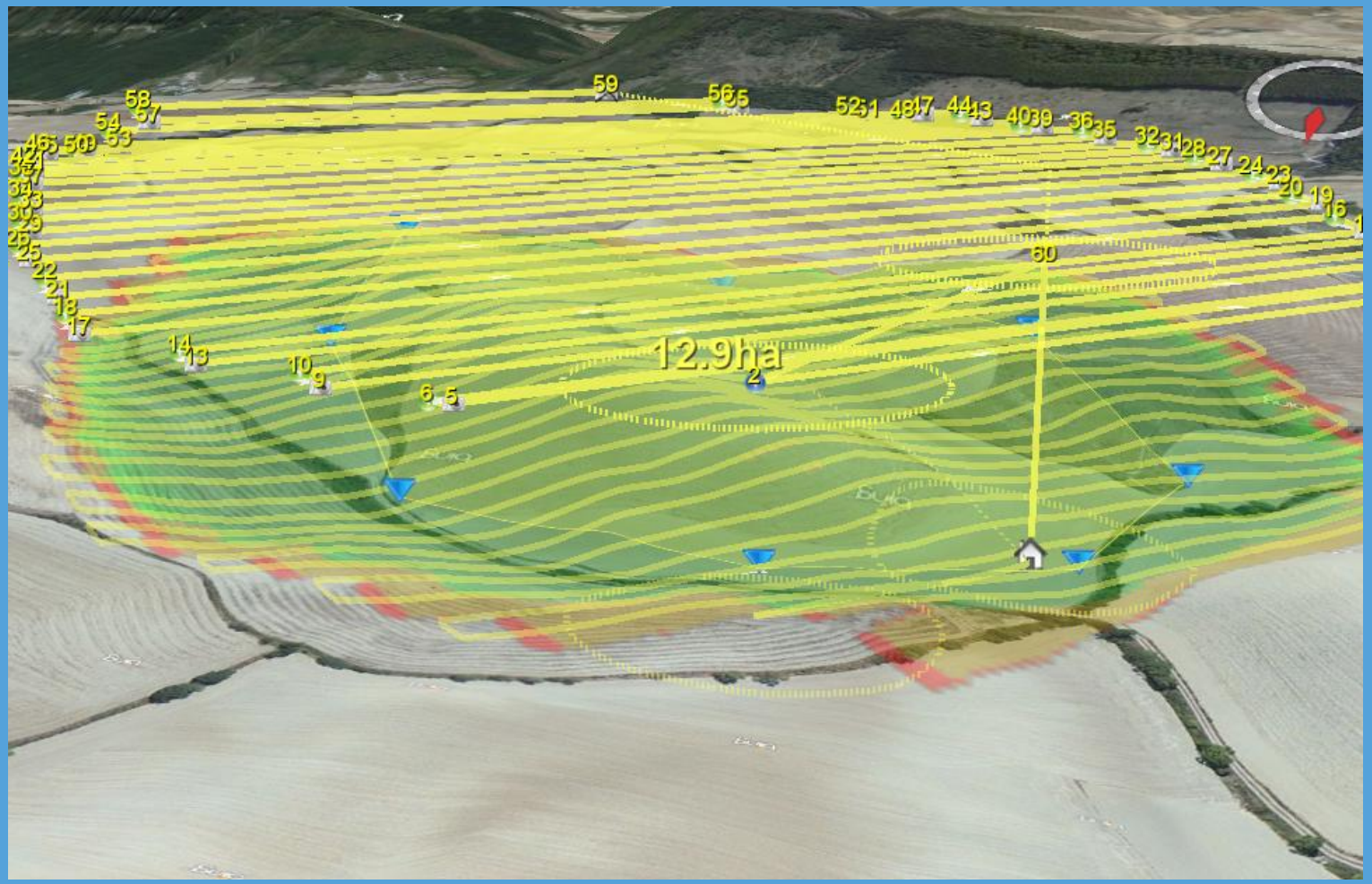
HRAP – UAS-carrier



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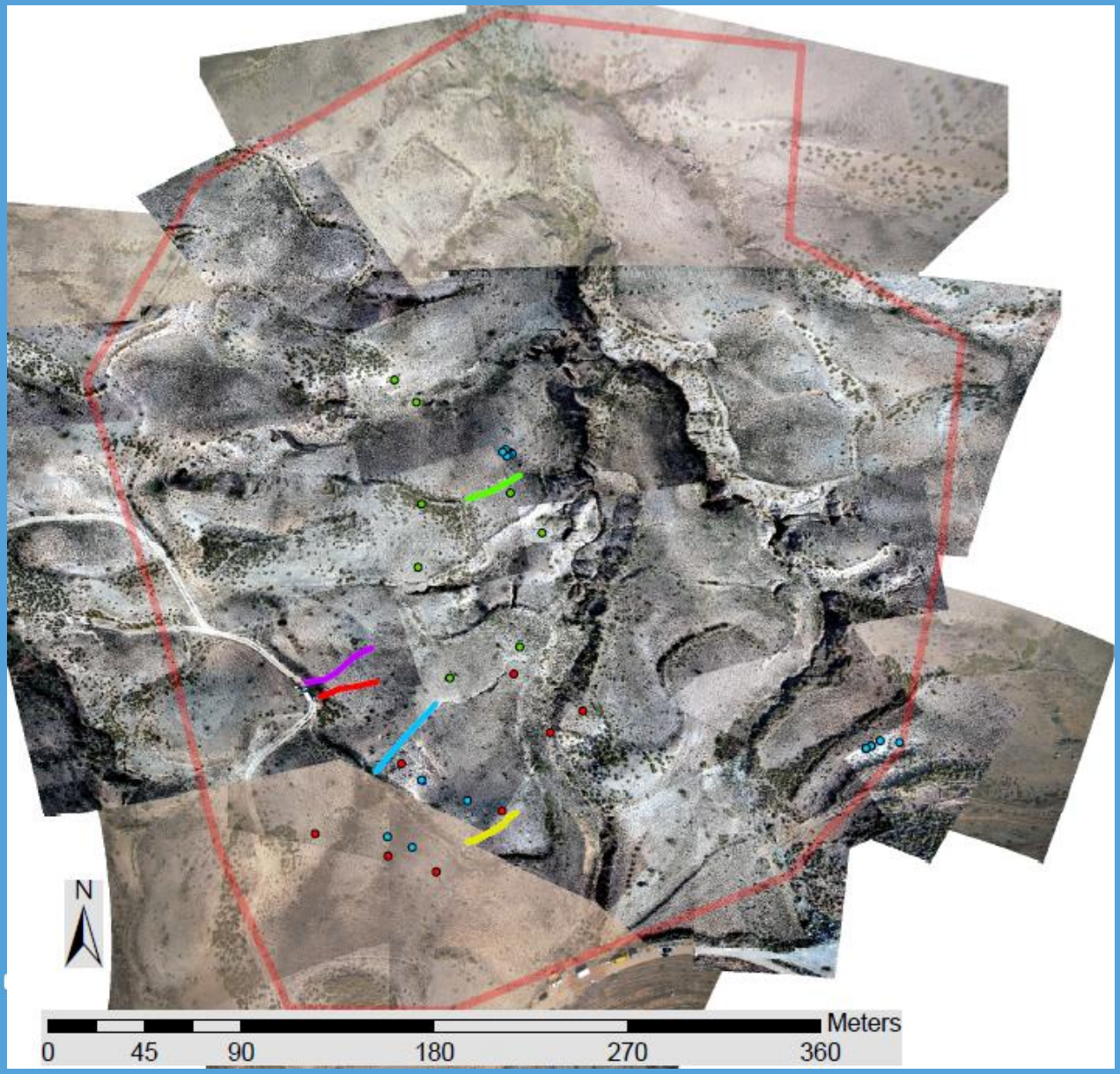
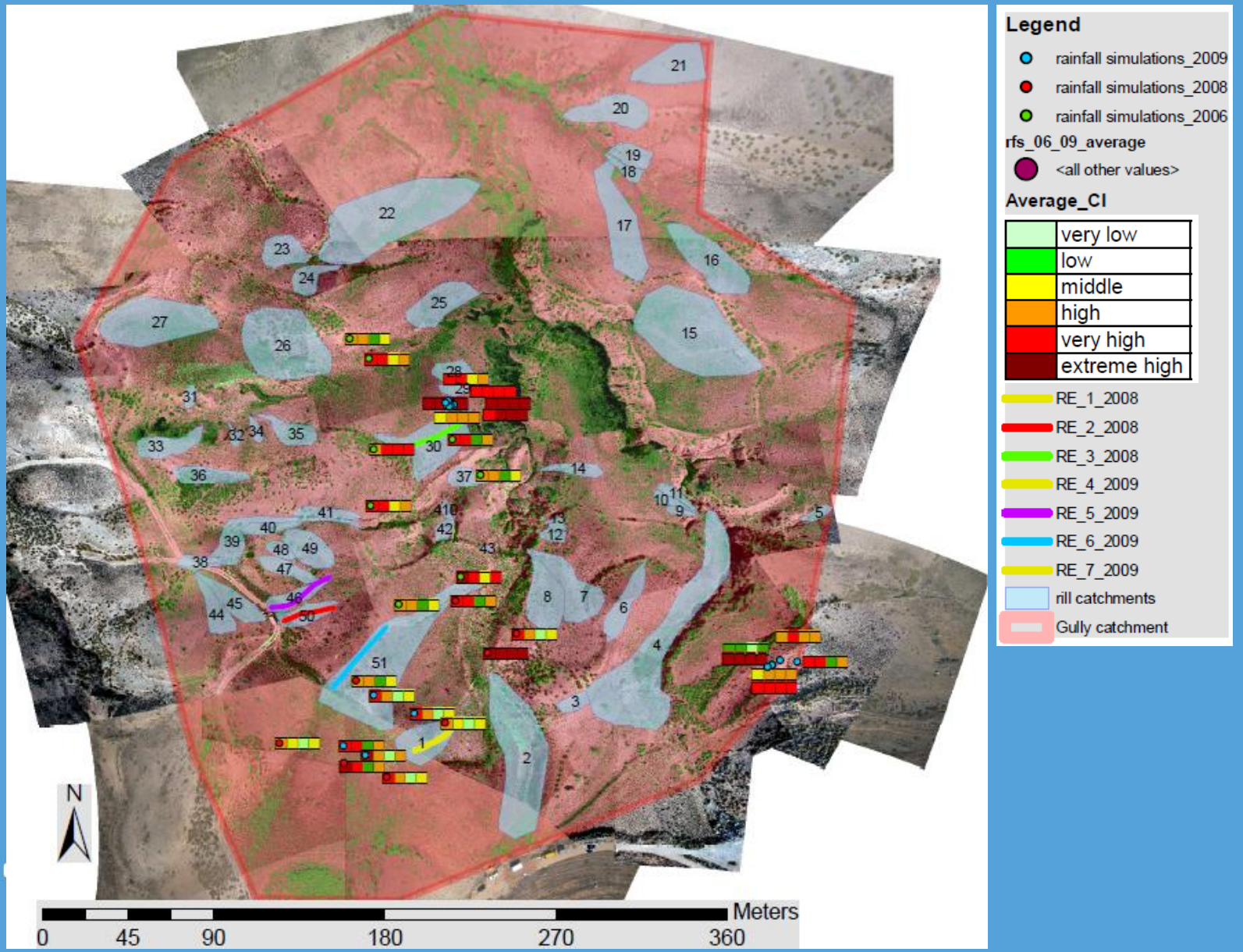
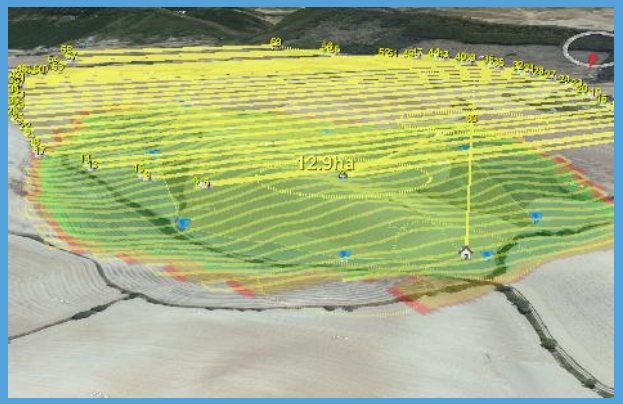
HRAP – UAS-carrier



HRAP – UAS-carrier



HRAP – UAS-carrier, 2nd generation



- 4 – 5 sequential flights
- Grd res 2 cm
- 4000 – 5000 images per catchment

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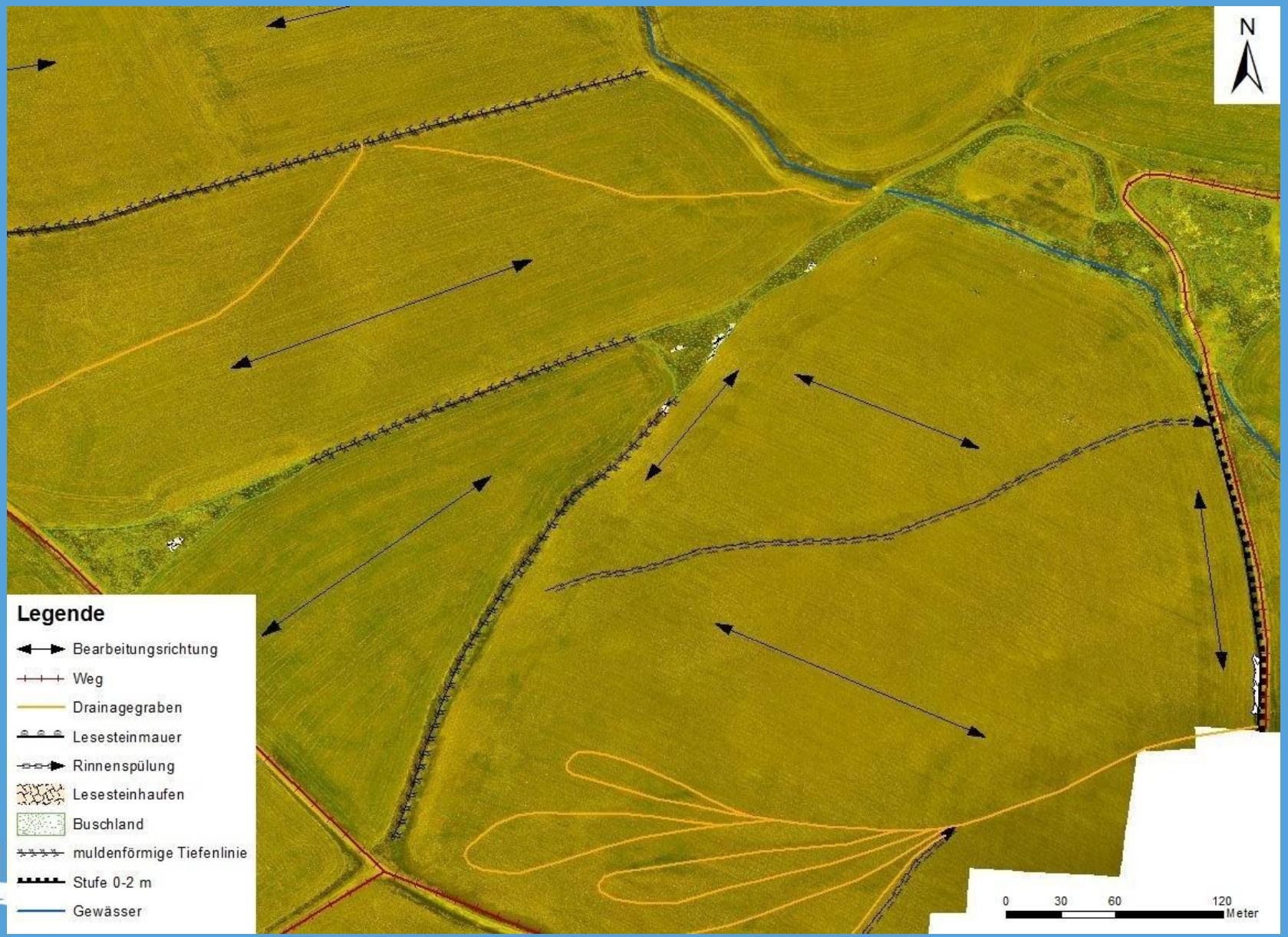
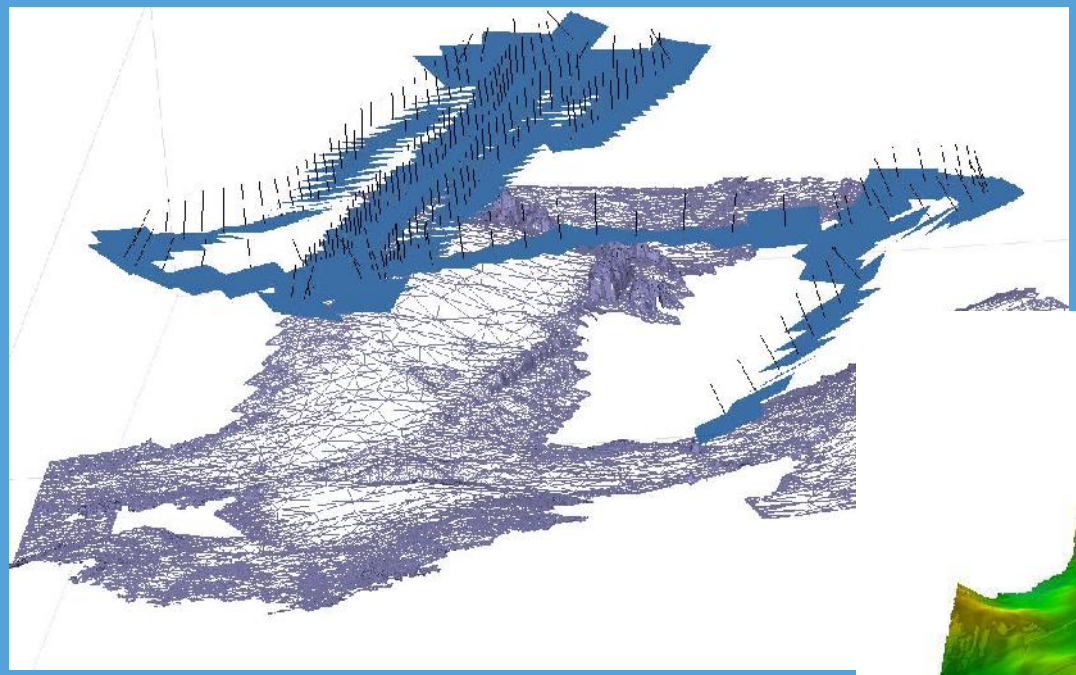
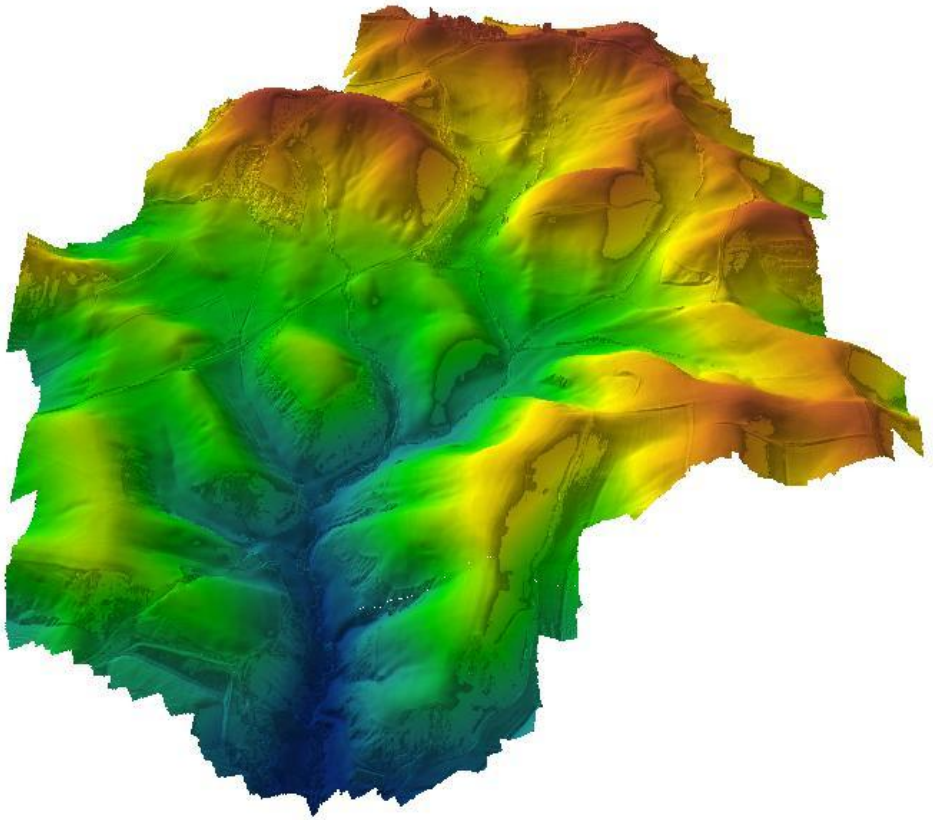
HRAP – UAS-carrier, 2nd generation



HRAP – UAS-carrier, 2nd generation





- ~ 30,000 x 30,000 grid cell DSM
- 250 GB point cloud

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HRAP – UAS-carrier, 2nd generation

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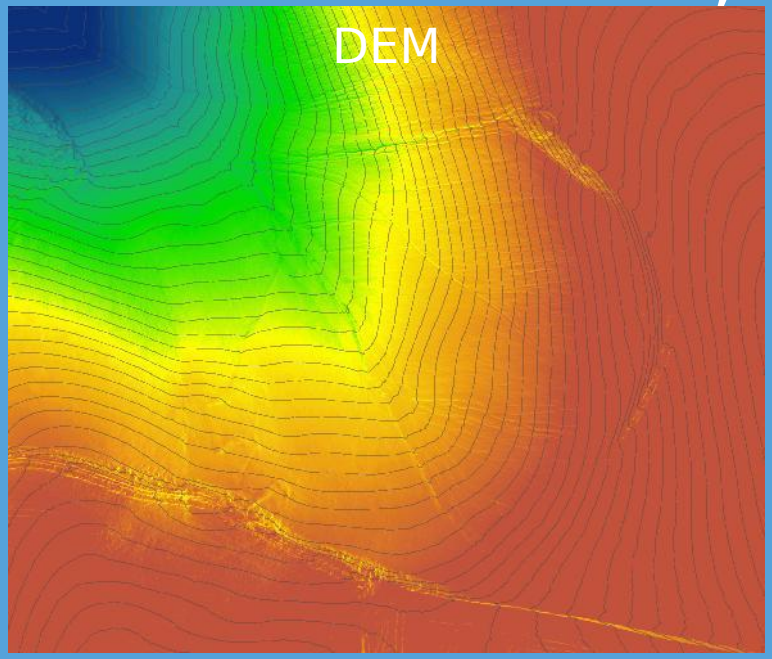
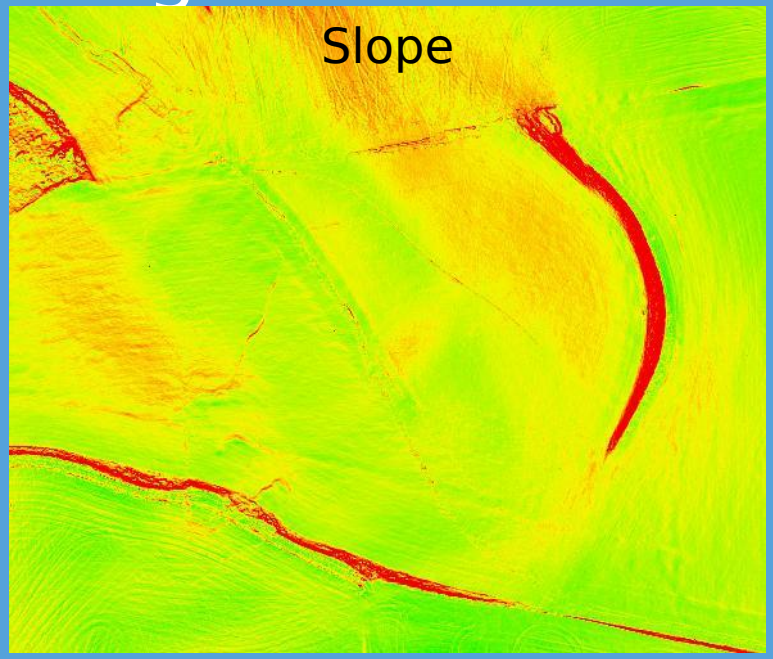
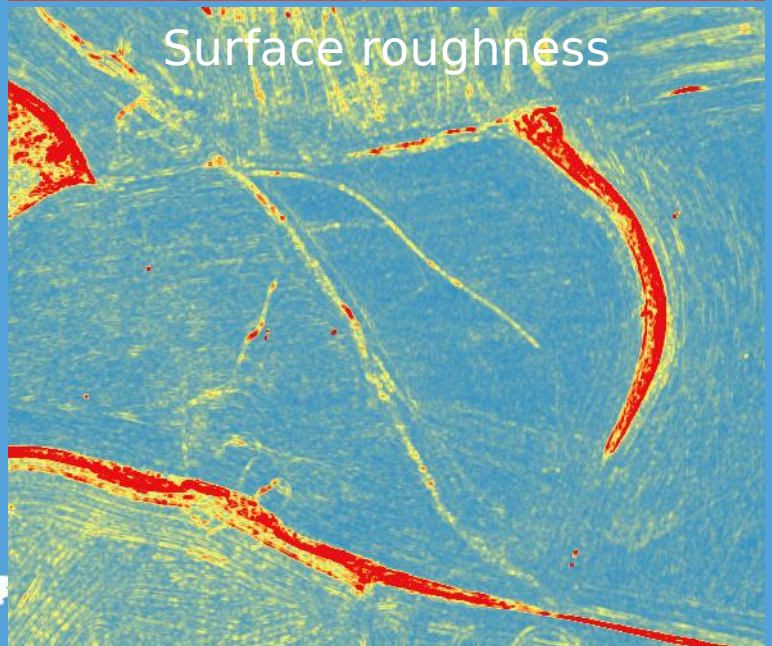
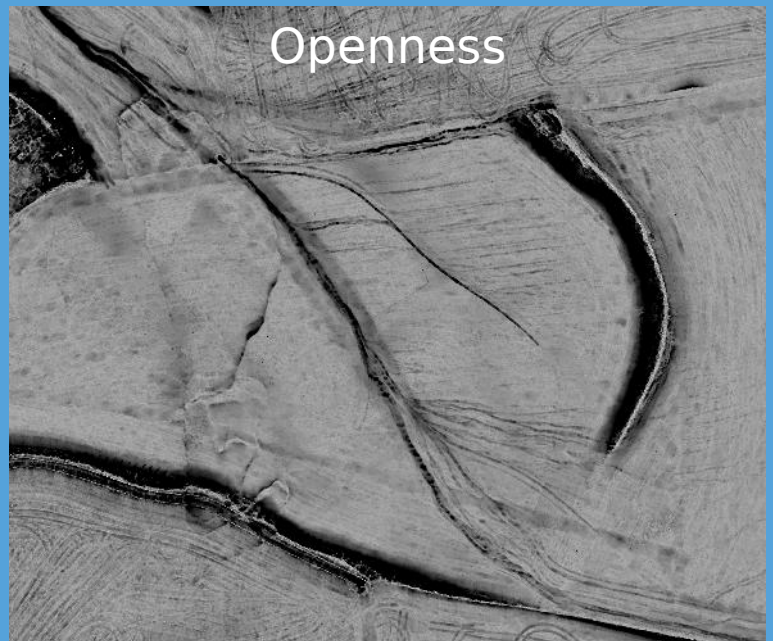






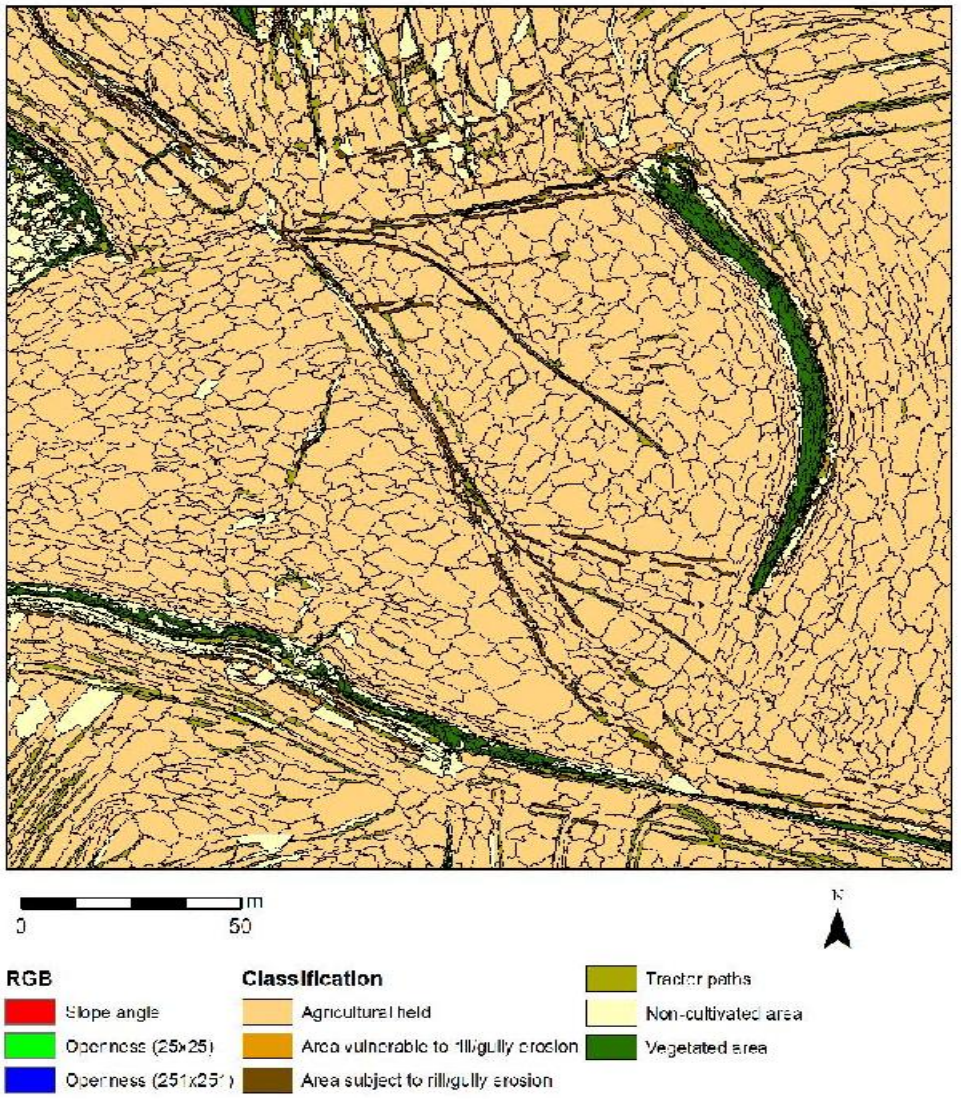


HRAP – UAS-carrier, 2nd generation

HRAP – UAS-carrier, 2nd generation

Automated feature detection

- Object-based image Analysis
- Automated soil erosion feature classification



HRAP – UAS-carrier, 2nd generation

Introduction of UAS allows

- Considerable enlargement of monitoring areas
- Increase of frequency of survey

But

- Makes us deal with very large datsets

Wageningen/Trier University collaboration

- Soil Physics and Land Management Group (Wageningen)
  - Facilities: Plane and RFS
- Department of Physical Geography (Trier)
  - Facilities: Outdoor laboratory (and RFS)

Outlook

- Testing image quality requirements
- Testing RADAR for soil surfce roughness
- Coupling radar & motion

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Thanks!

- Dr. Irene Marzolff (Dpt. Geography, Johann Wolfgang University Frankfurt)
- Prof. Dr. Johannes B. Ries (Physical Geography, Trier University)
- Dr. Niels Anders (Wageningen University)

Thank You!

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Literature

Giménez, R., Marzolff, I., Campo, M.A., Seeger, M., Ries, J.B., Casalí, J., Álvarez-Mozos, J., 2009. Accuracy of high-resolution photogrammetric measurements of gullies with contrasting morphology. Earth Surface Processes and Landforms 34, 1915–1926.

Marzolff, I., Ries, J.B., 2007. Gully erosion monitoring in semi-arid landscapes. Zeitschrift für Geomorphologie 51, 405–425.

Marzolff, I., Ries, J.B., Poesen, J., 2011. Short-term versus medium-term monitoring for detecting gully-erosion variability in a Mediterranean environment. Earth Surface Processes and Landforms 36, 1604–1623.

record.url?eid=2-s2.0-80052609649&partnerID=40&md5=97a975c90d6952ae5839ad5aa3df0efa, n.d.

Ries, J.B., Marzolff, I., 1997. Identification of sediment sources by large-scale aerial photography taken from a monitoring blimp. Physics and Chemistry of the Earth 22, 295–302.

Ries, J.B., Marzolff, I., 2003. Monitoring of gully erosion in the Central Ebro Basin by large-scale aerial photography taken from a remotely controlled blimp. Catena 50, 309–328.

Ries, J.B., Marzolff, I., Seeger, M., 2000. Der Einfluss von Beweidung auf die Vegetationsbedeckung und Bodenerosion in der Flyschzone der spanischen Pyrenäen, in: Aktuelle Beiträge Zur Angewandten Physischen Geographie Der Tropen, Subtropen Und Der Regio Trirhena, Freiburger Geographische Hefte. Institut für Physische Geographie, Albert-Ludwigs-Universität Freiburg i. Br., Freiburg i. Br., pp. 167–194.

Seeger, M., Marzolff, I., Ries, J.B., 2009. Identification of gully-development processes in semi-arid NE-Spain. Zeitschrift fur Geomorphologie 53, 417–431..

For further references:
Irene Marzolff: http://www2.uni-frankfurt.de/46055652/marzolff
Johannes B. Ries: http://www.uni-trier.de/index.php?id=18534