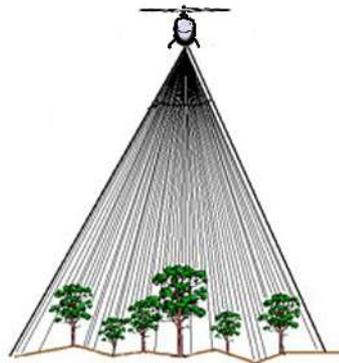


***Airborne Laser Scanning measurements in
Central Kalimantan to achieve high-resolution
Digital Elevation Models of Tropical Peatlands, PSF, in EMRP
Flood Simulation of river Kahayan and Lake Batu north of
Palangkaraya***
by
H.-D. Viktor Boehm, Juergen Frank, Kalteng Consultants

Airborne Laser Scanner



Landsat image 2000 with overview of ALS-flight tracks starting at PKY and MSC

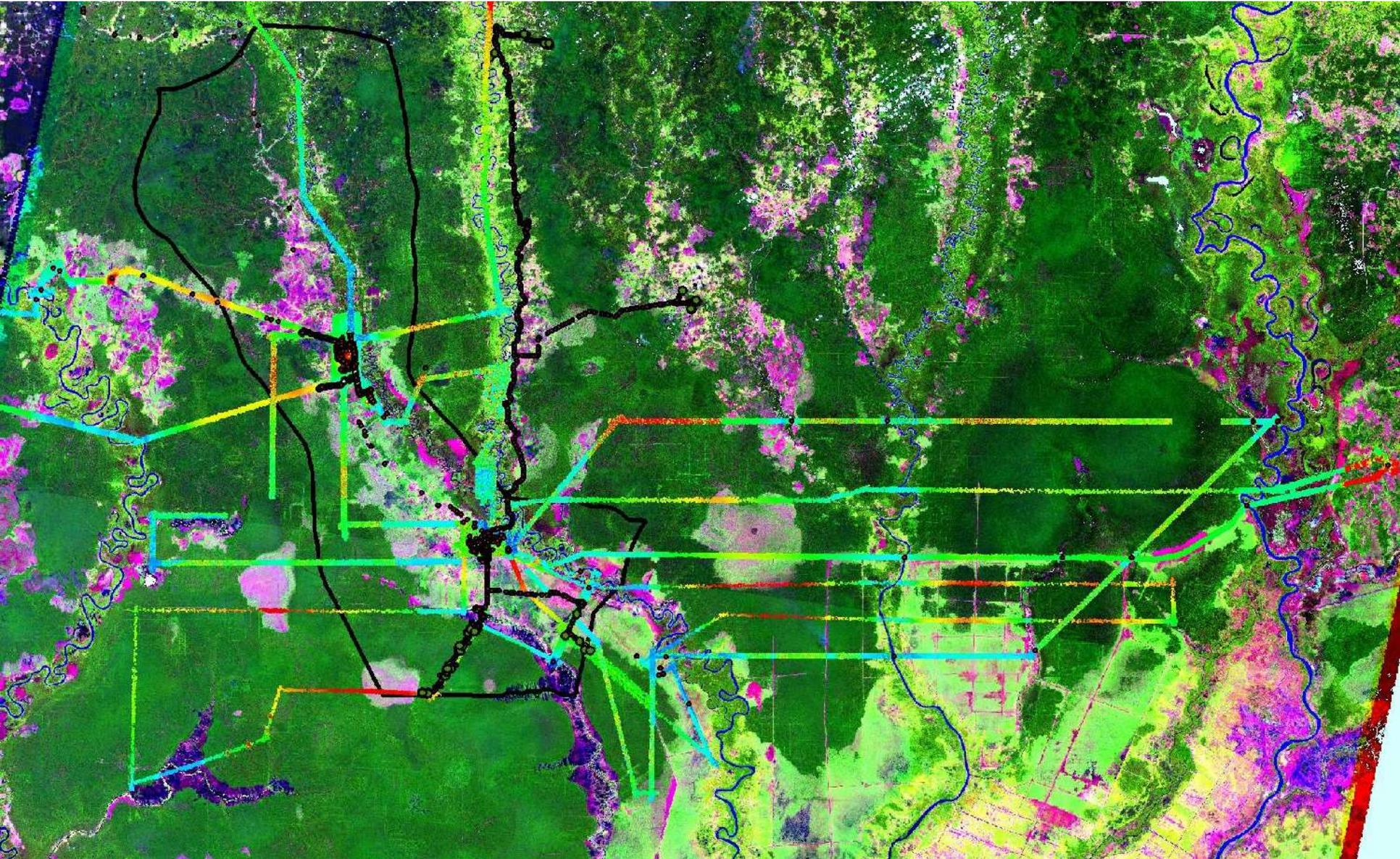


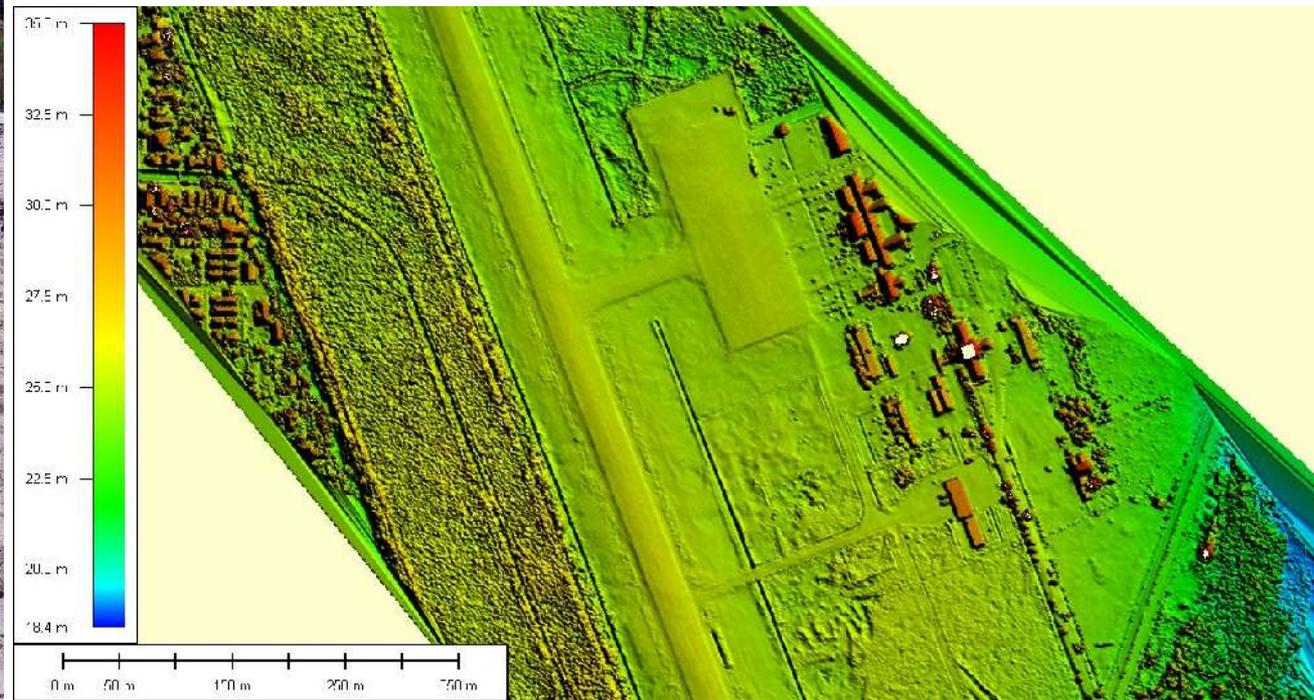
Photo from ALS-team Juergen, Detlef, Suyud, Alam, Viktor, Jan, Mustafa in MSC, Rungan Sari, Central Kalimantan, Indonesia



Calibration, DGPS



Orthometric Height = GPS ellipsoidal Height - Geoid Height



**DGPS, left, and ALS-image, right, of Airport Palangka Raya;
Reference point at PKY is 25.0m in Elevation;
Latitude = 2.225°S, Longitude = 113.9425°E,
after 2h flight same altitude**

Technical equipments of Airborne Laser Scanner

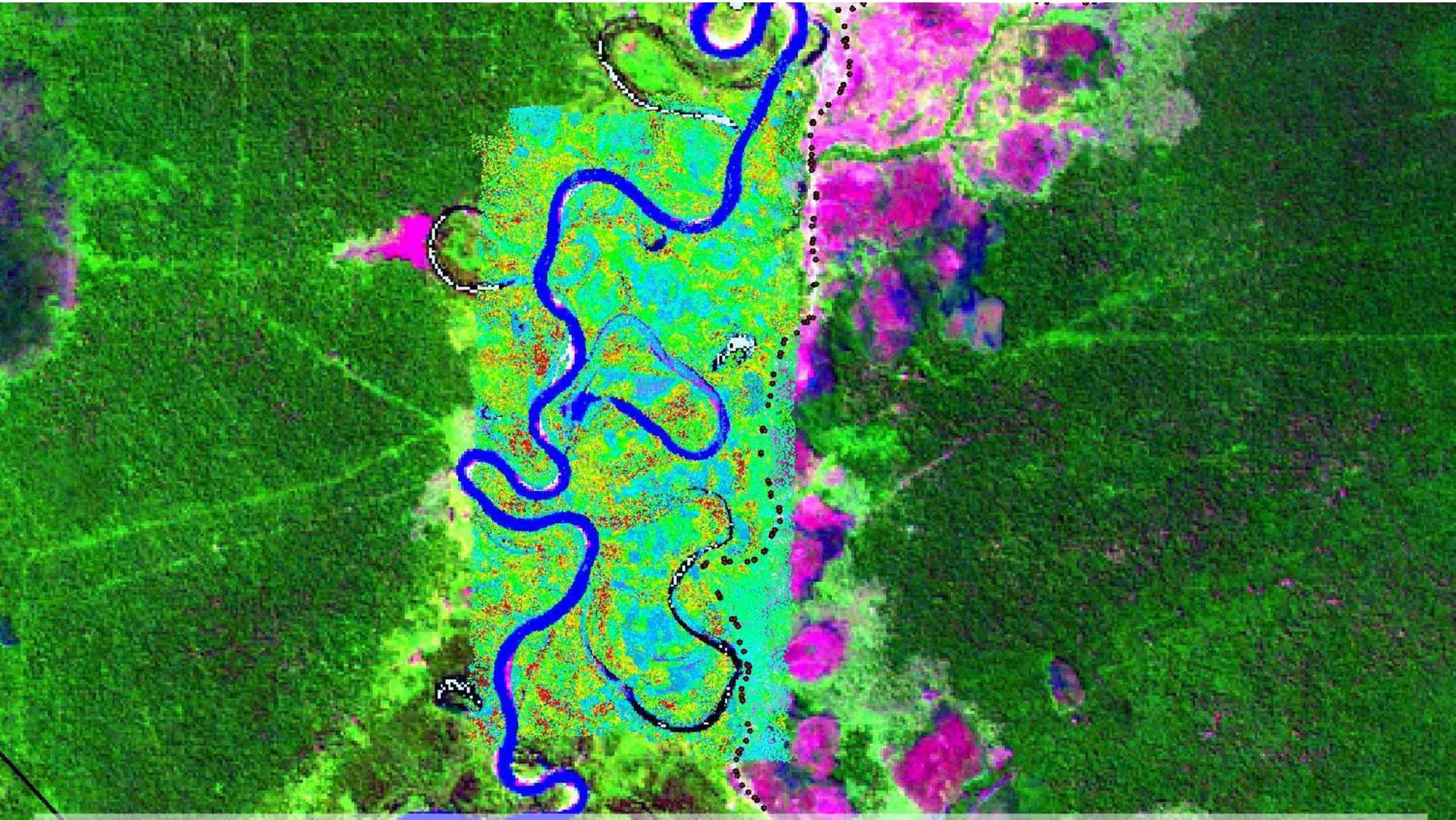
The following equipments were used during the helicopter flight trials in August 2007:

- **Inertial Navigation System (INS)**
- **Flight Management System (FMS)**
- **GPS-Antenna L1/2-band located at the helicopter tail boom**
- **DGPS-ground station**
- **ALS Equipment with Riegl Technology, LMS Q560**
- **Several Recorder**
- **Digital RGB camera from Hasselblad with 22 MB pixel**

- Power supplies and a mechanical support structure under the helicopter
- Displays in the helicopter

Topography measurements with Airborne Laser Scanning Technology

**(Kahayan Lake Batu)
Ortho-Photos (22MB) and
Aerial Photos are available**



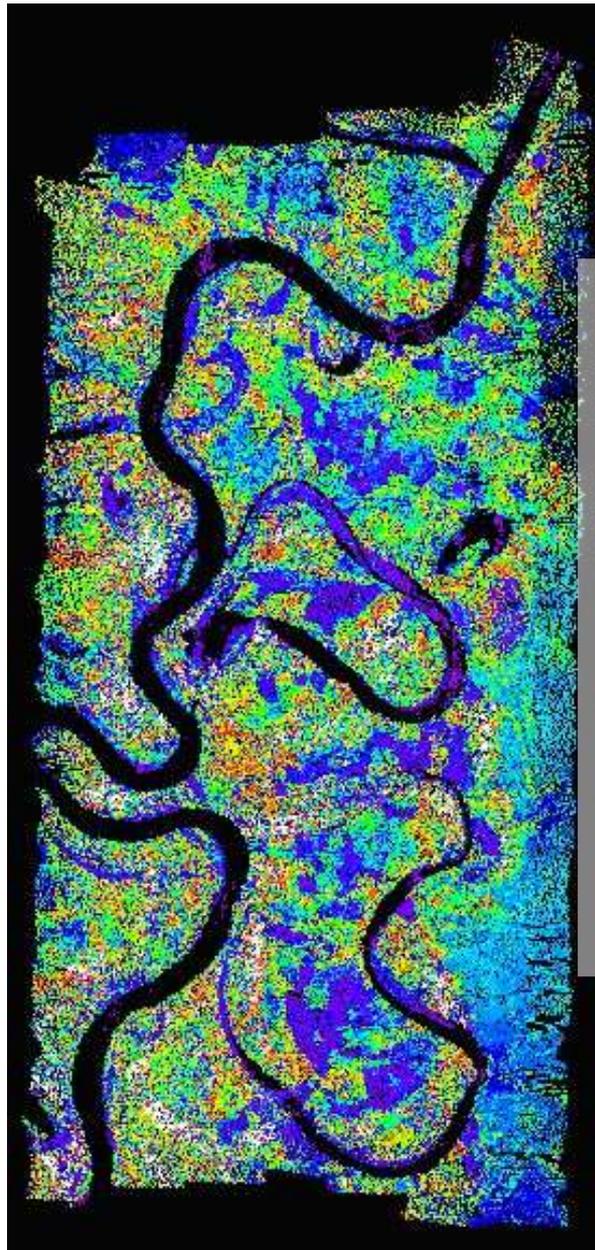
**3.7km x 7.2km DSM (Digital Surface Model)
as LAS-presentation**

Kahayan – Lake Batu, Ortho-Photo-Mosaik



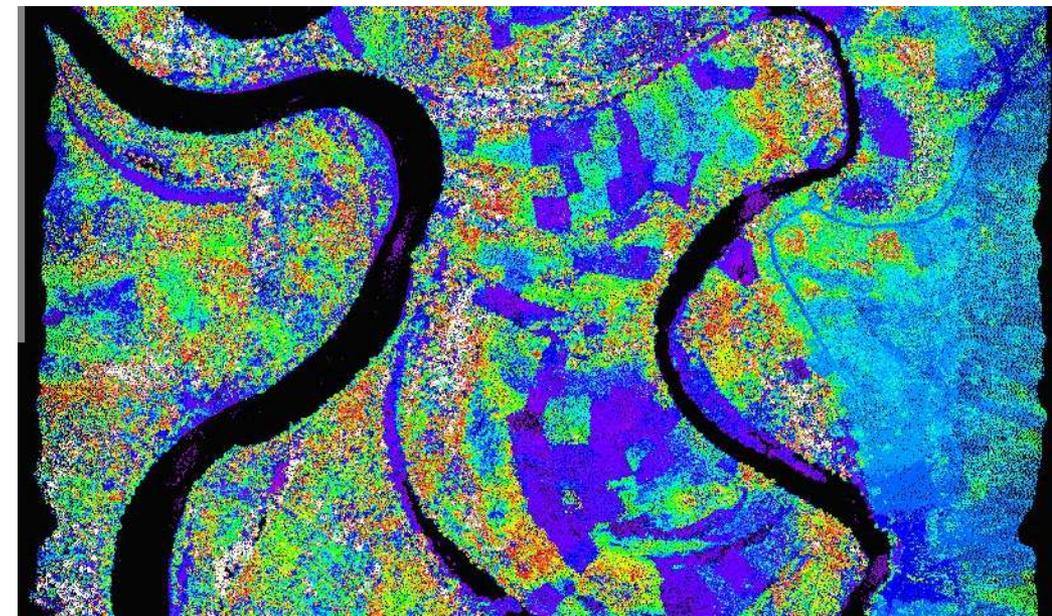
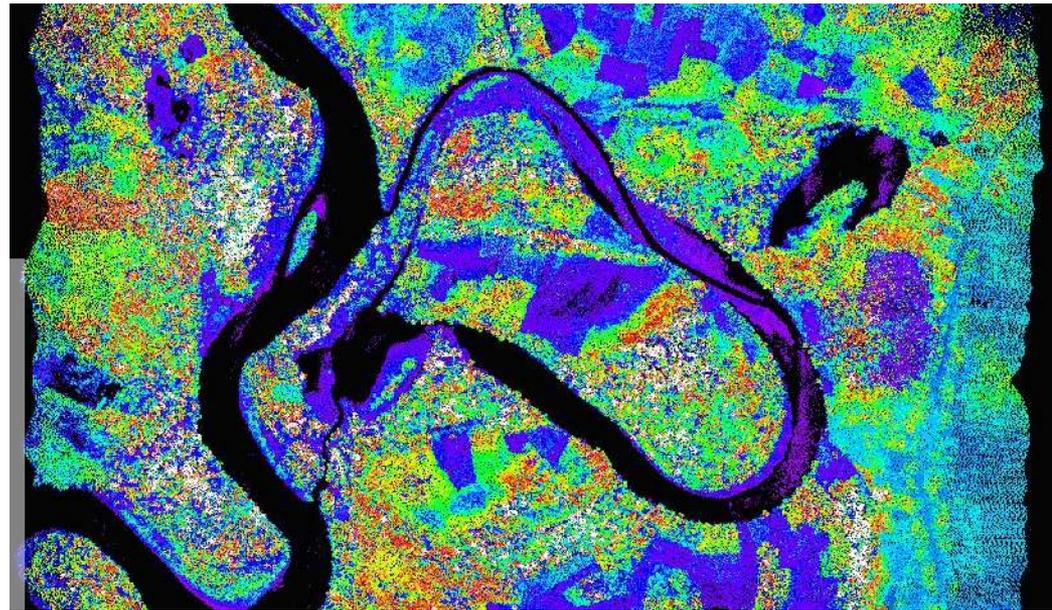
3.7km x 7.2km Ortho-Photo-Mosaik of 300 RGB-Photos

ALS-DSM-LAS Kahayan – Lake Batu

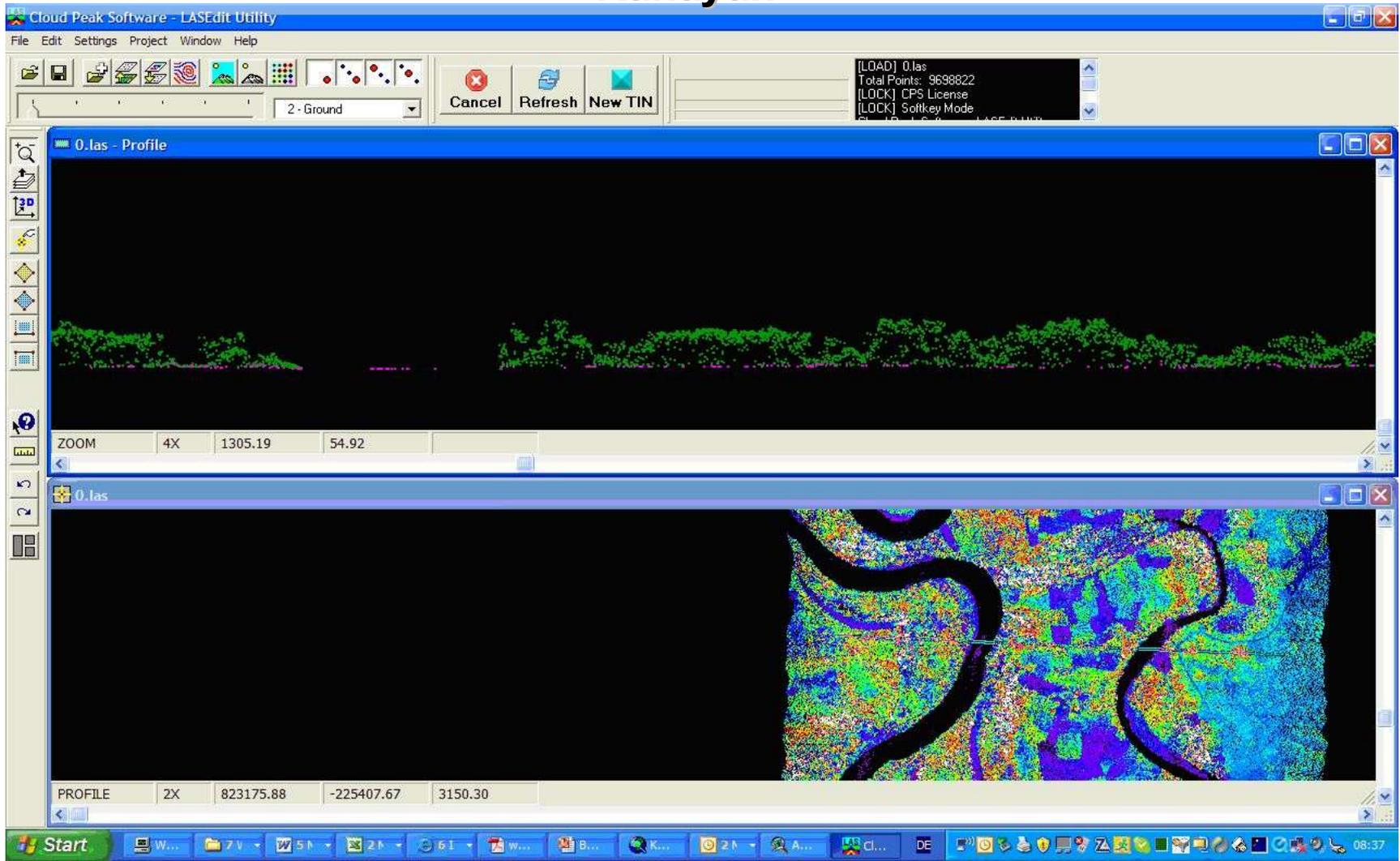


**3.7km x
7.2km**

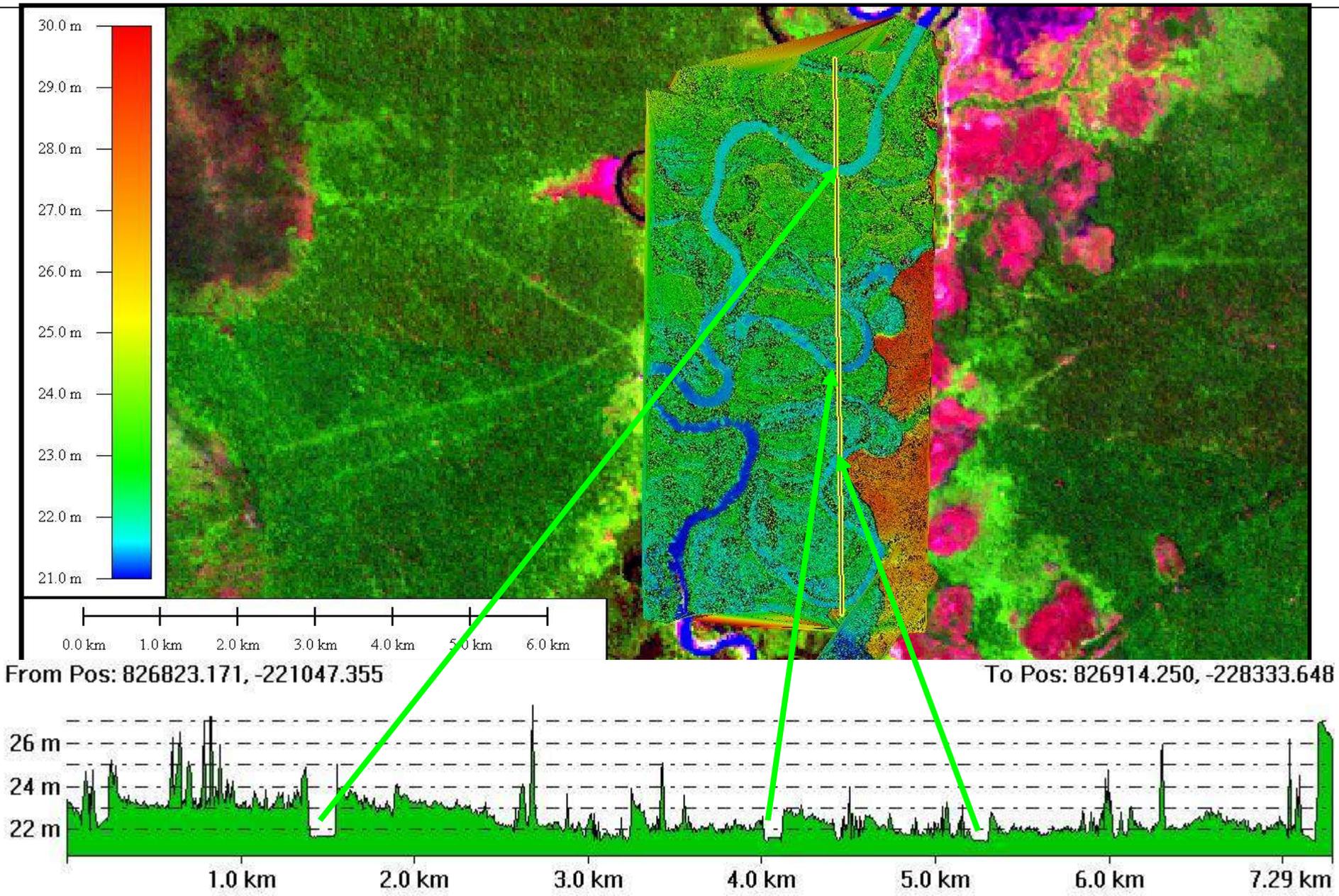
**DSM
(Digital
Surface
Model)
as
LAS-
presentati
on**



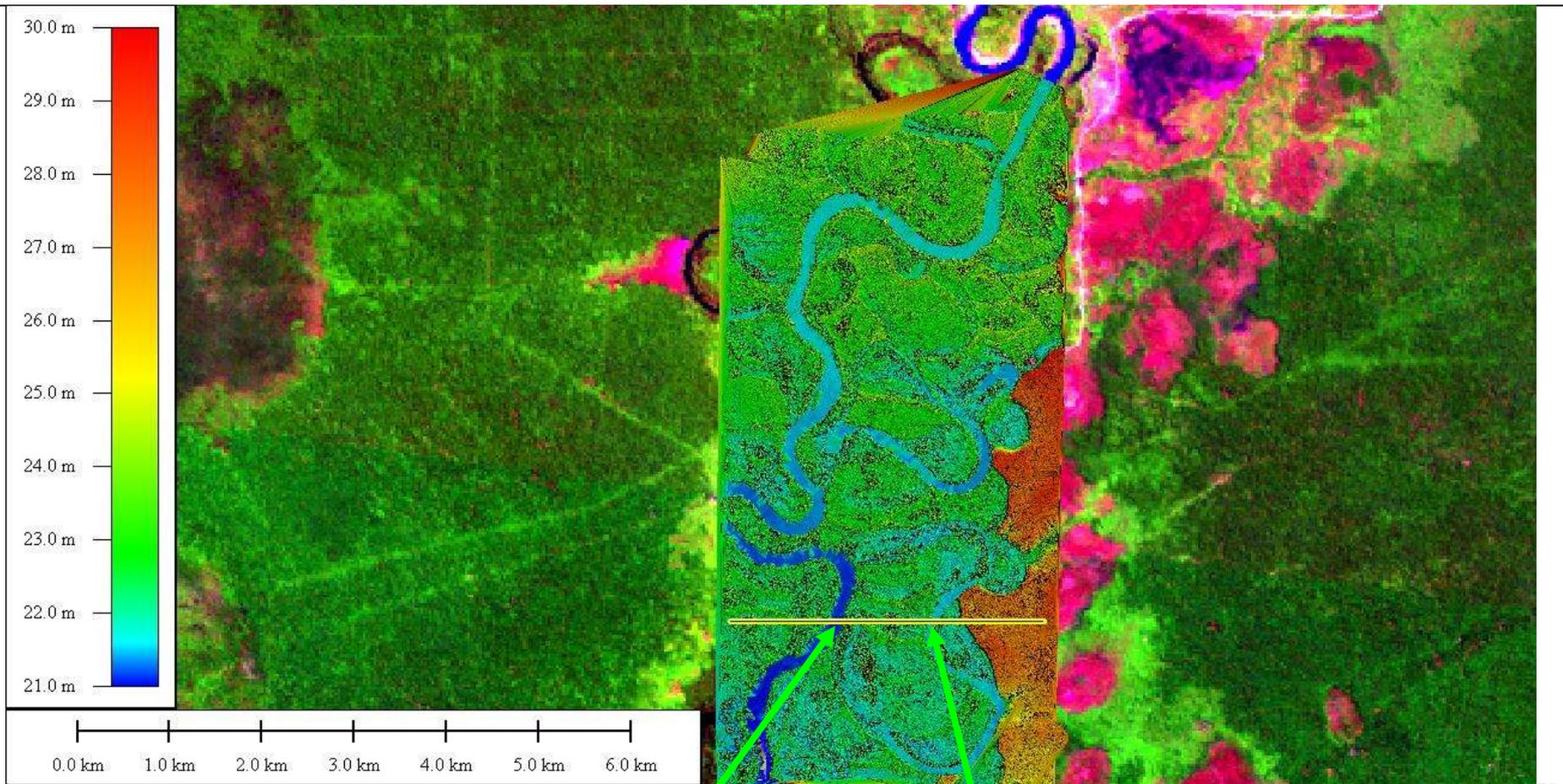
3.7km x 7.2km DSM (Digital Surface Model) as LAS-presentation with cross-section and single tree detection, Kahayan



ALS-DTM Kahayan – Lake Batu, LS2001

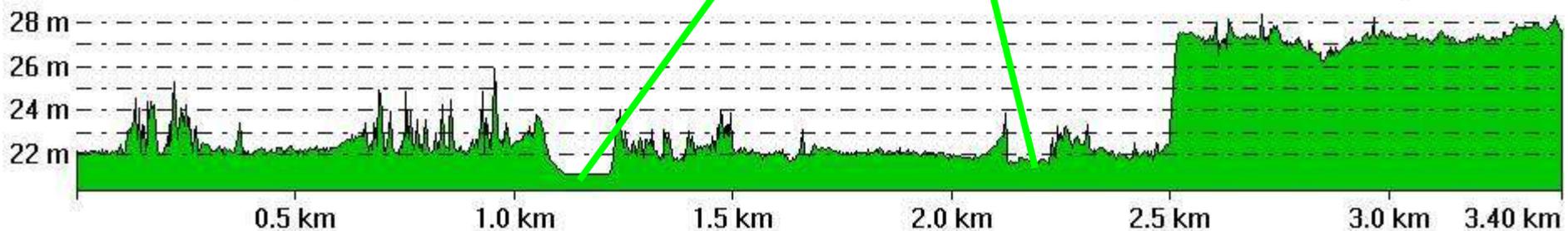


ALS-DTM Kahayan – Lake Batu, LS2001 Digital Terrain Model with cross-section

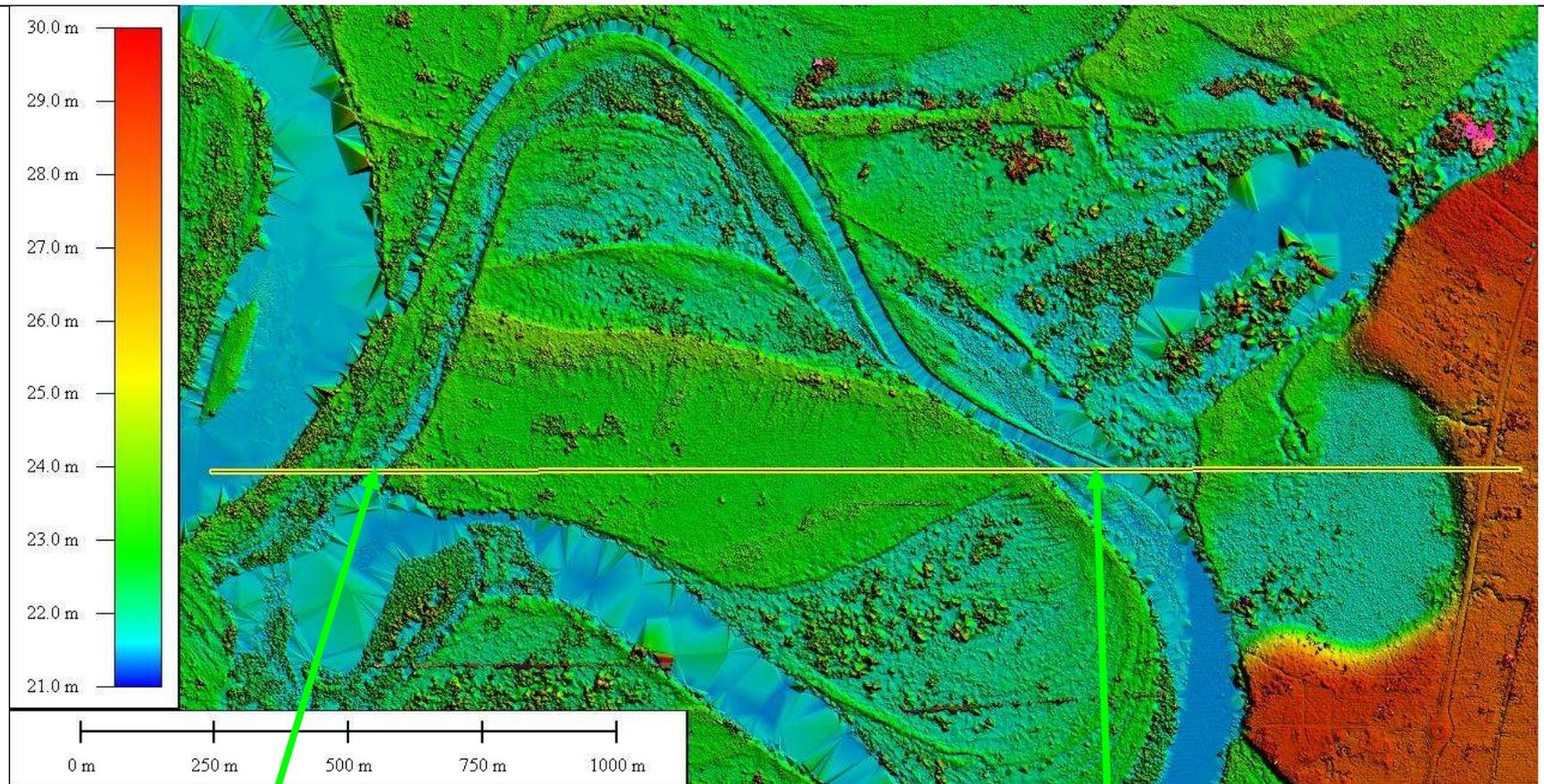


From Pos: 824494.159, -226562.494

To Pos: 827890.093, -226562.494

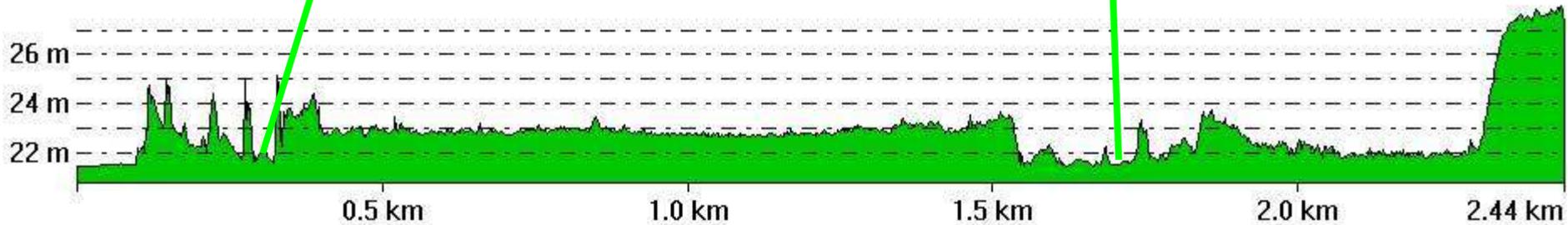


ALS-DTM Kahayan – Lake Batu Digital Terrain Model with cross-section



From Pos: 825392.006, -224344.383

To Pos: 827828.340, -224339.917



Ortho-Photo Kahayan – Oxbow



Ortho-Photo Kahayan – Lake Batu area

Single tree detection of canopy



Aerial-Photo Kahayan – Lake Batu



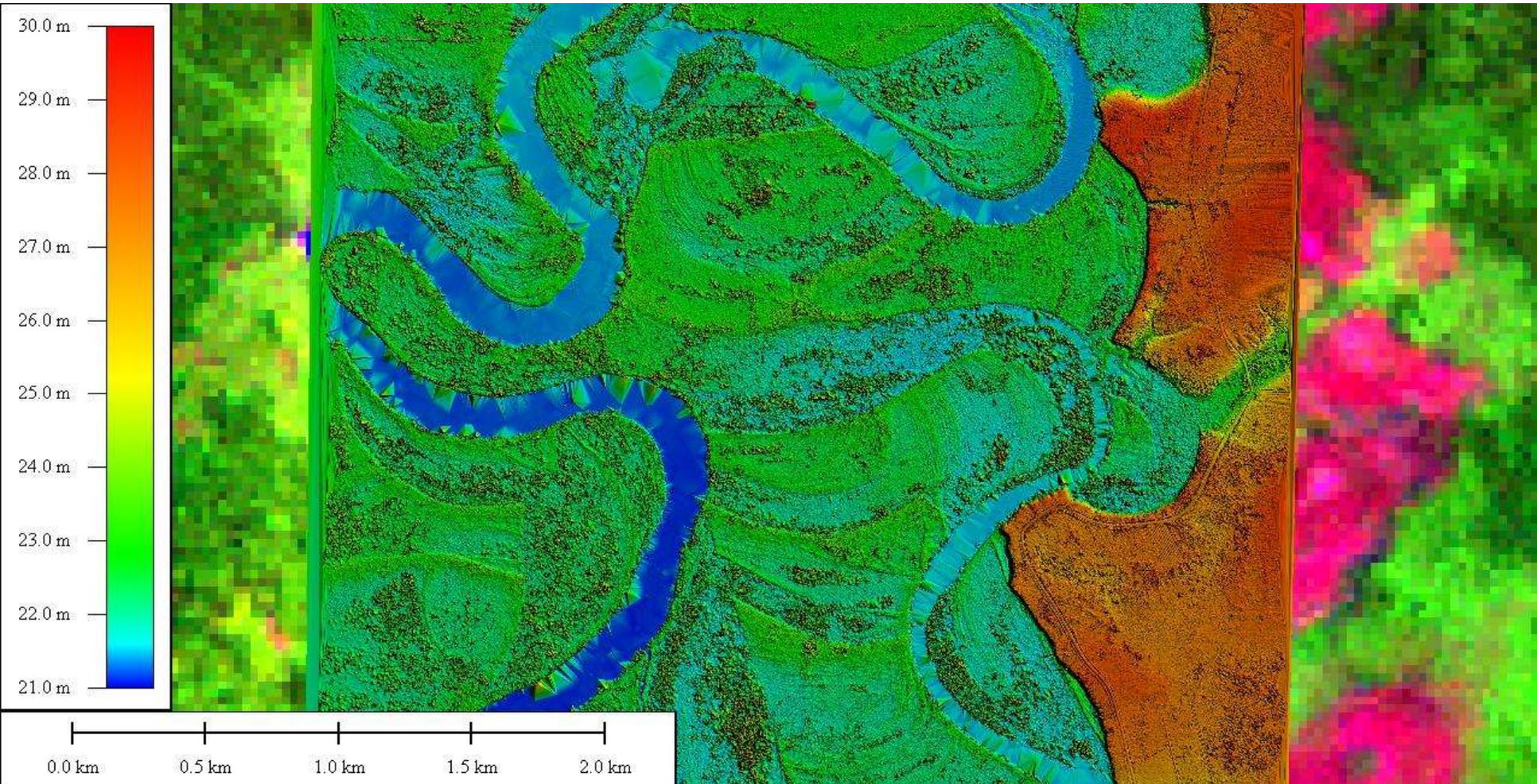
Aerial-Photo Kahayan – Lake Batu



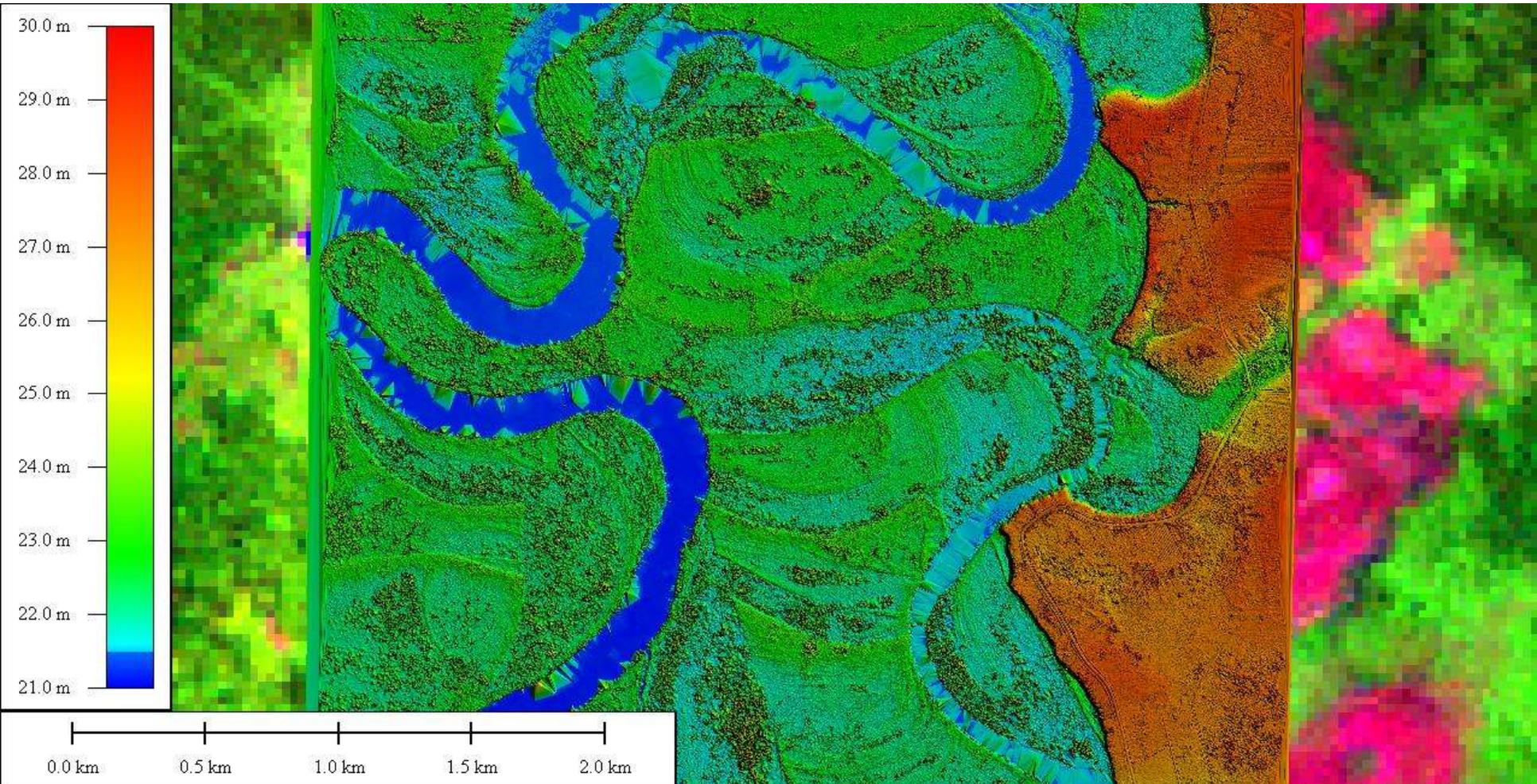
Aerial-Photo Kahayan – Lake Batu area



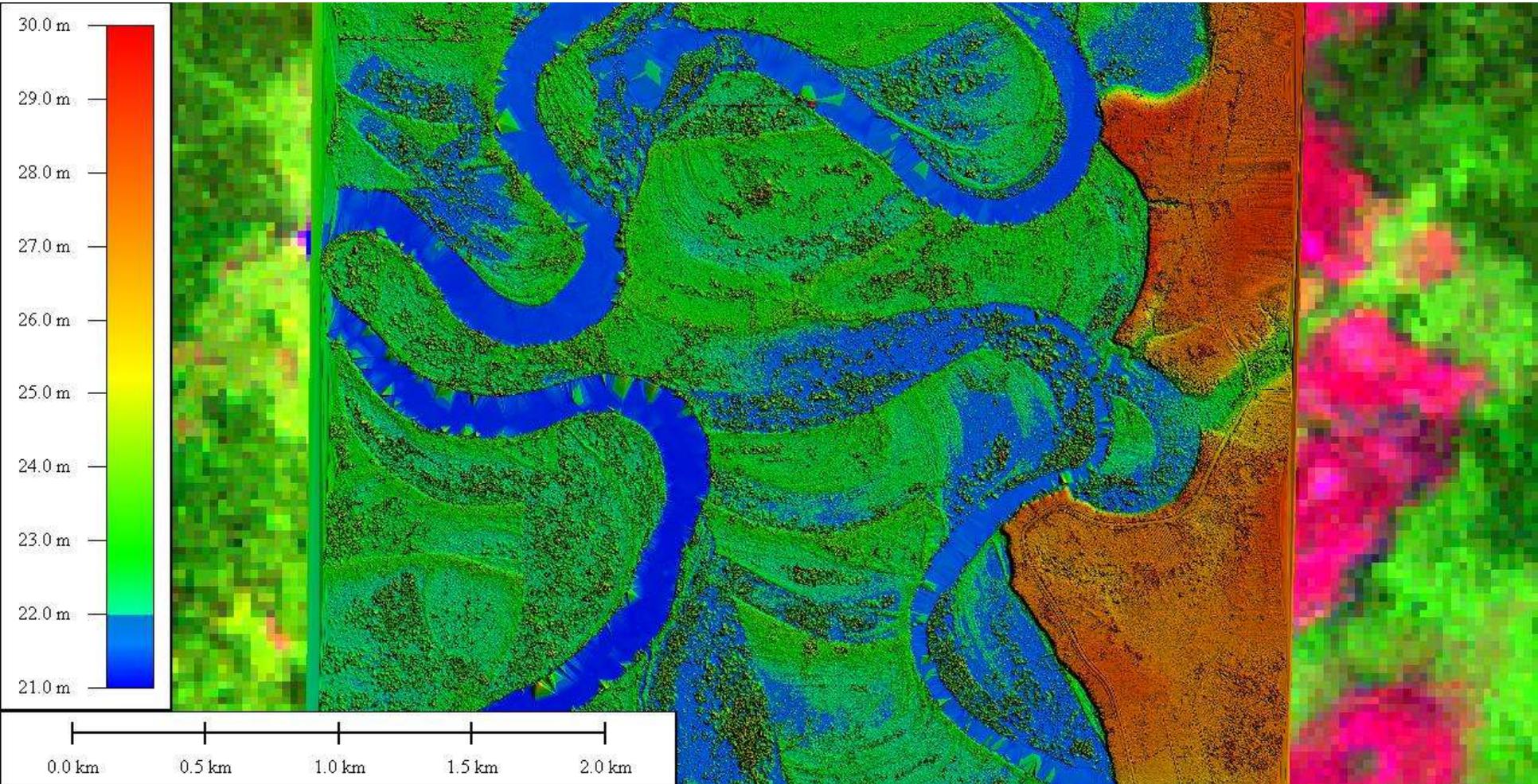
ALS-DTM Kahayan – Lake Batu, water-level 21m Flood-Simulation



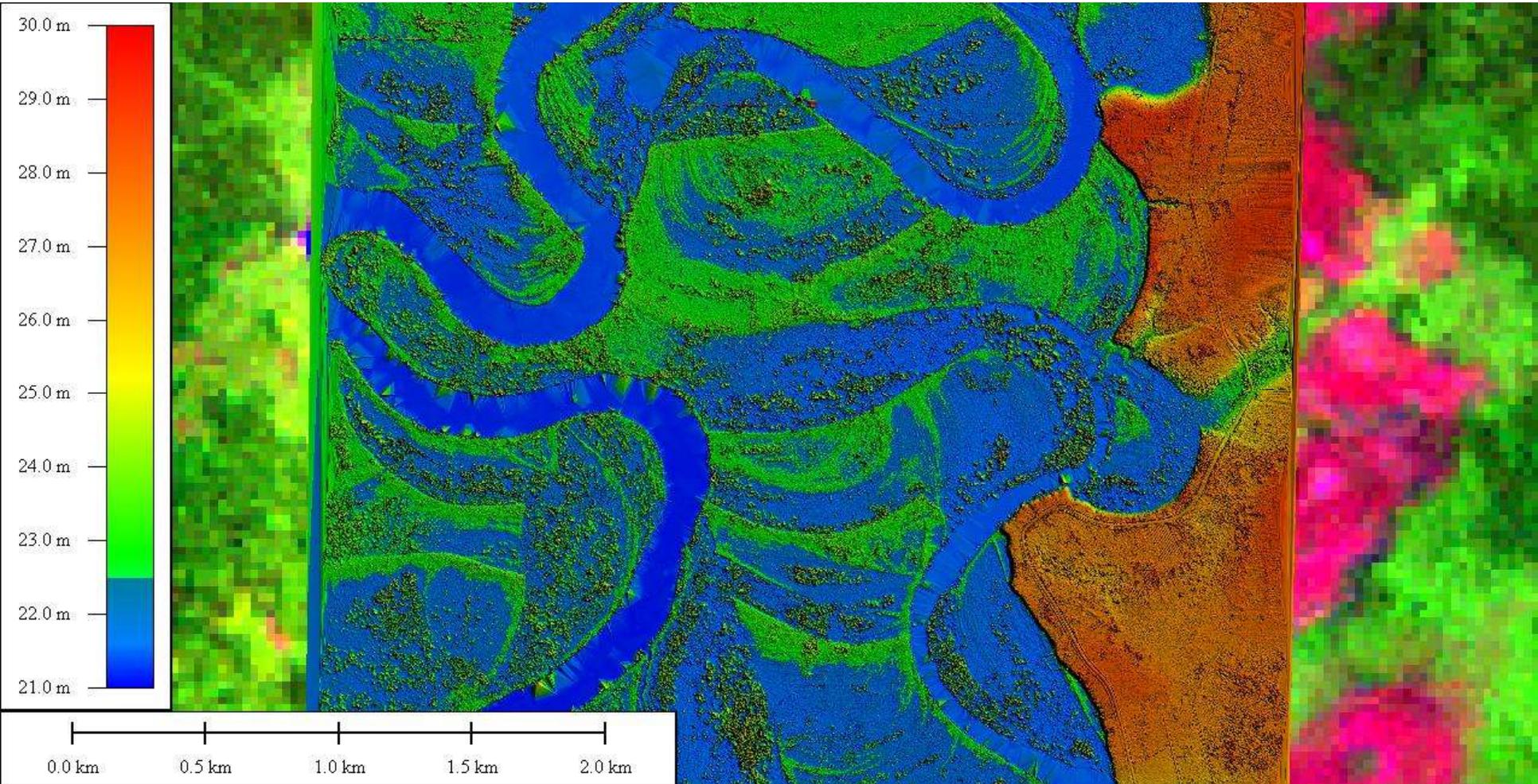
ALS-DTM Kahayan – Lake Batu, water-level 21.5m Flood-Simulation



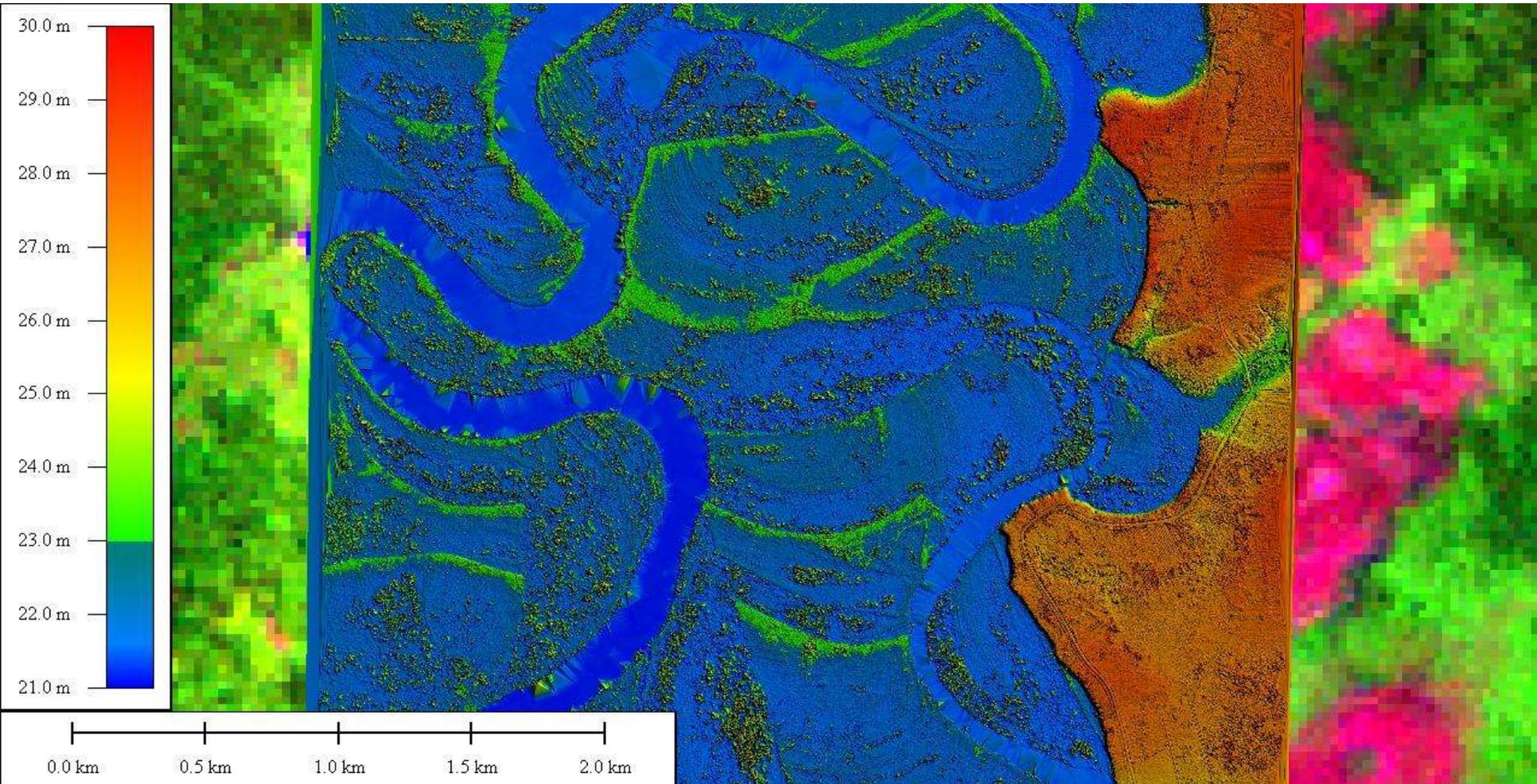
ALS-DTM Kahayan – Lake Batu, water-level 22m Flood-Simulation



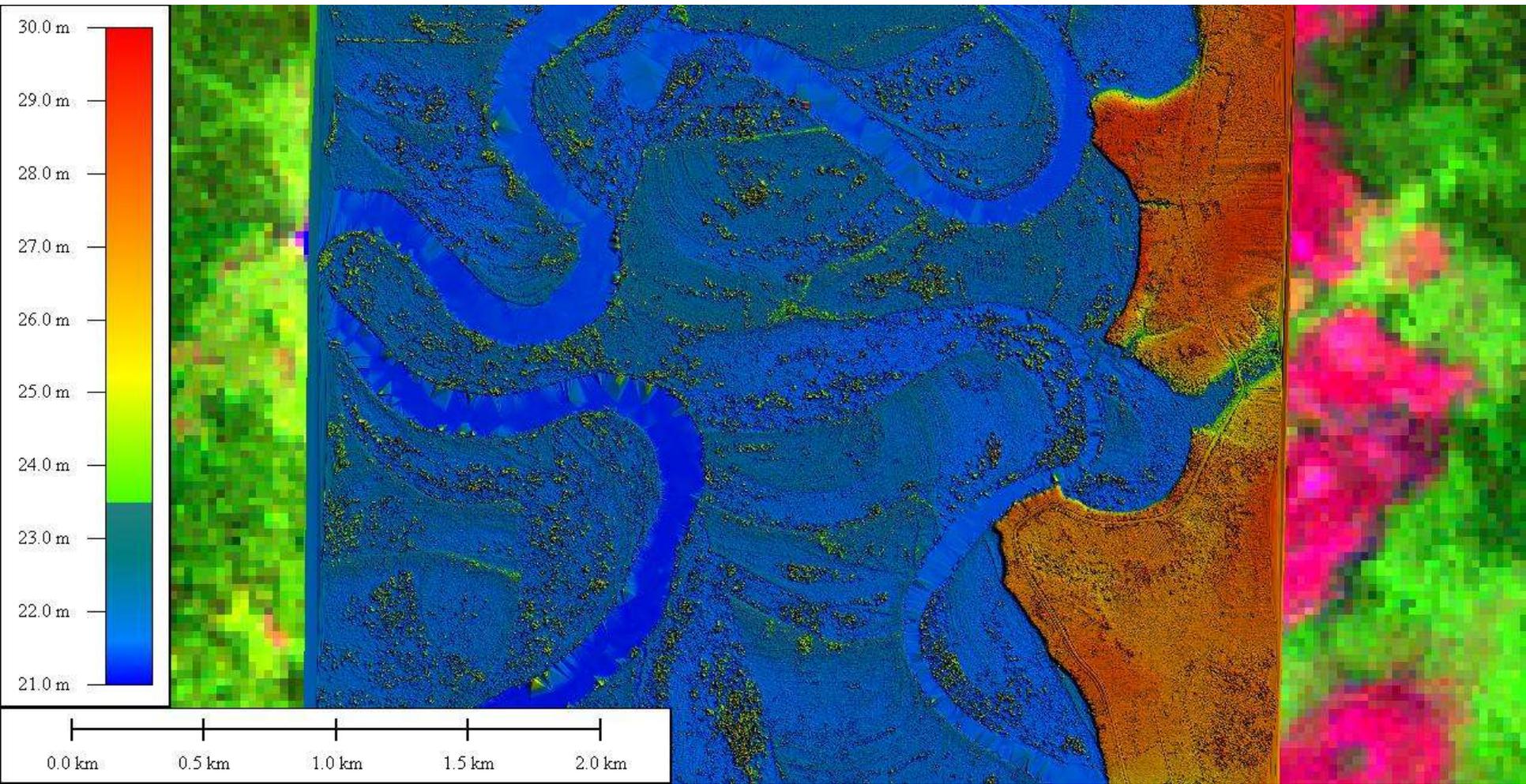
ALS-DTM Kahayan – Lake Batu, water-level 22.5m Flood-Simulation



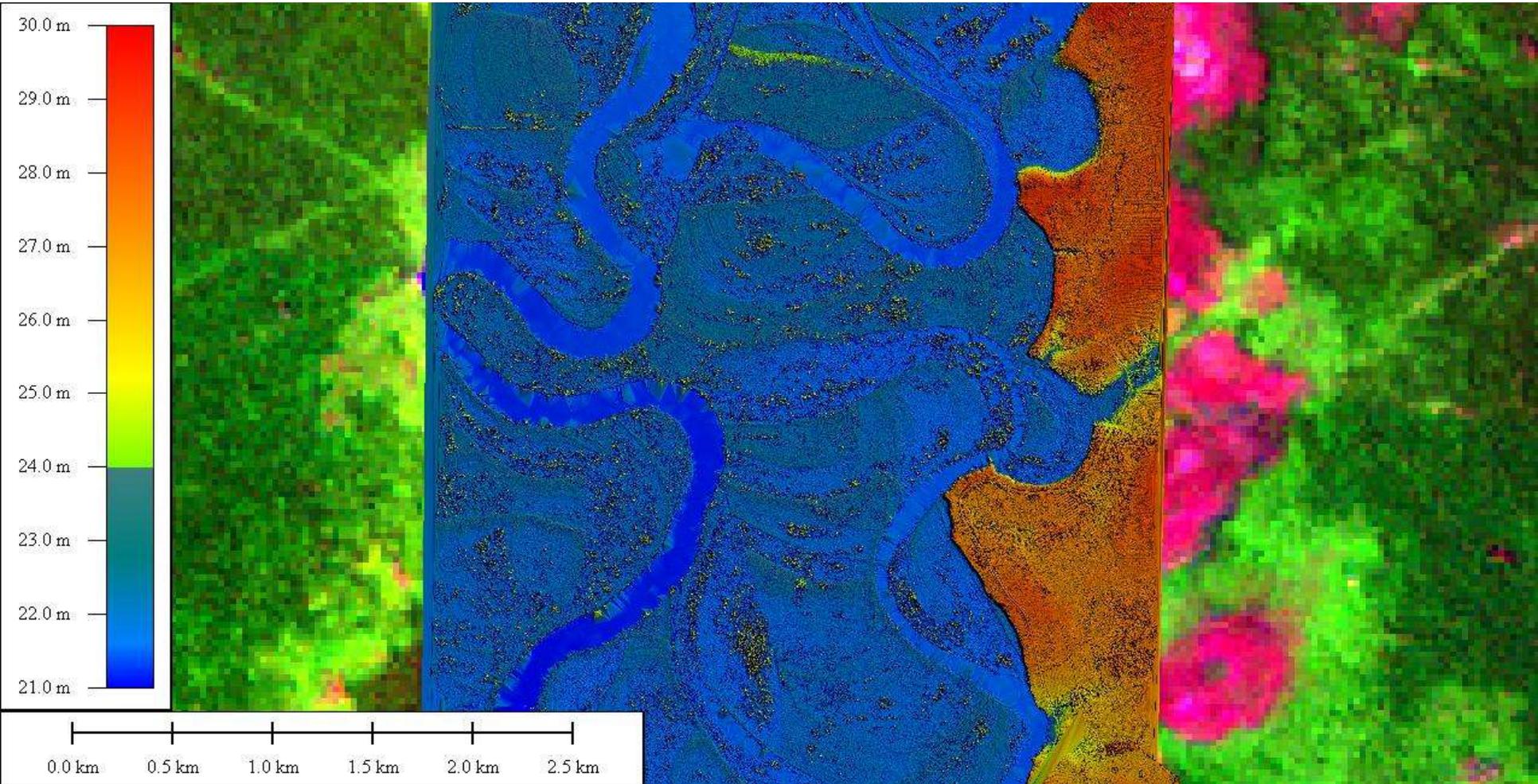
ALS-DTM Kahayan – Lake Batu, water-level 23m Flood-Simulation



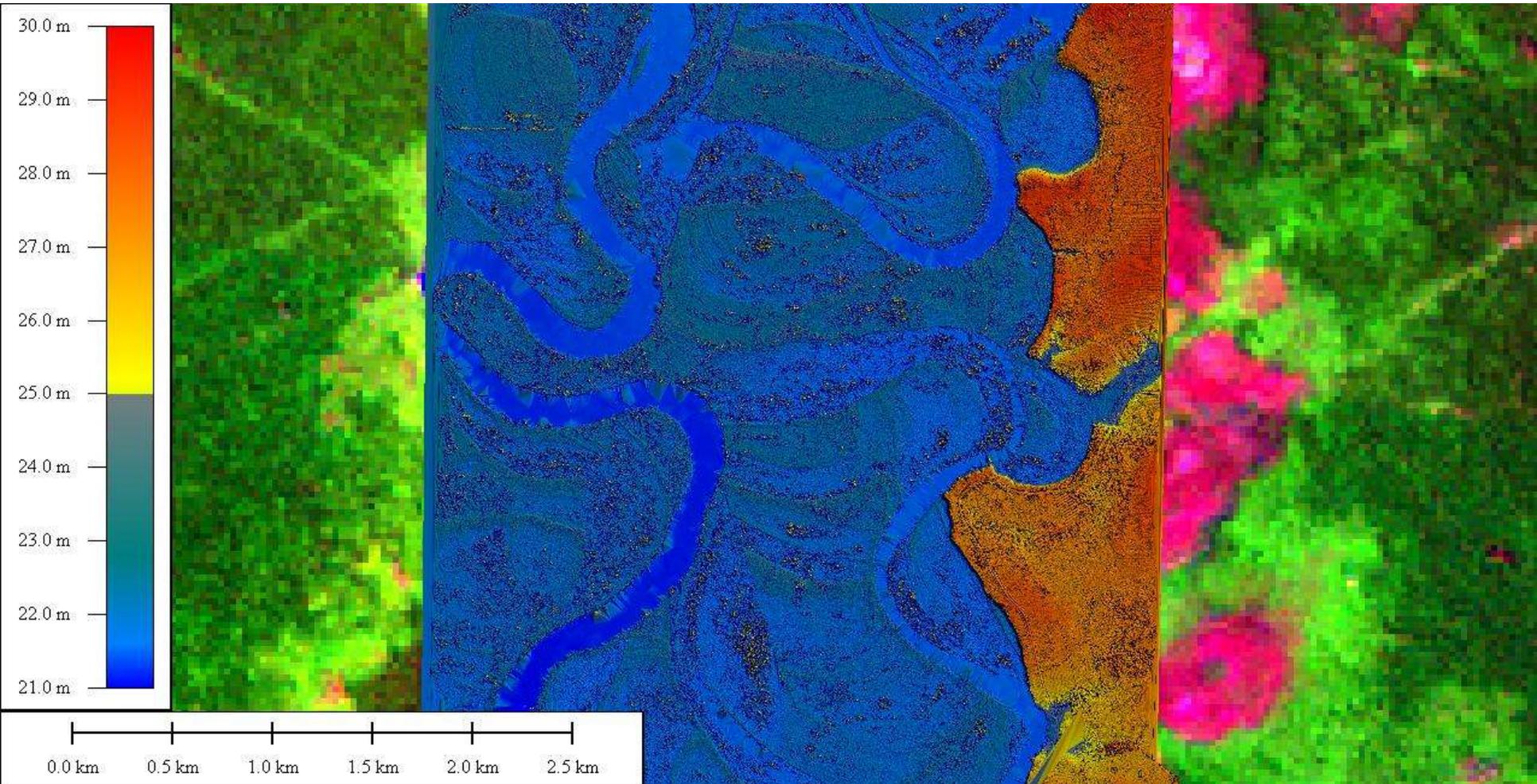
ALS-DTM Kahayan – Lake Batu, water-level 23.5m Flood-Simulation



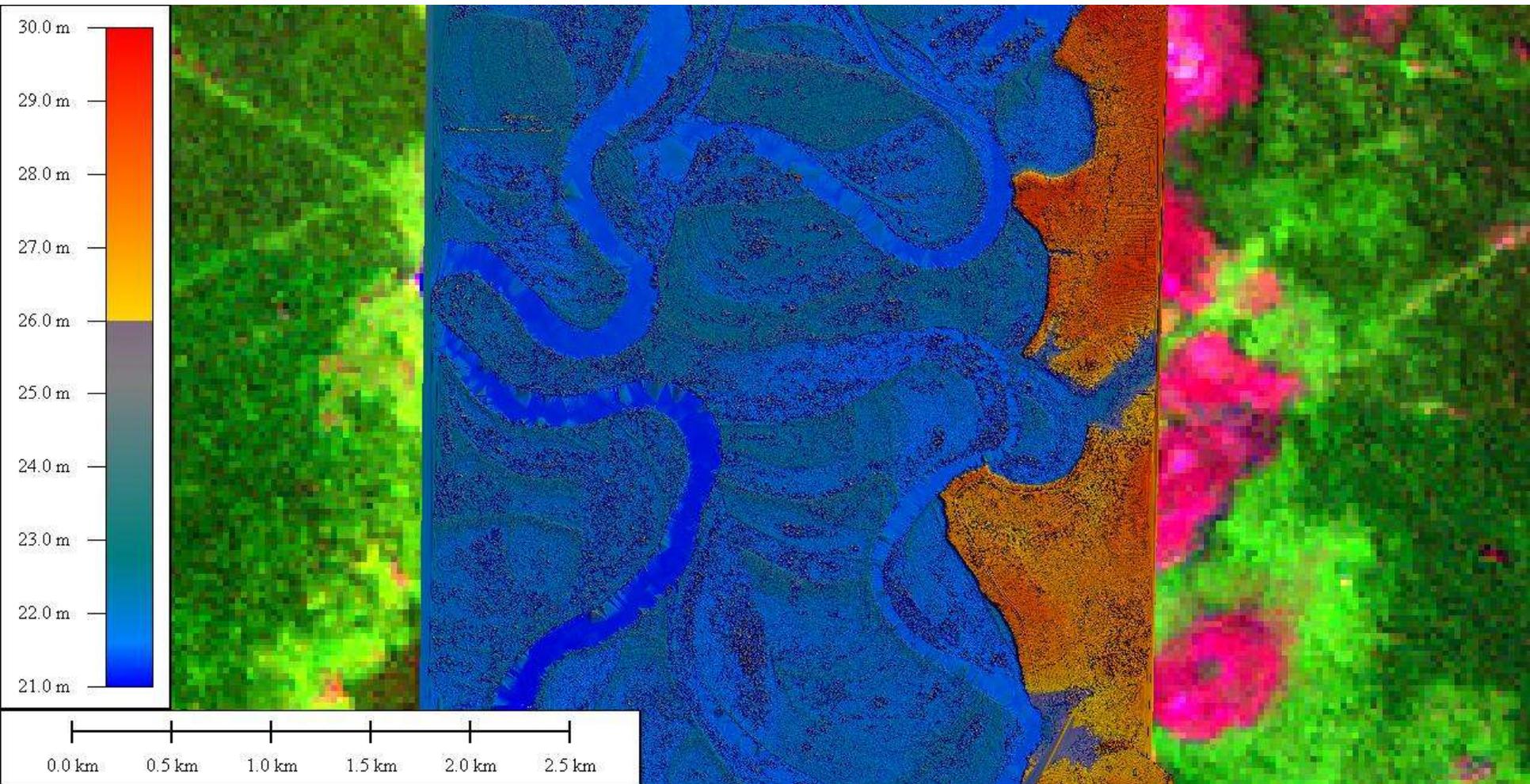
ALS-DTM Kahayan – Lake Batu, water-level 24m Flood-Simulation



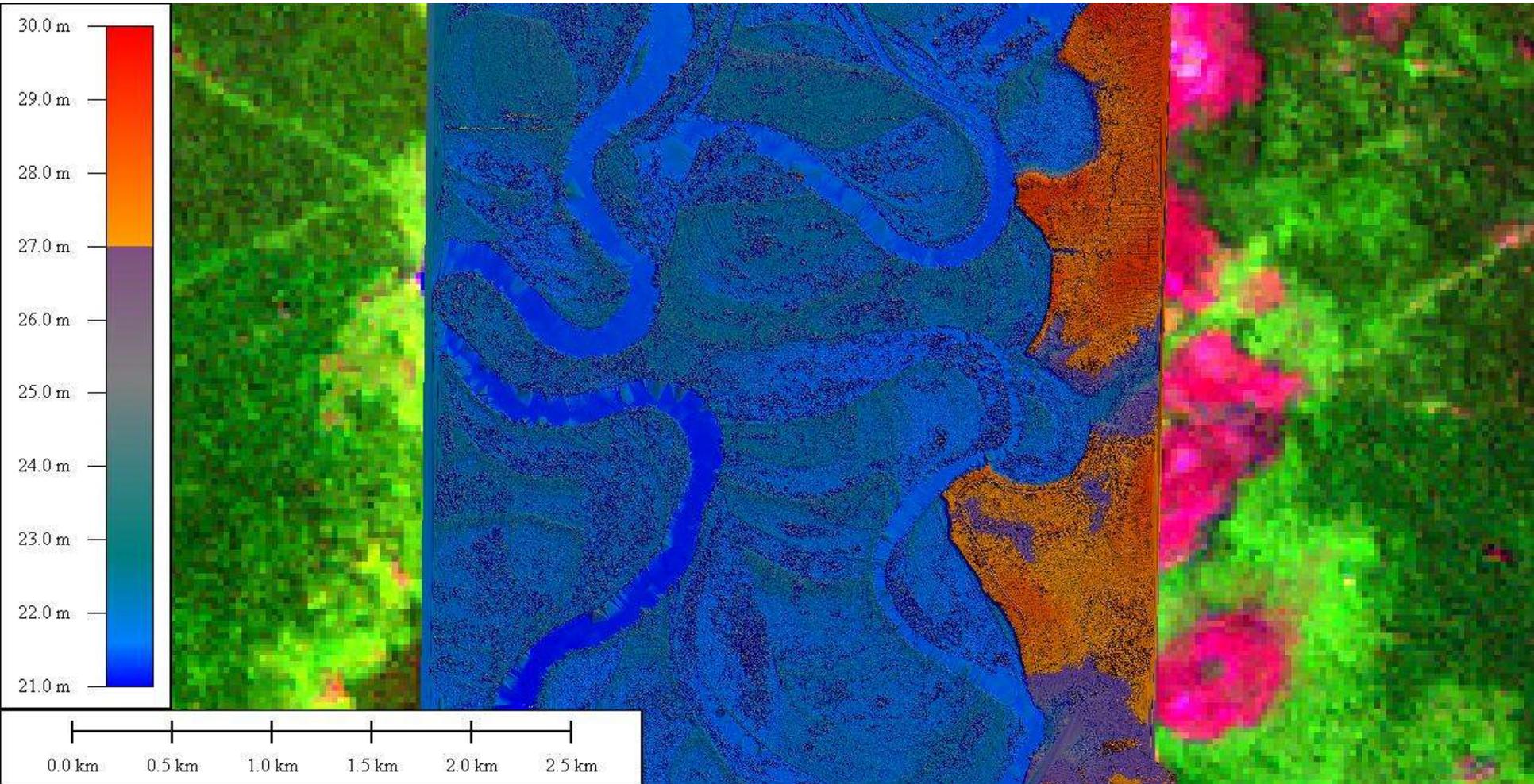
ALS-DTM Kahayan – Lake Batu, water-level 25m Flood-Simulation



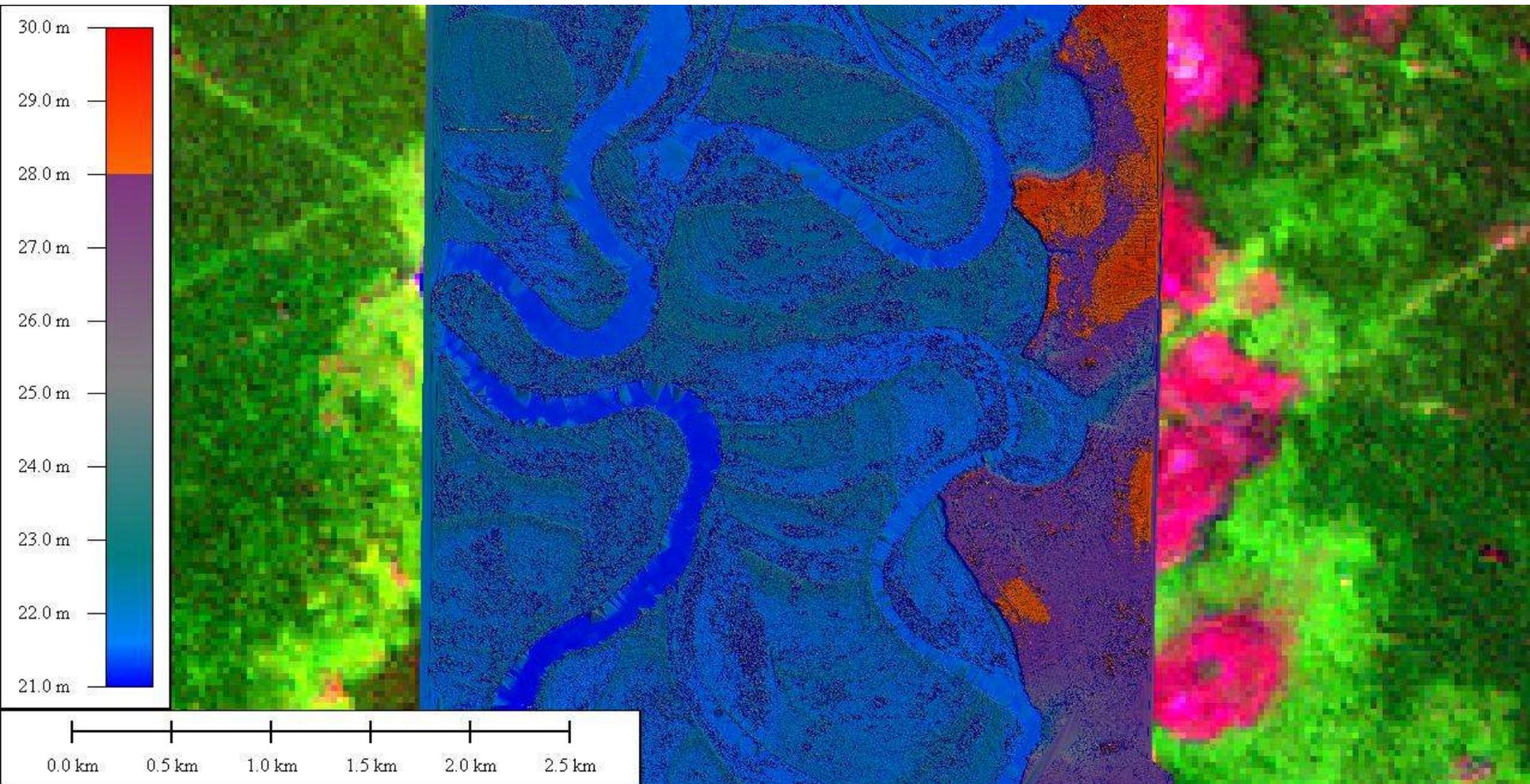
ALS-DTM Kahayan – Lake Batu, water-level 26m Flood-Simulation



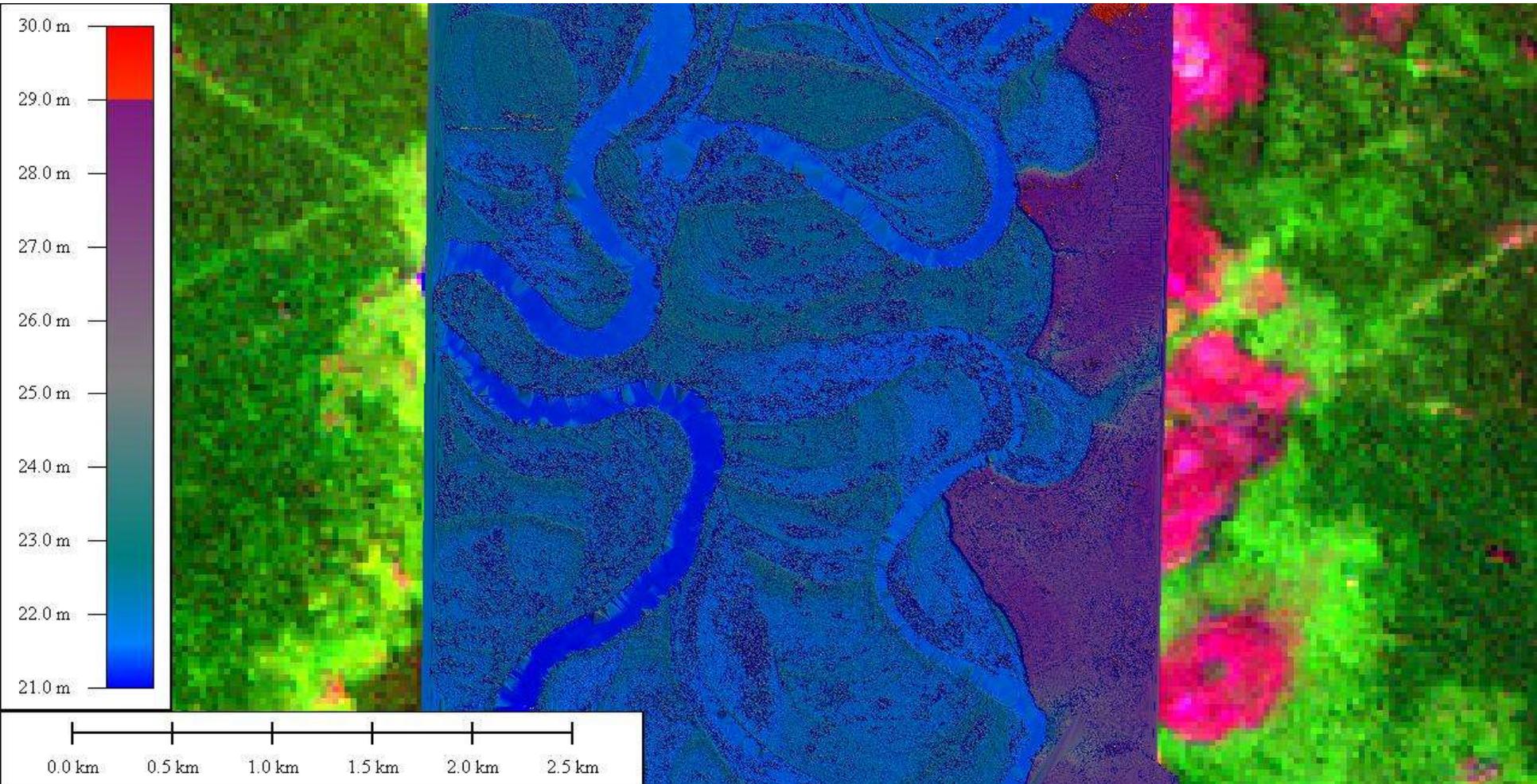
ALS-DTM Kahayan – Lake Batu, water-level 27m Flood-Simulation



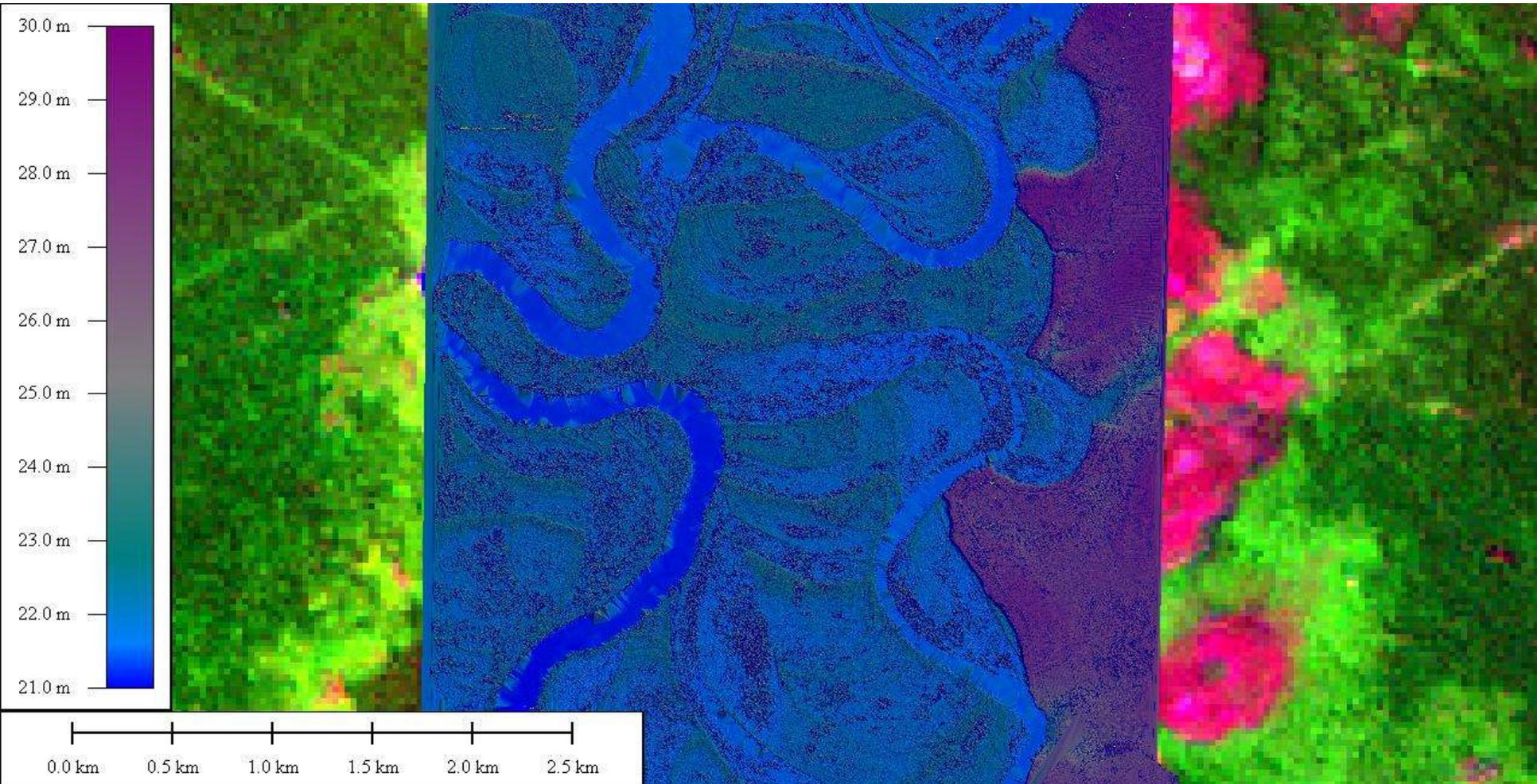
ALS-DTM Kahayan – Lake Batu, water-level 28m Flood-Simulation



ALS-DTM Kahayan – Lake Batu, water-level 29m Flood-Simulation



ALS-DTM Kahayan – Lake Batu, water-level 30m Flood-Simulation



ALS-FINDINGS

- Corrected ALS (geo-coded) raw data are available from several helicopter flights of Sebangau and of Ex-MRP area. The calibration flight track 88 confirmed the 25.0m altitude for PKY airport. Even other flights on other days had the same elevation value of 25.0m for PKY airport.
- Precise ALS-data with +/-0.5m resolution in x and y and +/-0.15m in z (elevation) were recorded for analysis's of PSF-bio mass estimation, topographical and hydrological. With the processed DSMs and DTMs the tree height can be determined very quickly by subtraction. Filtering/Classification was done automatically with manual controls.
- The ALS is penetrating the PSF, which shows the very good results of the DTMs. Manual analysis of the ALS data show a similar result compared to the automatic SW-analysis. The visualisation of three dimensional data is not so easy and needs specific SW and skills of the operator. Tracks from the ALS flights are available of Sebangau and EX-MRP to be analysed.
- The ALS campaign in August 2007 of the Sebangau and Ex-MRP area was a success. The laser beam in the near infra-red could penetrate the PSF with the divergence of 0.5mrad. No interrupts of the ALS with 100,000 pulses per second, INS and other measuring devices occurred during the complete all HC-flights. Big Peat Layers are accumulated in Central Kalimantan between the rivers in the low altitude near to the Java Sea with up to 12m thickness (UNPAR) in the Ex-Mega Rice Project (Ex-MRP) and in Sebangau National Park.
- A lot of carbon is stored in Central Kalimantan; emission of these carbon will contribute to climate change. Degraded Peatlands without trees are sensitive for burning in the dry season; e.g. 1994, 1997, 2002, 2006. The water-level should be kept high in the peat area of Sebangau National Park and Ex-MRP by blocking of many channels with different sizes and the area should be replanted with forests, to avoid fires.

Kalteng Consultants Office



Jalan Tjilik Riwut km 36, No.33, Rungan Sari

Sei Gohong, Palangkaraya,

Central Kalimantan, 73225, Indonesia

M Mustafa Syafrudin

Mobile: +62 (819) 52-057-600

Dr. H.-D. Viktor Boehm

Kirchstockacher Weg 2

D-85635 Höhenkirchen, near Munich, Germany

Tel: +49-(0)8102-774848; Fax: +49-8102-774850

Mobile: +49-(0)170-3161199

Email: viktorboehm@t-online.de

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