

Airborne Observation of Critical Infrastructures

(LOKI: Luftgestützte Observation Kritischer Infrastrukturen)

Creation of damage interpretation rules and decision criteria for the automatic detection of earthquake damage based on image and 3D data

J. Kohns¹, L. Stempniewski¹

¹ Institute of Reinforced Concrete Structures and Building Materials (IMB), Department Reinforced Concrete Structures, Karlsruhe Institute of Technology (KIT)

1. Motivation and Aims

The project „LOKI“ is funded by the **Federal Ministry of Education and Research (BMBF)** under funding code *03G0890E*. Heidelberg University serves as the coordinator of the research project. The other project partners are the Aeromey GmbH, the Research Center for Information Technology in Karlsruhe (FZI), the German Research Centre for Geosciences in Potsdam (GFZ) and the Karlsruhe Institute of Reinforced Concrete Structures and Building Materials, Department Reinforced Concrete Structures (KIT - IMB).

The aim of the LOKI project is to develop an **interdisciplinary system** that enables fast and reliable airborne situation assessments following an earthquake. The system will serve to reduce longer-term damage after an earthquake by recording information on the current situation as efficiently as possible, thereby enabling remediation actions to be undertaken within appropriate timescales. A central focus is the **timely overview and detailed recording of the damage to critical infrastructures**, such as lifelines (bridges and roads), health care facilities and public institutions (e.g. schools). LOKI will improve the response time and reliability of information provided in the event of an earthquake, and enables better use of existing resources and emergency forces. The objectives will be met by **combining existing expertise in earthquake research with a variety of new technologies and concepts**, including machine learning, crowdsourcing, Unmanned Aerial Vehicles (UAVs, flying drones available for civil use) and 3D monitoring.



Figure 1: Schematic representation of the overall LOKI system [1]

2. Proceeding

The **research focus** of the Institute of Reinforced Concrete Structures and Building Materials (IMB) includes **damage analysis** with regard to damage patterns, damage interpretation rules and decision criteria as the basis for automatic **damage detection and damage assessment** from images and 3D data as well as crowdsourcing. For this purpose, **damage catalogs** with abstracted damage patterns have to be developed and **degrees of damage** determined using numerical non-linear simulations.

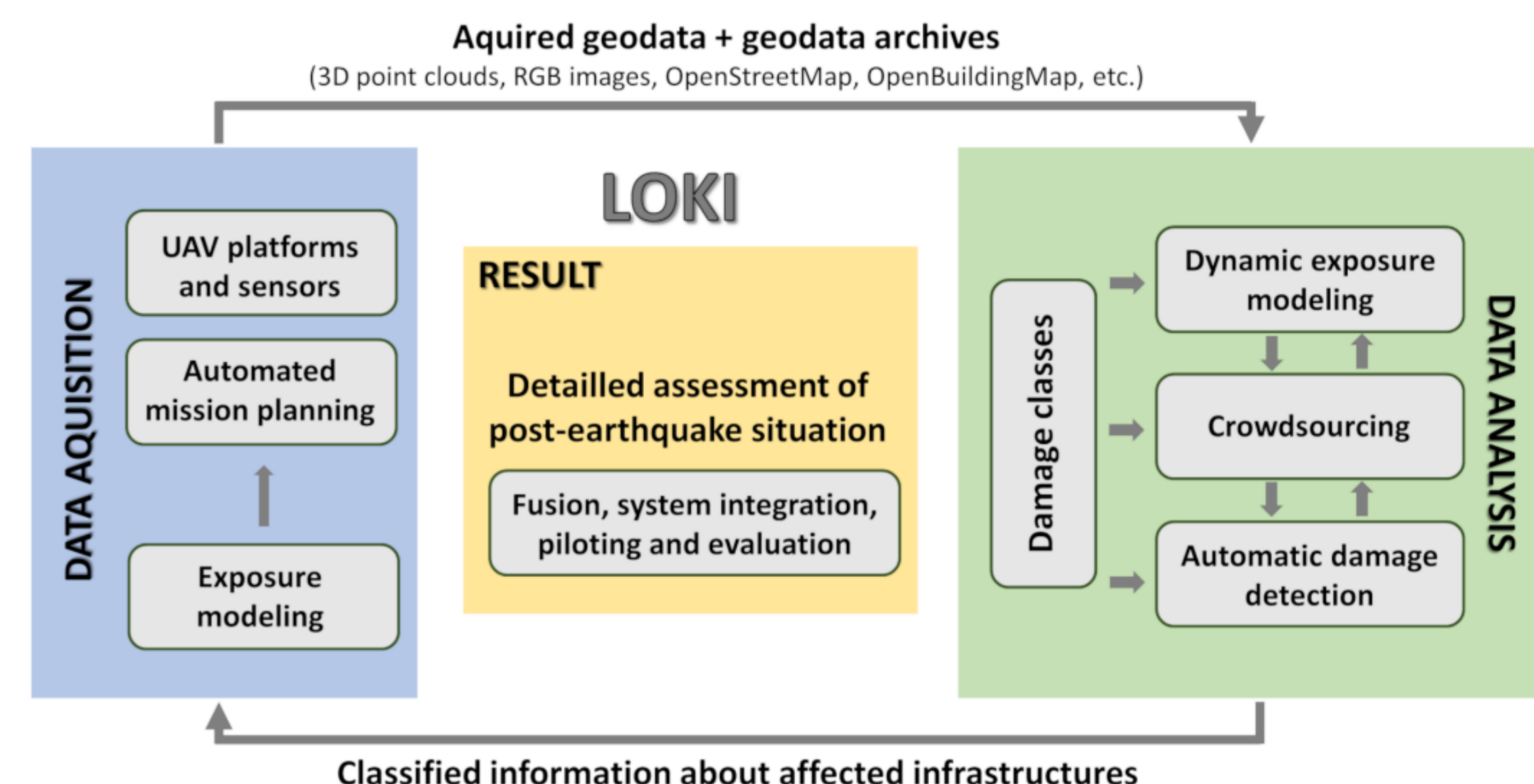


Figure 2: Core components of the LOKI research project and their interaction [2]

The damage images and data are recorded beforehand with UAV flying and automated mission planning in the affected area.

The information at the level of the individual infrastructures that is required to assess the damage and stability is provided via an exposure model.

The damage assessment serves as the basis for the rescue measures to be initiated.

Further information and current developments can be found on the website of the Institute of Geography of Heidelberg University as the project coordinator:

https://www.geog.uni-heidelberg.de/gis/LOKI_en.html

[1] Heidelberg University: LOKI – Project description, version from 06.03.2019

[2] Heidelberg University: https://www.geog.uni-heidelberg.de/gis/LOKI_en.html

Julia Kohns M.Sc.

Gotthard-Franz-Straße 3, 76131 Karlsruhe
phone: +49 721 608-42265
email: julia.kohns@kit.edu

