Geophysical Research Abstracts
Vol. 17, EGU2015-7555-1, 2015
EGU General Assembly 2015

Morphometric Characterization and Classification of Alluvial Fans in Eastern Oman

Annette Leuschner (1), Frank Mattern (2), and Stephan van Gasselt (1)

(1) Freie Universität Berlin, Institute of Geological Sciences, Department of Earth Sciences, Berlin, Germany (leusca88@zedat.fu-berlin.de), (2) Department of Earth Sciences, Sultan Qaboos University, Muscat, Oman

Morphologic characteristics of alluvial fans are a product of fluvial erosion, transportation and deposition. Consequently, fans have been described and defined on the basis of their shape, their composition, conditions and processes under which they from, their so-called "controlling factors", and their geomorphic and tectonic settings. The aim of our study is to reconstruct the morphologic evolution and to relate it to past and present climate conditions. In order to achieve this, we first characterize alluvial fans based on their climatic settings and conditions and classify them accordingly using satellite image data and digital elevation models. For mapping of different alluvial fan bodies multispectral images of the Landsat Enhanced Thematic Mapper (ETM+) with a scale of 15-30 m/px were utilized. For the detection of morphometric parameters as input data for subsequent hydrological studies digital terrain model data of the Shuttle Radar Topography Mission (SRTM) and the ASTER GDEM with a scale of 90 m/px and 30m, respectively, were used. Using these datasets morphological characteristics, such as sizes of drainage basins, transport areas and areas of deposition derived from spatial semi-automatic analysis, have been computed.

The area of Muscat at the Oman Mountains has been selected as a study area because of its size, accessibility and climate conditions and it is considered well-suited for studying the development of alluvial fans and their controlling factors. The Oman Mountains are well-known for the world's largest intact and best exposed obducted ophiolite complex, the Semail Ophiolite. They are today subjected to a mild desert climate (Bwh), in[U+FB02]uenced by the Indian Ocean but they have experienced extensive pluvial periods in the geologic past. Formation of alluvial fans was, therefore, likely triggered by the interplay of increased sediment production caused by high rainfalls with enhanced erosion of hillslopes and transport rates during pluvial periods.

Typical morphometric parameters controlled by hydrological conditions are sizes of catchment areas, the morphometry of associated rivers and slope angles as well as sizes of alluvial fans. In order to distinguish the catchment areas, semi-automatized spatial analyses based on DEM data were carried out within a commercial GIS environment. Our analyses generally verify that there is a positive correlation between, e.g., fan areas and sizes of catchment areas as well as between fan areas and lengths of valley lines of associated rivers. Furthermore, our analyses show a negative correlation between average fan slopes and sizes of catchment areas. The observations are in good agreement with previous analyses from other areas we conducted. The applied methodology has shown to be adequate to be compared to and combined with future field investigations. Flow events are dominant in fan evolution, but the way in which alluvial fan systems responded to fluvial environmental conditions differs between systems under different climate conditions. We compared our results with data from other places located in different climate zones around the world. This allows us to constrain boundary conditions and their potential influence on shapes in a more efficient way.