# Generation and analysis of meter-scale digital elevation models in the Central Andes

Digital Elevation Models (DEMs) are 3D representations of the Earth's surface. They are the basis for many topographic, geomorphological, and hydrological analyses, but are also used in disciplines other than the earth sciences, e.g. in ecology and archaeology. Medium resolution (30 m) elevation data are freely available for the entire globe. However, for many tasks, a 30 m resolution is insufficient, especially in mountainous environments where surface elevation change rapidly and an accurate slope measurement is important. With the advent of high-resolution optical satellite imagery, stereophotogrammetry can be used to generate meter-scale DEMs that depict the Earth's surface in much greater detail. Stereophotogrammetry is a technique in which the 3D structure of an object is determined by matching corresponding pixels from two or more photographs taken from different camera locations. This course provides an introduction to stereophotogrammetry and the creation of stereo DEMs using Agisoft Metashape and NASA's Ames Stereo Pipeline, a free and open-source collection of tools for geodesy and stereophotogrammetry. Participants will work with SPOT-7 tri-stereo satellite imagery to generate elevation models of the steep and rugged Eastern Andean Cordillera in northwestern Argentina. The same data will be used to create elevation models with commercial software (Agisoft Metashape), and the results will be compared. Details of processing steps and their caveats are discussed. Finally, the capabilities of modern software to extract 3D information from historical aerial photographs and the advantages of meter-scale resolution elevation data for geomorphological applications are explored.
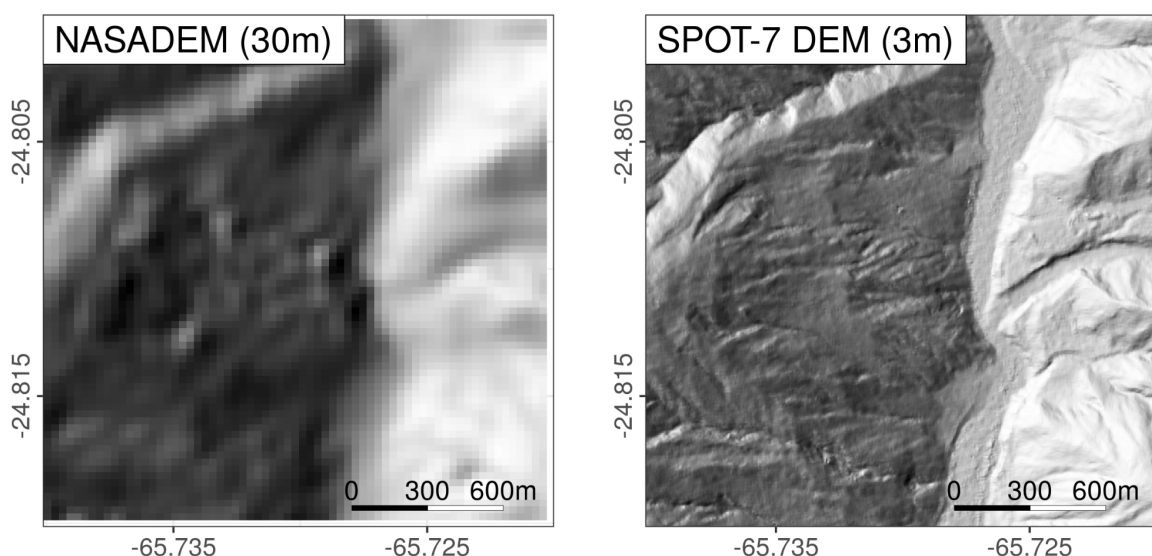
Comparison of freely available elevation data (NASADEM, 30 m), and a DEM derived from SPOT-7 tri-stereo imagery with a resolution of 3m for the same area.

Schedule:

Day1: Introduction to Stereophotogrammetry and some examples

Day2: Working with Agisoft Metashape

Day3: Working with Historical Aerial Images in Agisoft Metashape

Day4: Generation of DEMs from SPOT-7 data (Ames)

Day5: Pointcloud and DEM filtering

Participants will need their own Laptop/PC to follow along with the exercises. Ames Stereo Pipeline will require a Linux-based operating system. Windows users can run the software using a Linux subsystem for windows. Also, a basic knowledge of bash commands will be required.

Steep topograhy requires high-resolution topography to resolve abrupt elevation changes and deeply incised channels (examples from the Quebrada del Toro).