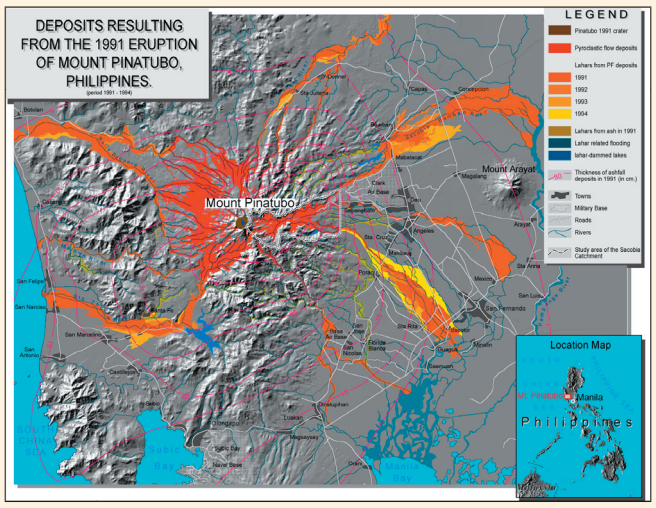
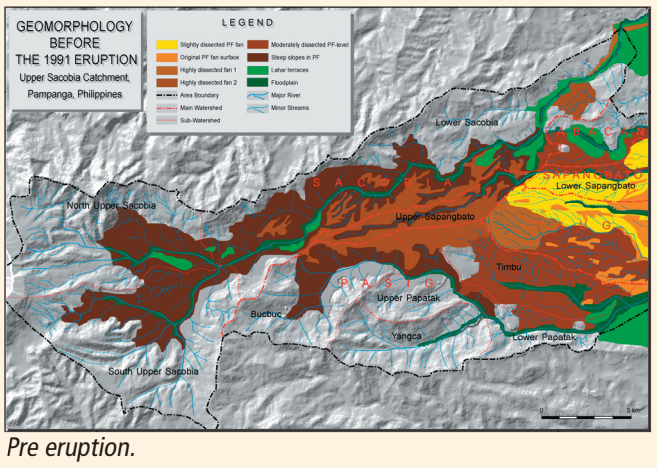
Modelling the erosion in pyroclastic flow deposits



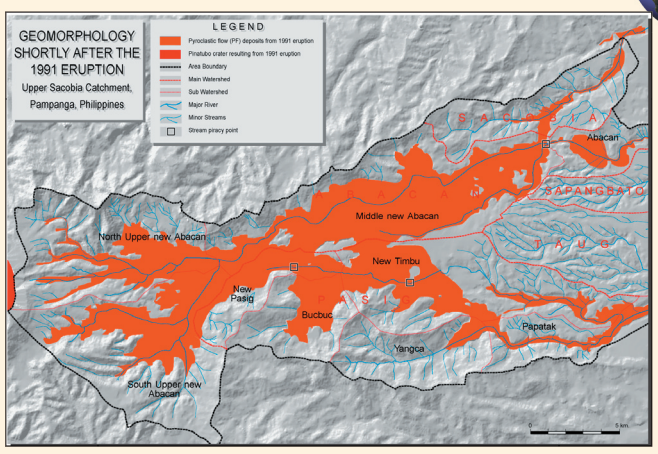
Deposits resulting from the 1991 eruption of Mount Pinatubo, Philippines.

Pyroclastic flow in action.

Lahars resulting from pyroclastic flow deposits.



Pre eruption.



Shortly after the eruption.

Modelling the erosion in pyroclastic flow deposits in the Sacobia watershed

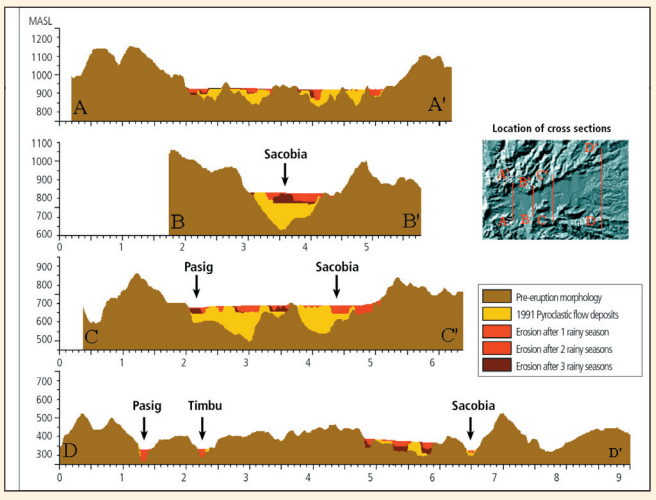
Mount Pinatubo is situated on the island of Luzon, about 80 km northeast of Manila, the capital of the Philippines. The eruption of the Pinatubo Volcano on June 15, 1991 deposited approximately 5 to 7 km3, of pyroclastic flows.

The accumulated thickness of the pyroclastic flows varies, depending on theproximity to the crater and the pre-eruption morphology, and reaches more than 200 meters along deep pre-eruption valleys. The pyroclastic flow deposits affected eight major watersheds around the slopes of the volcano and radically altered the hydrological regimes, leading to unprecedented amounts of erosion and sediment delivery in the form of destructive lahars.

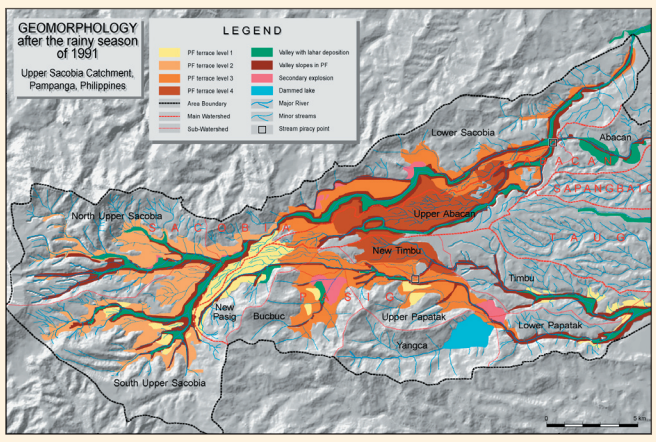
The rapidly changing geomorphology of the watersheds before, during and 3 consecutive years after the eruption were investigated. Emphasis is given to the importance of stream captures as a result of erosion and secondary explosions.

To calculate the volume of the 1991 pyroclastic flow deposits and the yearly eroded sediment volumes, a DEM overlaying technique using GIS was applied. For this procedure it was necessary to construct DEMs of several periods: i.e. the pre-eruption DEM; the post-plinian eruption DEM which renders the undisturbed deposits of the 1991 pyroclastic flows; a post-lahar 1991 DEM; a post-lahar 1992 DEM; and a post-lahar 1993 DEM.

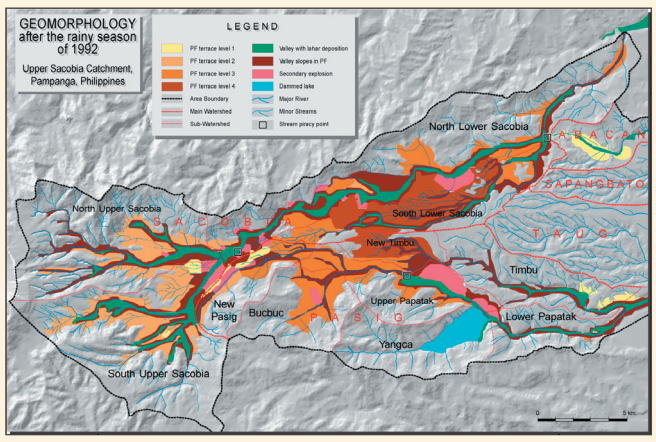
The total volume of pyroclastic flows deposited in 1991 in the Sacobia catchment was 1.278 km3 . It covered an area of 24 km2, and reached 15 km downstream from the crater. Erosion rates were calculated to be between 219 and 136 million m3 per year. A comparison is made with erosion estimates from other sources and a relation is established between erosion rates and volumes of lahars for the coming years.



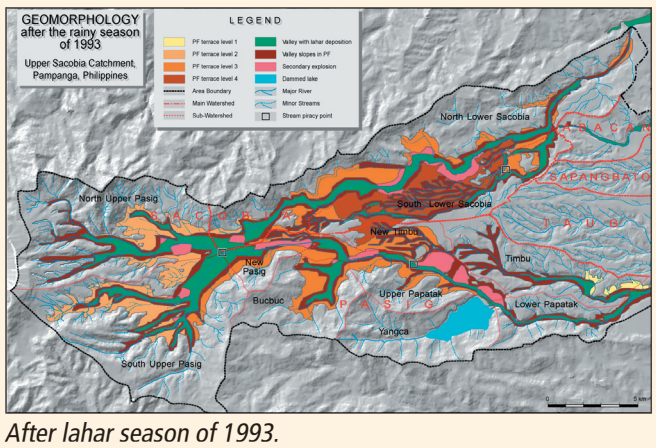
Cross sections showing elevations of the 1991 pyroclastic flow deposists within the pre-eruption valleys.



After lahar season of 1991.



After lahar season of 1992.



After lahar season of 1993.

For more information:

Cees van Westen
International Institute for Geo-Information Science and Earth Observation
P.O. Box 6, 7500 AA Enschede, The Netherlands
E-mail: westen@itc.nl
Arturo S. Daag
PHIVOLCS

ITC

INTERNATIONAL INSTITUTE FOR GEO-INFORMATION SCIENCE AND EARTH OBSERVATION