

Citizen science for water resources management and poverty alleviation

Experiences from data scarce mountain regions



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CONDESAN
Consortio para el Desarrollo Sostenible
de la Ecorregión Andina

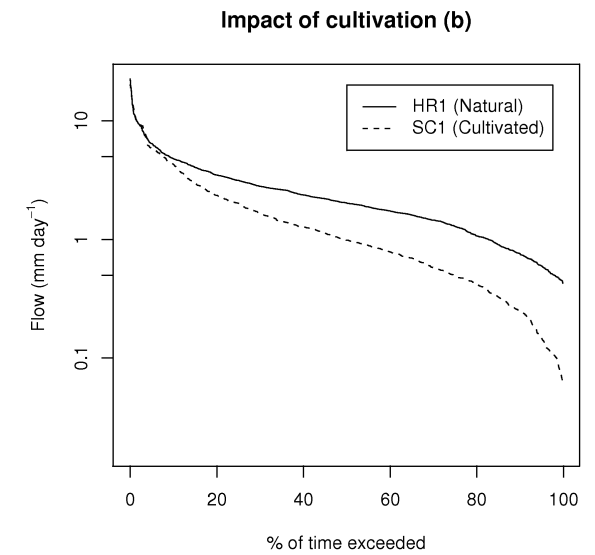
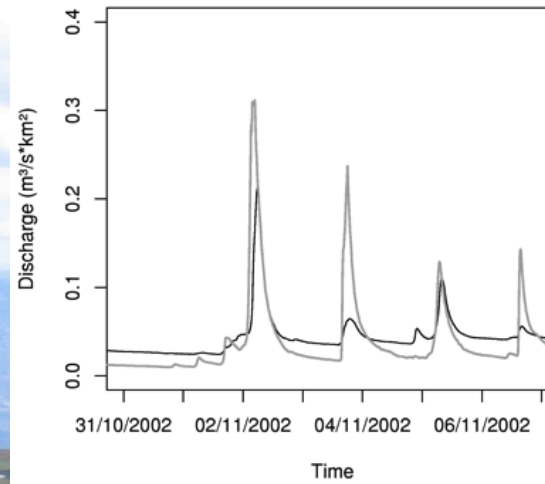
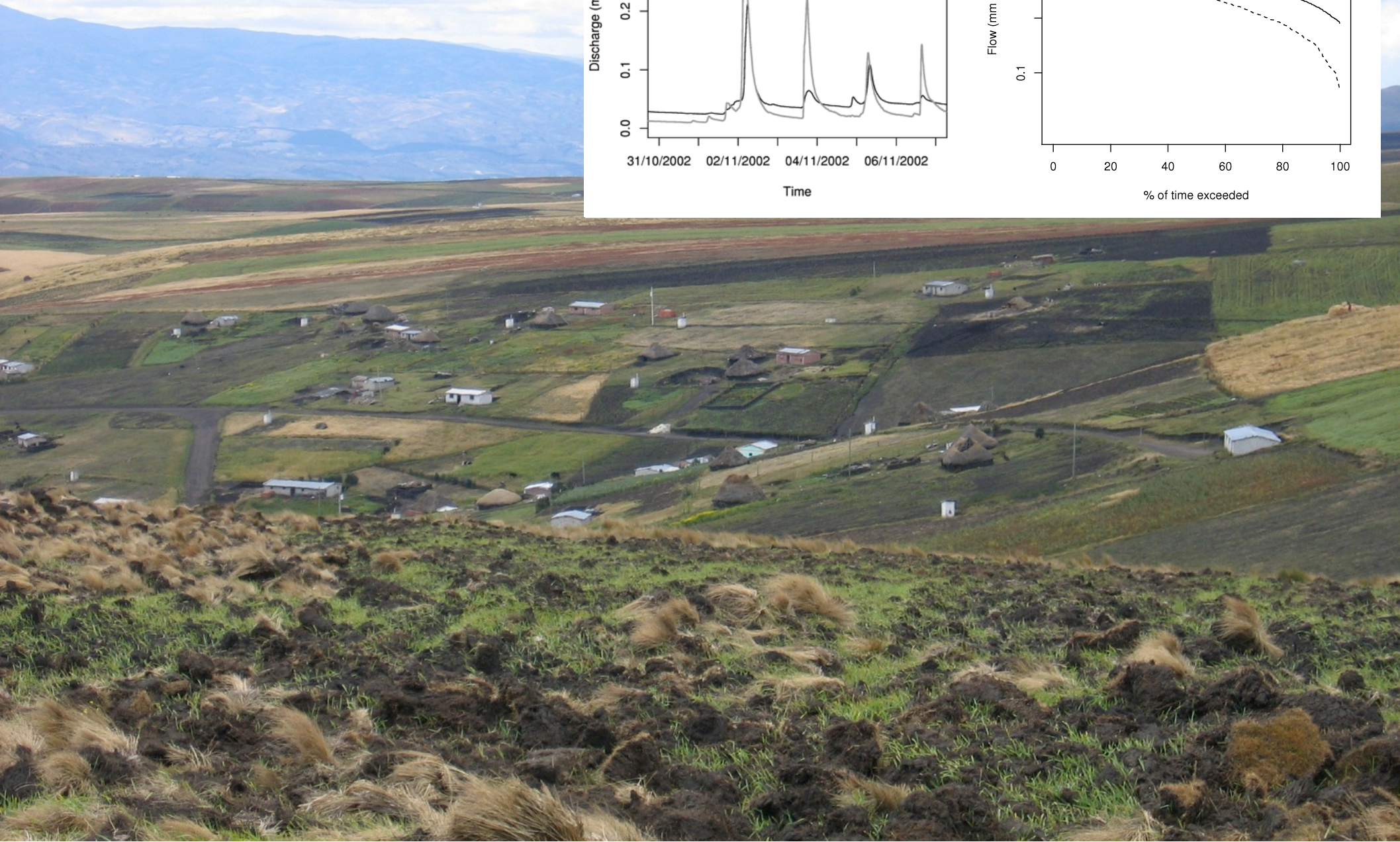


Mountain environments: poverty pockets

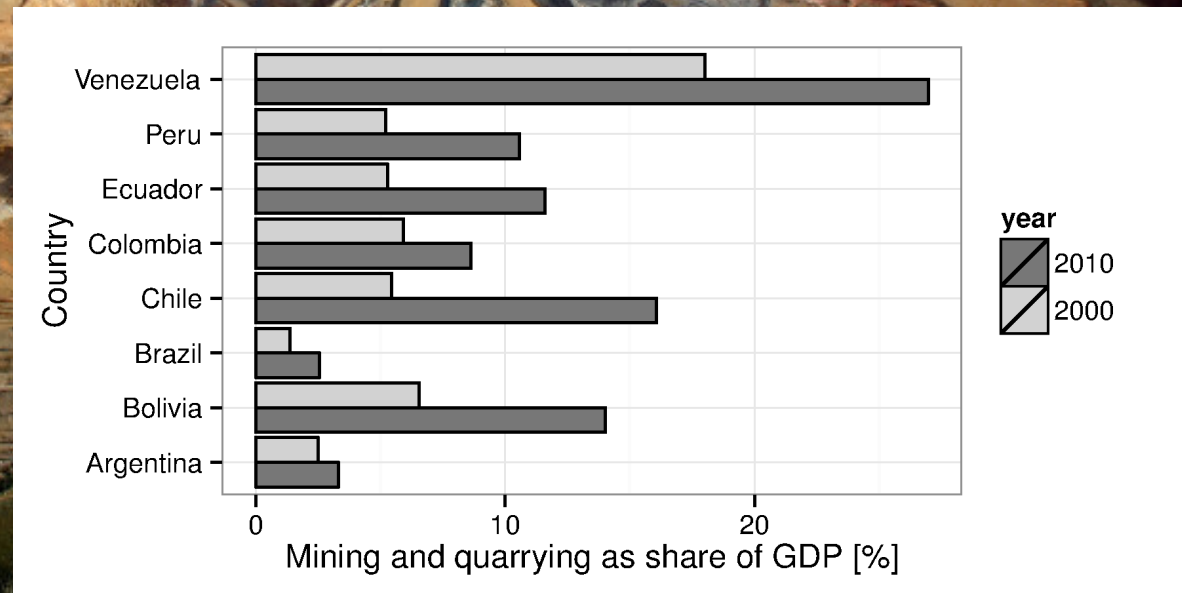
- Fast changing processes
- Extremely vulnerable
- Underdeveloped regions
- Very large uncertainties
- Data scarcity



Land use change

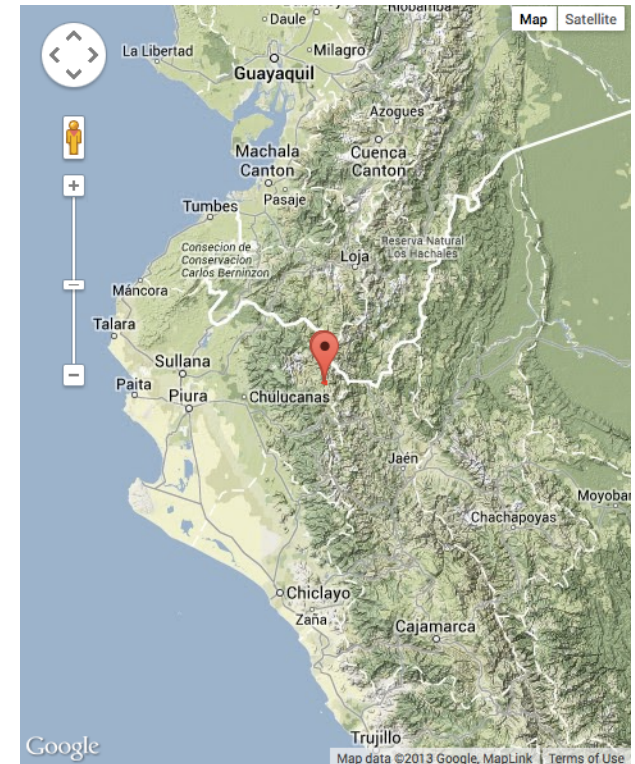


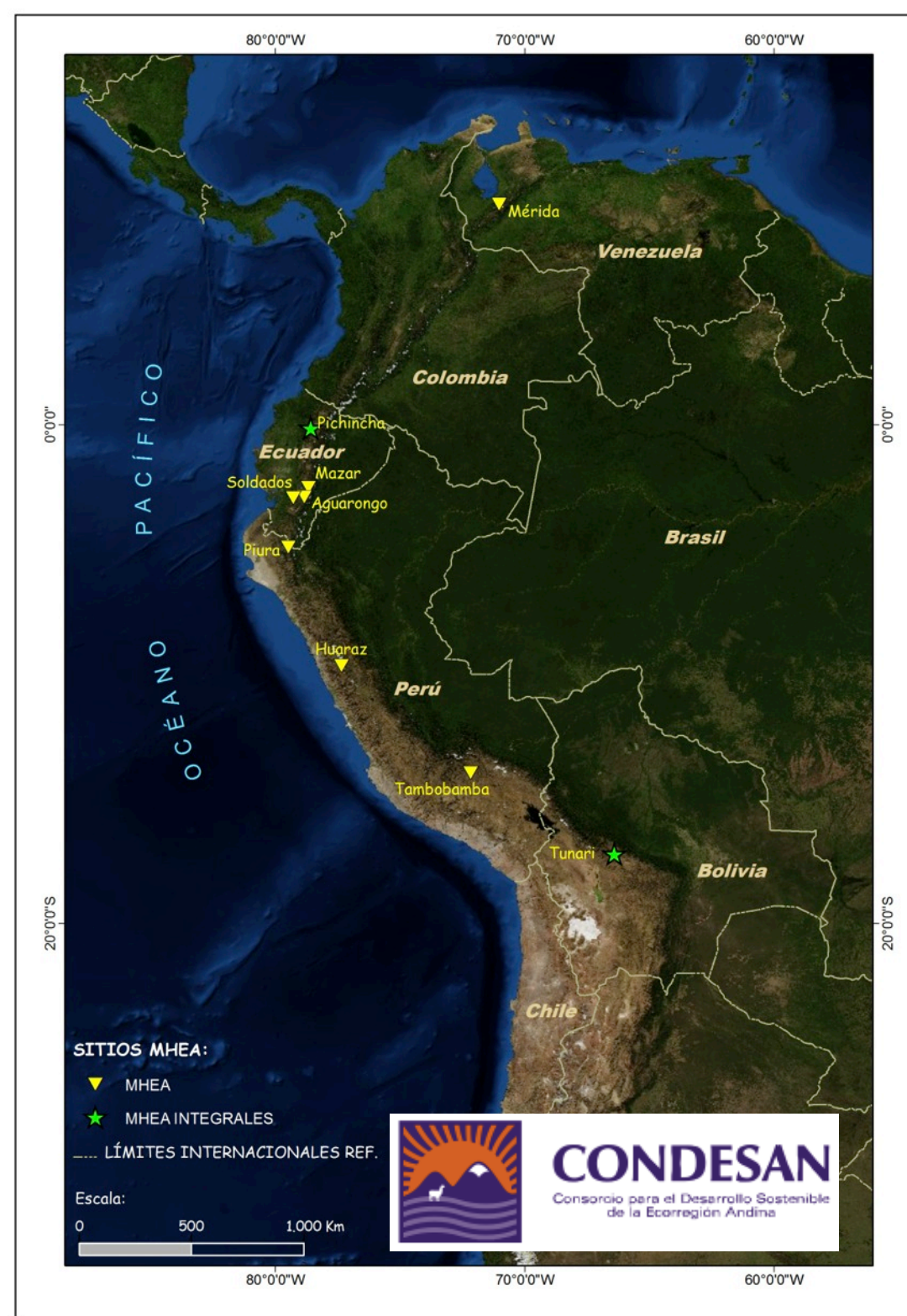
Mining



Participatory monitoring

- Focused on the catchment water balance
- Responding to local knowledge demand
- Cheap sensor package (~ 5000 USD)
- Local buy-in and participation







navegación

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- [Actualidad](#)
- [Cambios recientes](#)
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Iniciativa Regional de Monitoreo Hidrológico de Ecosistemas Andinos: el Wiki [\[editar\]](#)

El wiki de la Iniciativa iMHEA colecta información práctica sobre la instalación y manejo de equipo de monitoreo hidro-meteorológico; la colección, manejo y control de calidad de datos; y la interpretación de los resultados.

CONTENIDO [\[editar\]](#)

Introducción [\[editar\]](#)

Una introducción breve en la práctica del monitoreo hidrológico, su importancia e relevancia.

Medición de la precipitación [\[editar\]](#)

la instalación y manejo de pluviómetros

Medición del caudal [\[editar\]](#)

El diseño y la instalación de vertederos, tal como métodos sin estructura.

Control de calidad de datos [\[editar\]](#)

Cómo identificar errores y problemas de calidad.

Tratamiento de datos [\[editar\]](#)

Tratamiento y procesamiento de datos hidrometeorológicos

La plataforma Arduino [\[editar\]](#)

Instrucciones para la construcción de dataloggers con la plataforma abierta y de bajo costo Arduino

Bibliografía [\[editar\]](#)

Referencias y otros fuentes de literature útiles.



The project

Pacaipampa

Yasuní

Pacaya Samiria

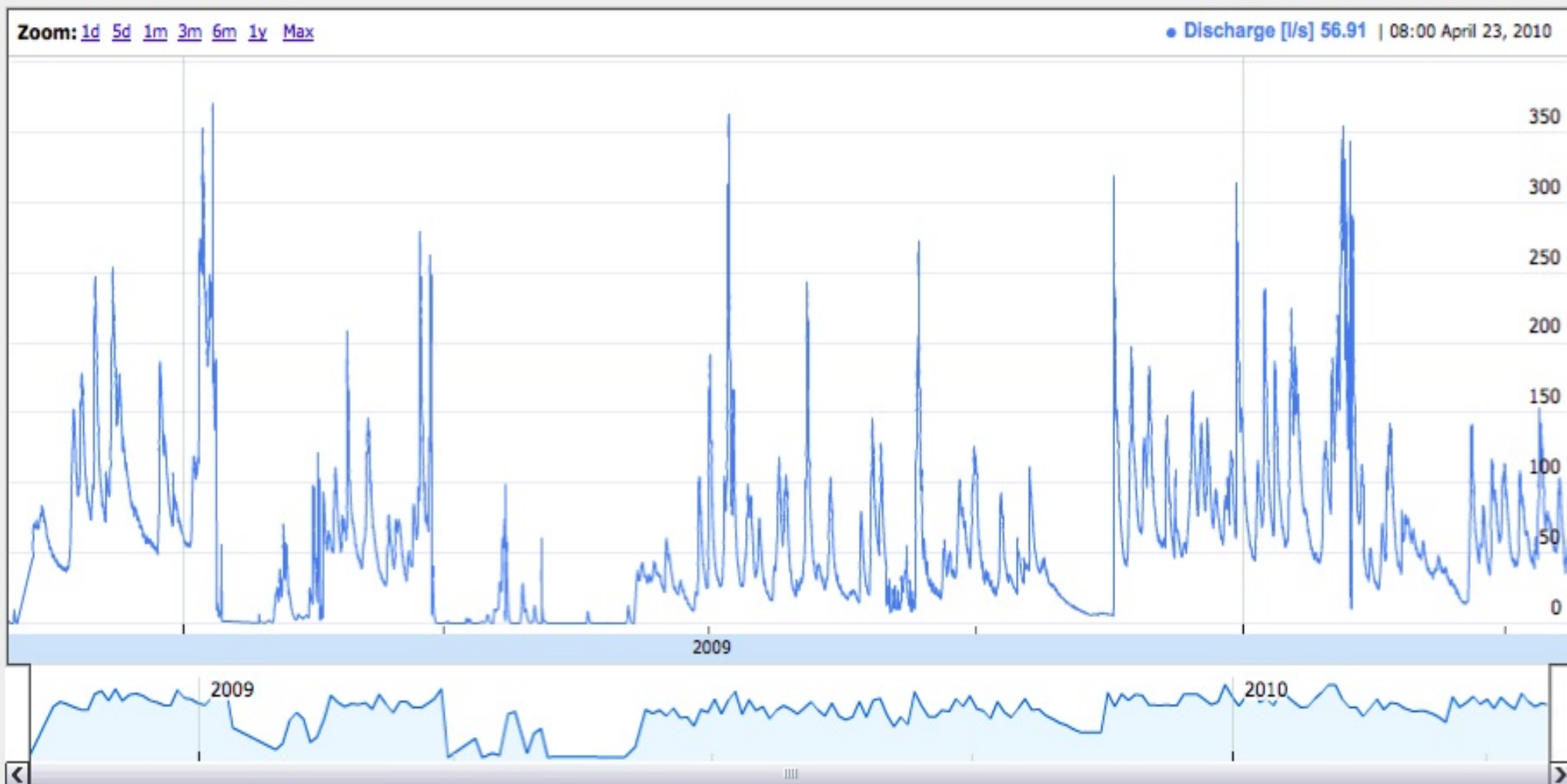
Technologies

Description

Data

Simulations

Riverflow in the Pacaipampa catchment



Citizen science

Distributed sensor networks

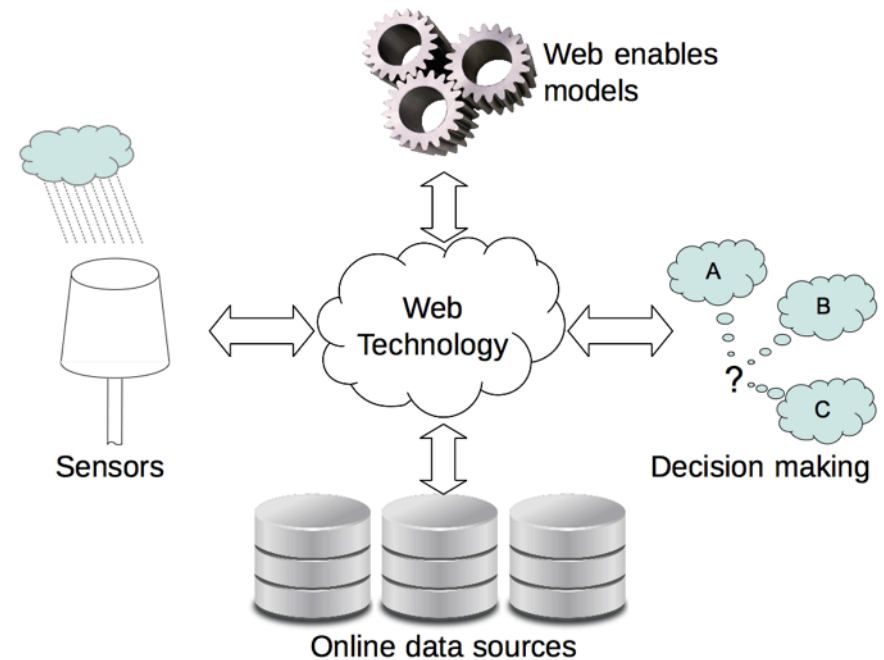
Big data analytics

Cloud computing

Web services

Adaptive governance

Smartphones & tablets



⇒ Opportunities for water resources management?



Citizen science in hydrology and water resources: opportunities for knowledge generation, ecosystem service management, and sustainable development

Wouter Buytaert^{1,2,3*}, Zed Zulkafli^{1,4}, Sam Grainger^{1,2}, Luis Acosta⁵, Johan Bastiaensen⁶, Bert de Bièvre⁵, Jagat Bhusal⁷, Tilashwork Chanie¹, Julian Clark⁸, Art Dewulf⁹, David M. Hannah⁸, Christian Hergarten¹⁰, Aiganysh Isaeva¹⁰, Timos Karpouzoglou⁹, Bhopal Pandey¹, Deepak Paudel⁷, Keshav Sharma⁷, Tammo Steenhuis^{11,12}, Seifu Tilahun^{11,12}, Gert Van Hecken⁶, and Munavar Zhumanova¹⁰,

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³Departamento de Ingeniería Civil y Ambiental, Escuela Politécnica Nacional, Quito, Ecuador

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⁶Institute of Development Policy and Management, University of Antwerp, Antwerp, Belgium

⁷Society of Hydrology and Meteorology, Kathmandu, Nepal

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¹⁰Mountain Societies Research Institute, University of Central Asia, Bishkek, Kyrgyz Republic

¹¹School of Civil and Water Resources Engineering, Bahir Dar University, Bahir Dar, Ethiopia

¹²Department of Biological and Environmental Engineering, Cornell University, Ithaca, New York, USA

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Rationale

Fragile and poorly known mountain ecosystem services
Increasing pressures & accelerated change



Poverty alleviation
through
adaptive governance
&
institutional change

Interactive models of
information exchange,
knowledge generation
and learning

Citizen science
Environmental virtual
observatories

Case studies

Jequetepeque basin, Peru

Kaligandaki basin, Nepal

Naryn district, Kyrgyzstan

Tana Lake region, Ethiopia

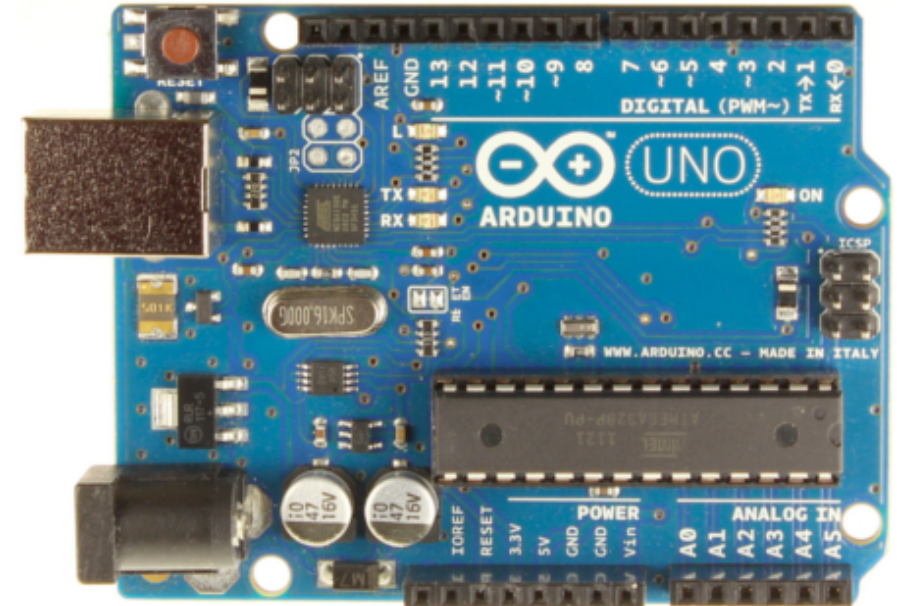
Selection criteria:

- Similar ecosystem services & threats
- Similar data scarcity & complexity
- Different socio-economic context
- Strong local platform & enthusiasm
- Scope for comparative analysis



Sensors

- Automatic sensor networks
- Web-enabling (“the internet of things”)
- E.g.: Arduino: cheap, open, robust, versatile (wifi, zigbee, ...)



Web-based tools



Mountain-EVO

[Home](#) » [Sensor sensor1](#)[Log Out \(admin\)](#) | [Users](#)

Sensor sensor1

test2
peru
talcahuana
sensor1 >
sensor2 >
test
huagrahuma
[Add a new sensor](#)
[Add a new catchment area](#)

SensorDataProcessingVisualizationExport

FilesCalibration

Your file: No file selected.

File	Status	Startdate	Enddate	Delete
M-401 Rio Ozogоче.x	processed	2013-06-10	2013-06-11	X

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107

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11

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Tweets

**ICHydroRain6** @ICHydroRain6 · 22h
Weather on 2014-07-27: Rain = 0mm; avg T = 24.68°C; max T = 30.02°C; min T = 20.91°C
Expand  Reply  Delete  Favorite  More

**ICHydroRain6** @ICHydroRain6 · Jul 27
Weather on 2014-07-26: Rain = 0mm; avg T = 26.87°C; max T = 35.04°C; min T = 18.53°C
Expand  Reply  Delete  Favorite  More

**ICHydroRain6** @ICHydroRain6 · Jul 26
Weather on 2014-07-25: Rain = 2.4mm; avg T = 22.63°C; max T = 30.33°C; min T = 18.33°C
Expand  Reply  Delete  Favorite  More

**ICHydroRain6** @ICHydroRain6 · Jul 25
Weather on 2014-07-24: Rain = 0mm; avg T = 25.6°C; max T = 32.22°C; min T = 17.87°C
Expand  Reply  Delete  Favorite  More

**ICHydroRain6** @ICHydroRain6 · Jul 24
Weather on 2014-07-23: Rain = 0mm; avg T = 24.55°C; max T = 32.73°C; min T = 17.09°C
Expand  Reply  Delete  Favorite  More

**ICHydroRain6** @ICHydroRain6 · Jul 23
Weather on 2014-07-22: Rain = 0mm; avg T = 25.49°C; max T = 33.66°C; min T = 17.36°C
Expand  Reply  Delete  Favorite  More

**ICHydroRain6** @ICHydroRain6 · Jul 22
Weather on 2014-07-21: Rain = 0mm; avg T = 23.56°C; max T = 29.99°C; min T = 18.25°C
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Scenario analysis



Simulating the impact of land-use changes

This system allows you to simulate the impact of land-use changes in the Pacaipampa basin. Select the land-use scenario with the sliders below and click the simulation button. Simulations are performed in real-time using a hydrological model (topmodel).

Basin characteristics

Land use

Change the sliders from top to bottom. You cannot change the last slider. Instead change the other three.

Native Forest:	<input type="range"/>	15%
Pine forest:	<input type="range"/>	0%
Grassland:	<input type="range"/>	80%
Cultivation:	<input type="range"/>	5%

Simulate

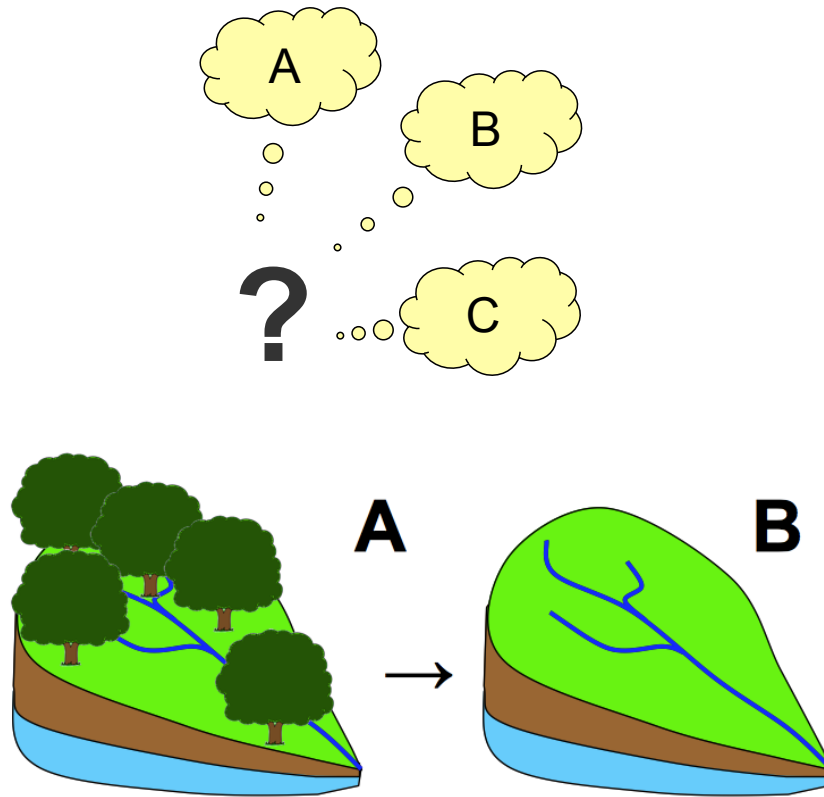
You can also call the modelling server directly using [this link](#) or pasting the following url in your browser:

[http://paramo.cc.ic.ac.uk/espa/server?
Service=WPS&Version=1.0.0&Request=GetCapabilities](http://paramo.cc.ic.ac.uk/espa/server?Service=WPS&Version=1.0.0&Request=GetCapabilities)

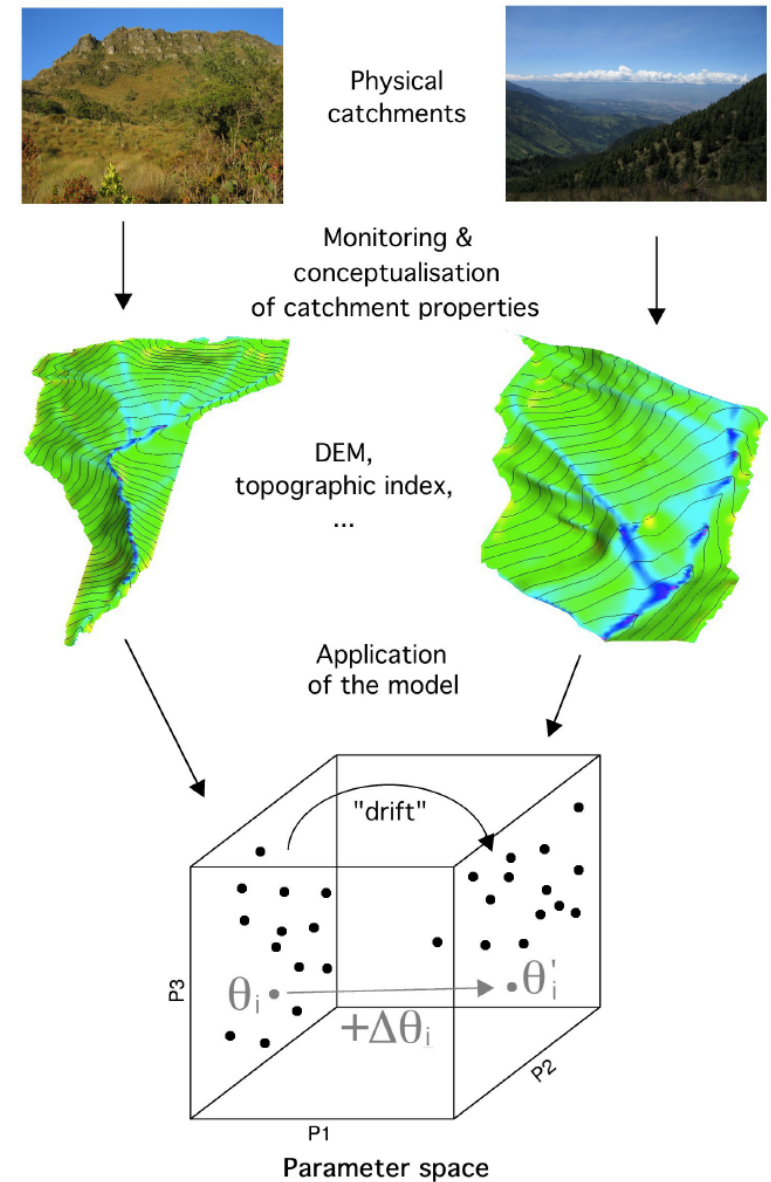
Note: you will need to authenticate first.



Scenario analysis



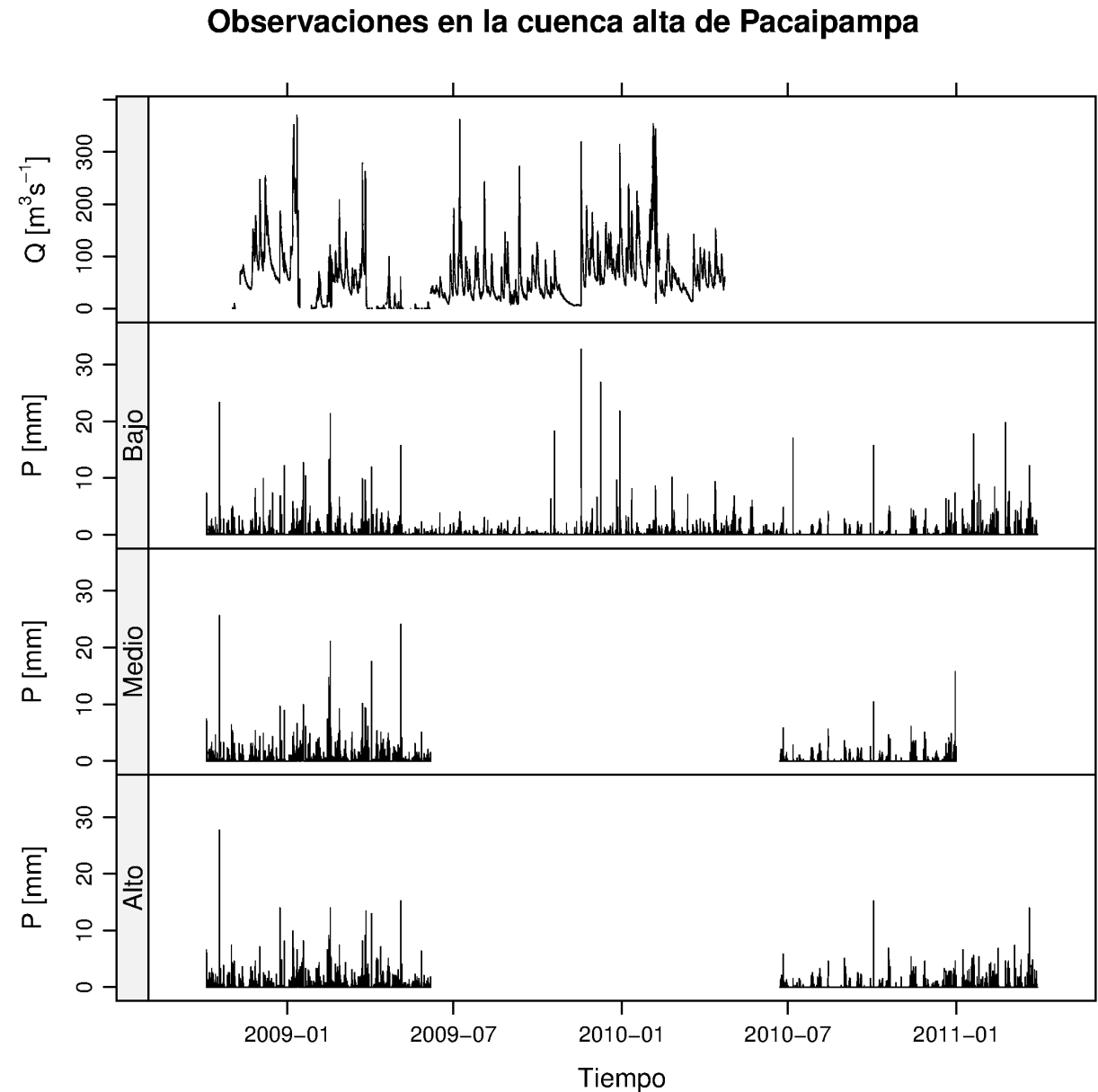
- Scenario definition
- Mapping and parameterization
- Scenario evaluation



Challenges

1. Data & processing

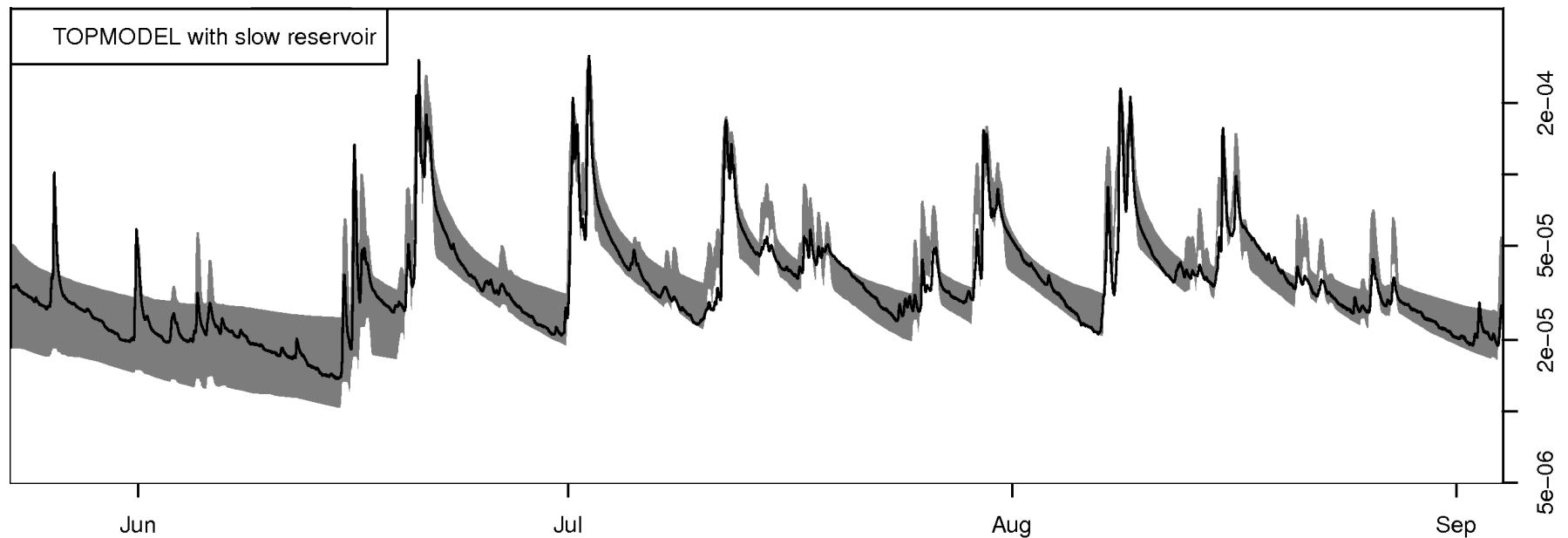
- Data quality
- Data processing
- Technical support
- Fatigue of local people
- Uptake of results



Challenges

2. Assumptions, limitations, and uncertainties

- Quantification
- Reduction
- Communication





Thanks to...



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