



**UNIVERSIDAD MAYOR DE
SAN SIMÓN**



Hydrological System Conceptualization to evaluate the discharge in a hydropower reservoir in Cochabamba-Bolivia

IUPWARE – Alumni event 2018 Cuenca Ecuador

FEBRERO DE 2018

Laboratorio de Hidráulica Facultad de Ciencias y Tecnología





Introduction

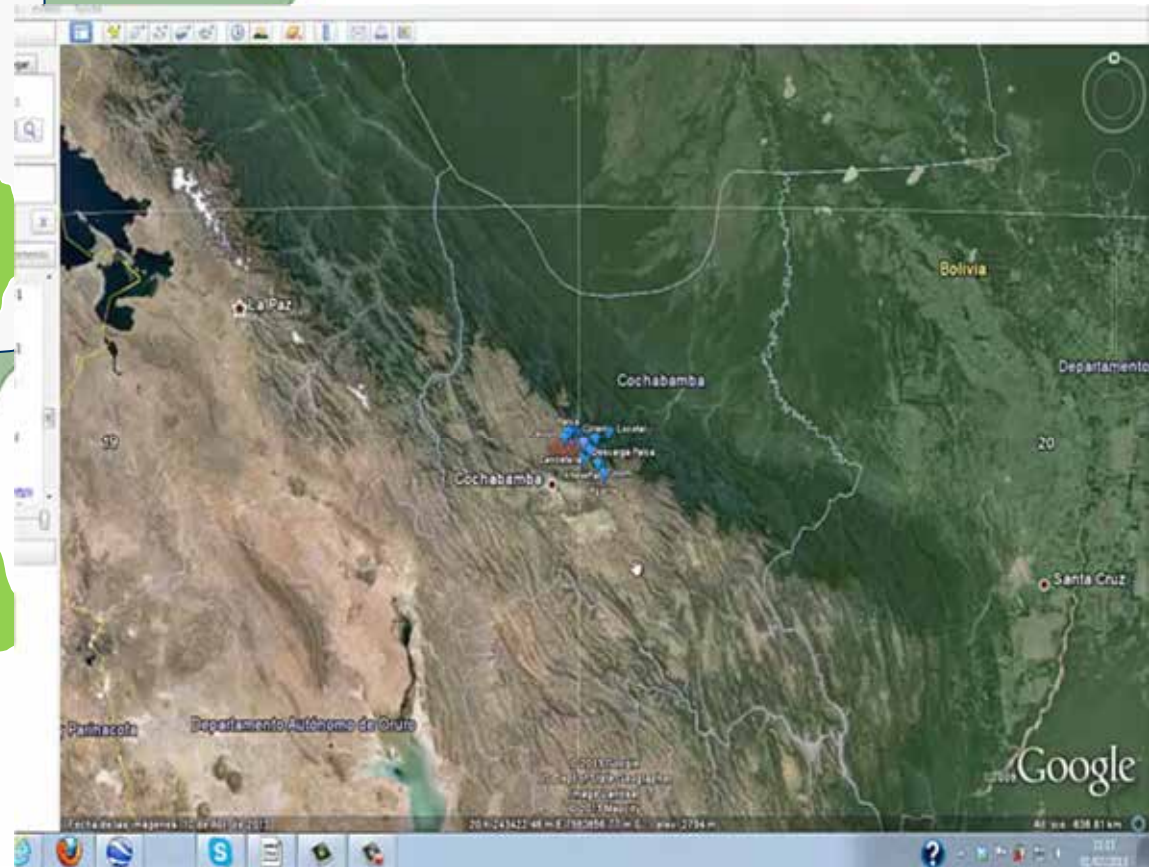
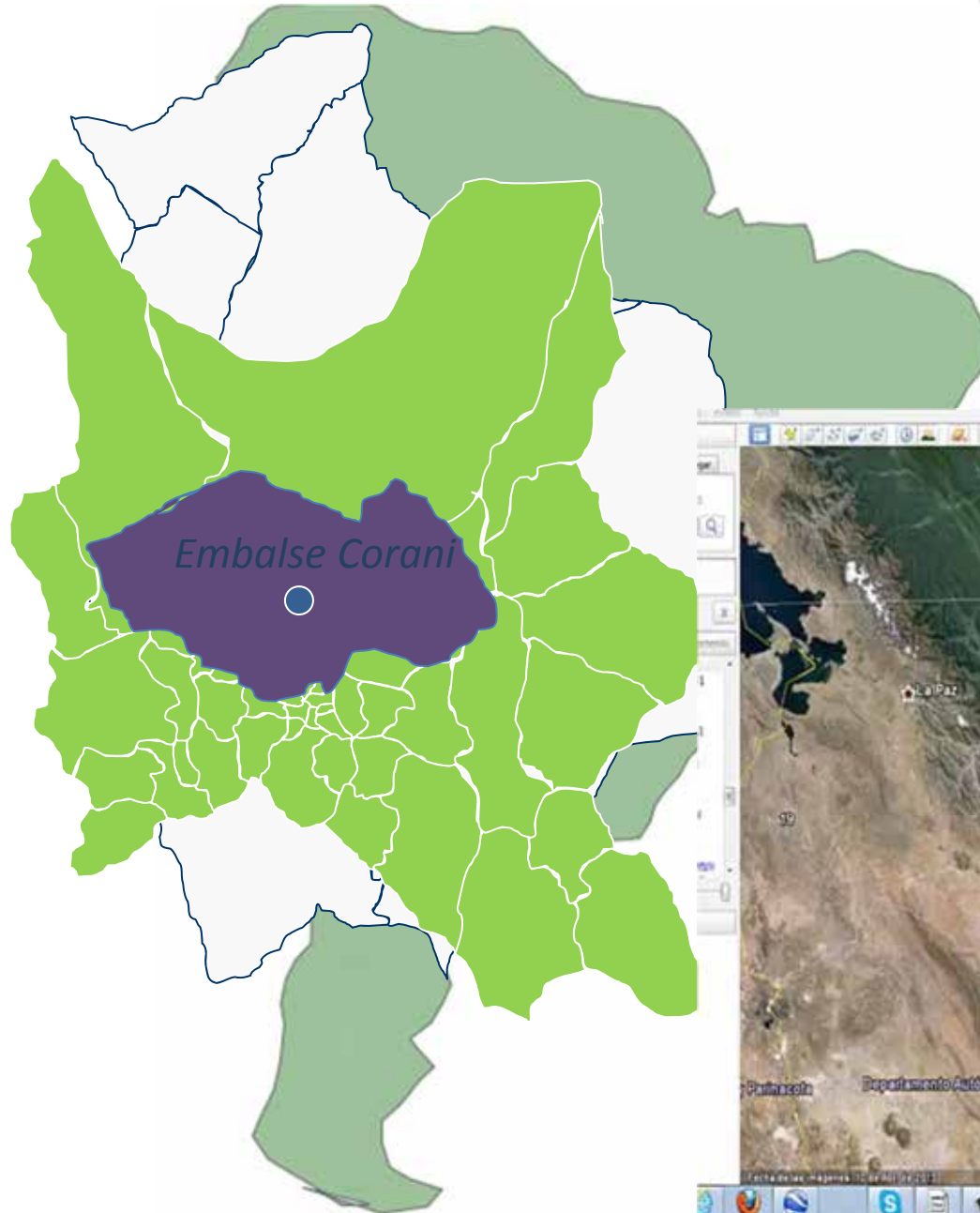
- Data Pre-processing
- Rainfall - runoff model
- Conceptual model
- Purpose (Climate change scenarios, Forecast Systems)

Alumni event 2018 - Cuenca Ecuador

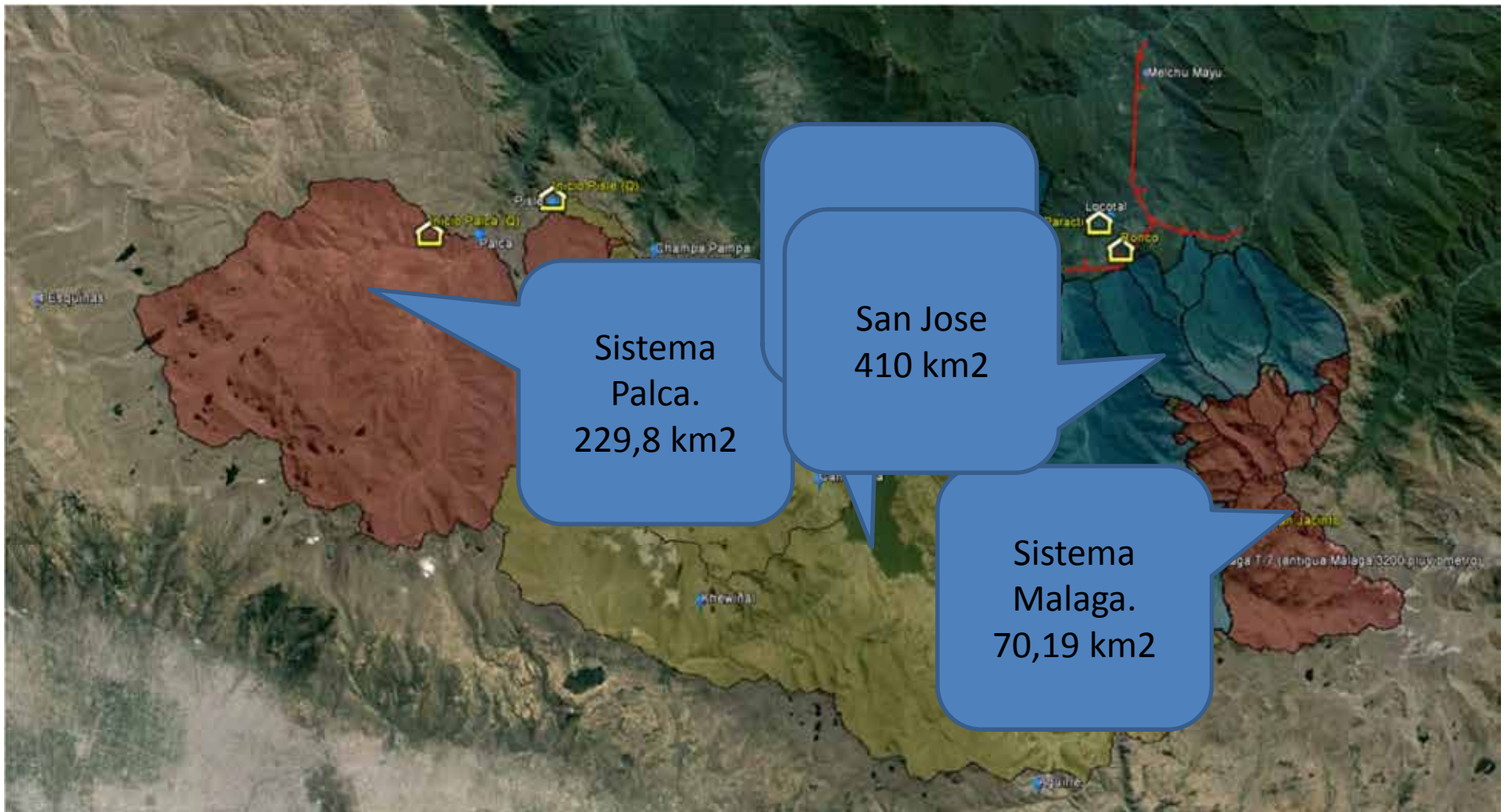


Introduction

The installed power of the Power Plants is
270 MW



Data Pre-processing



Data Pre-processing

- Type of discharge series (limited flows)



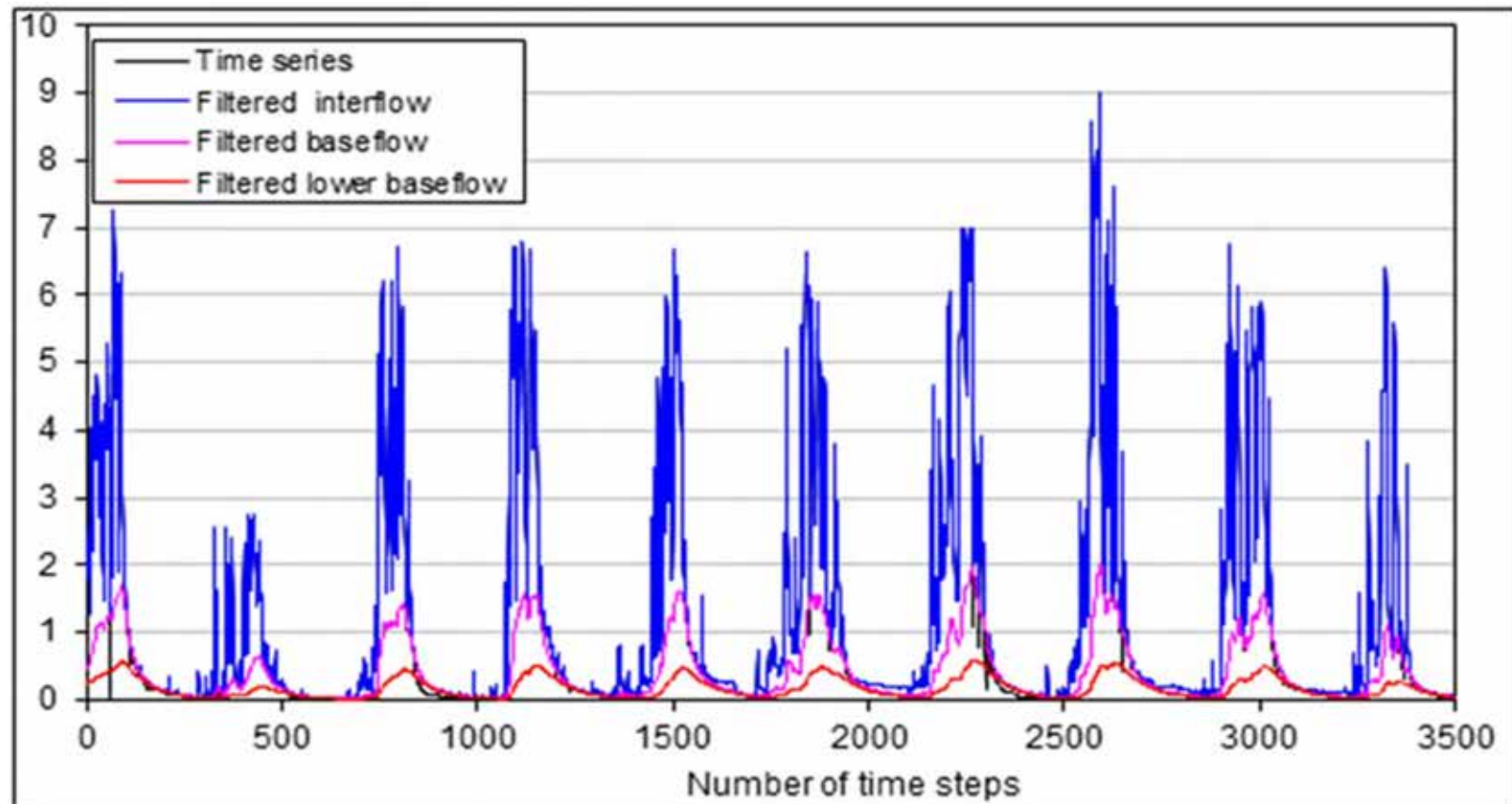
Data Pre-processing

- Type of discharge series (limited flows)



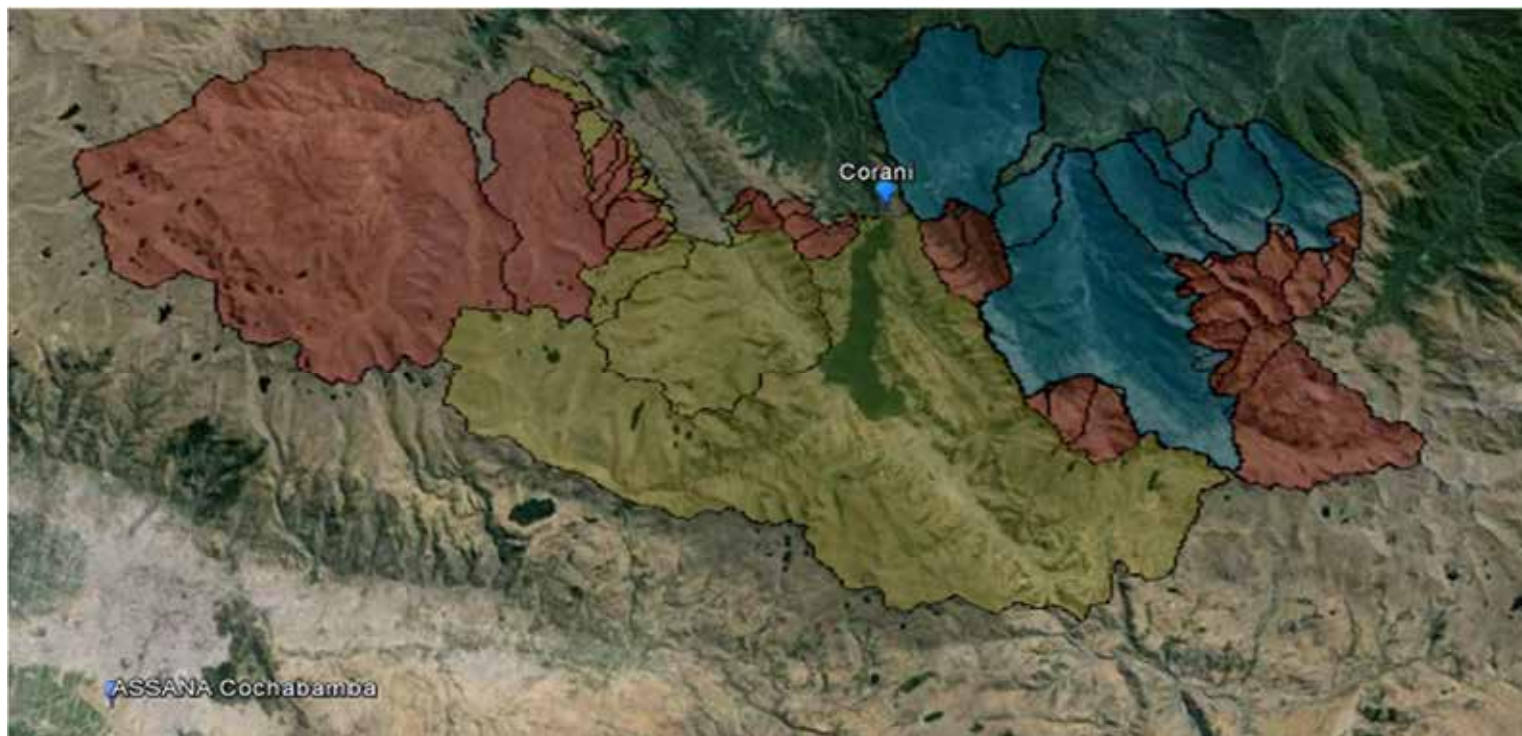
Data Pre-processing

- Filtered flow, Palca station

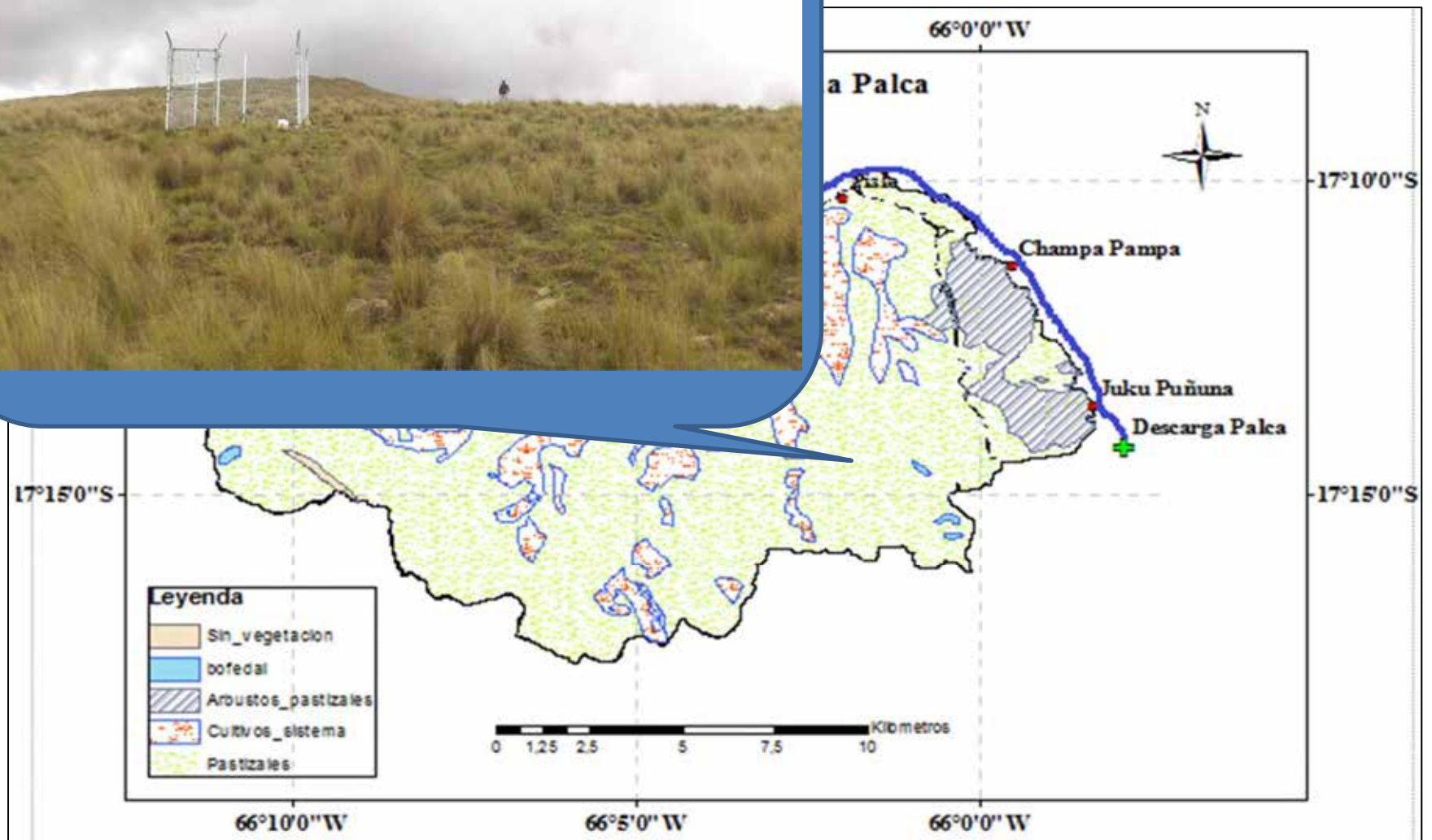


Rainfall - runoff model

- Two conceptual lumped hydrological models were implemented: HEC-HMS and Mike11-NAM

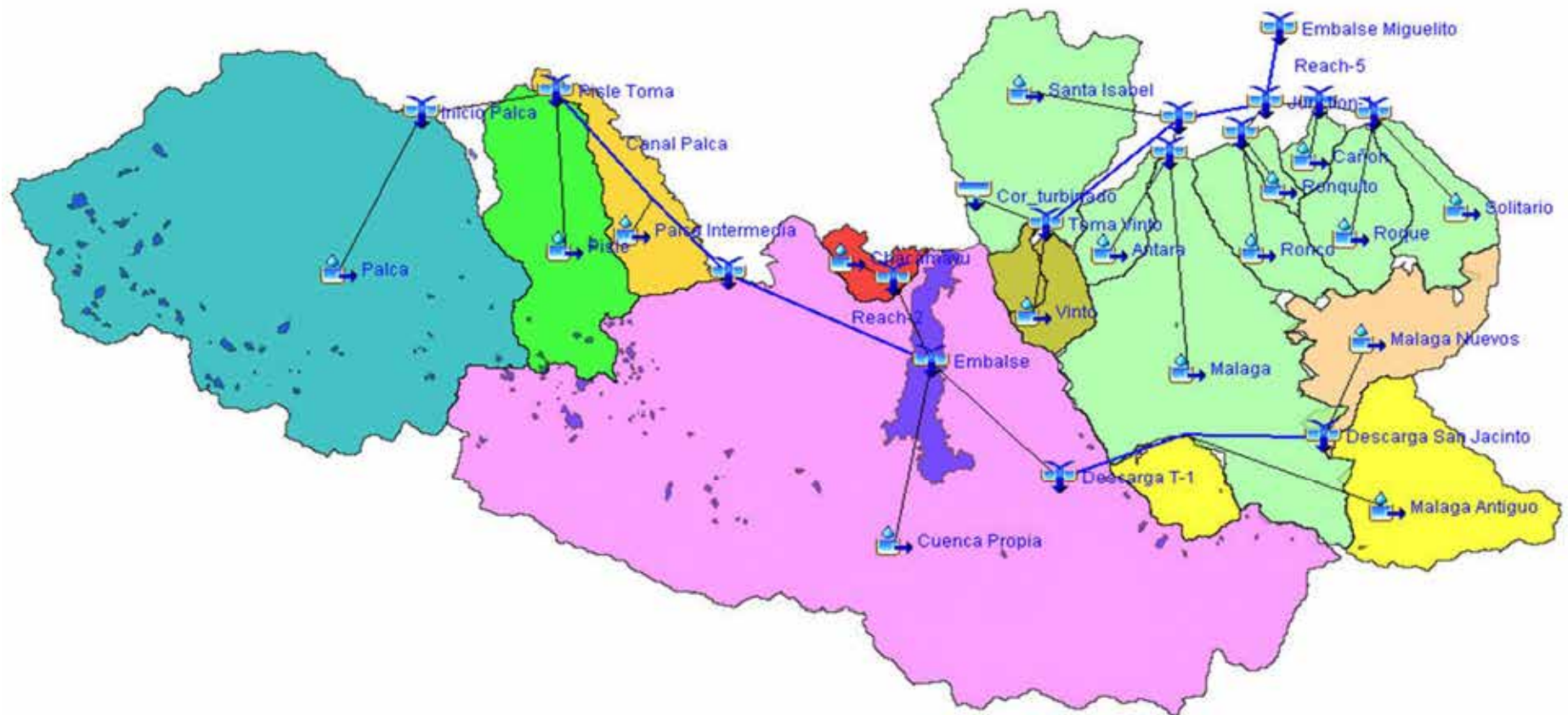


Alumni event 2018 - Cuenca Ecuador



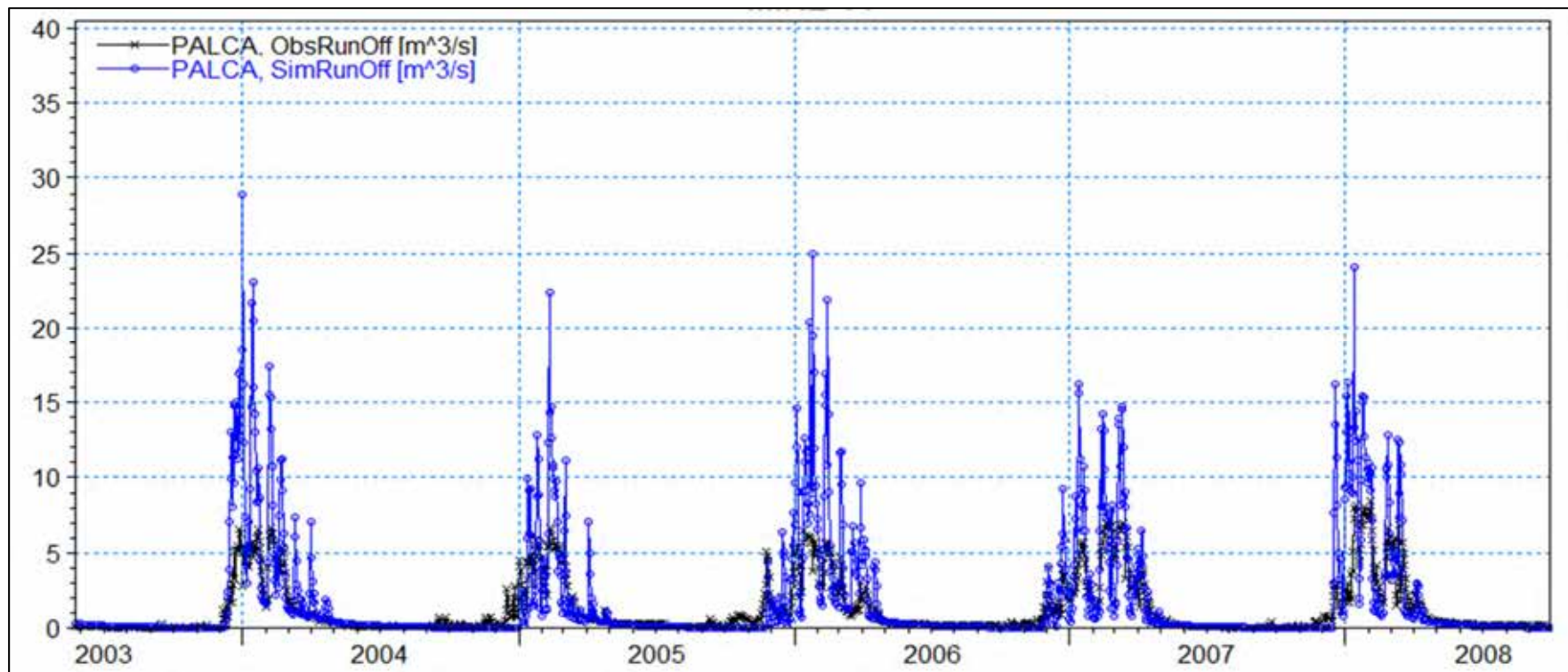
Rainfall - runoff model

- HEC-HMS



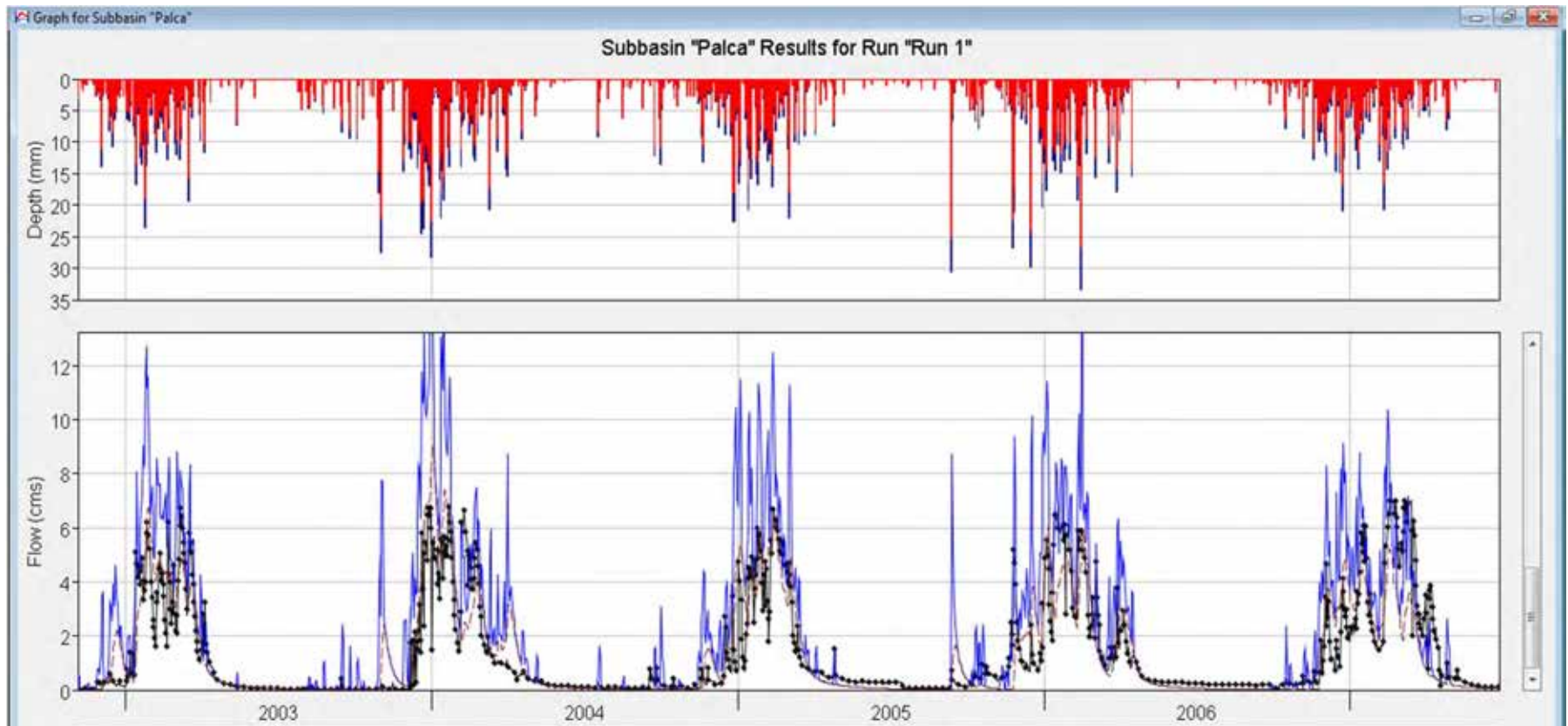
Rainfall - runoff model

- MIKE-NAM- Palca Inicio



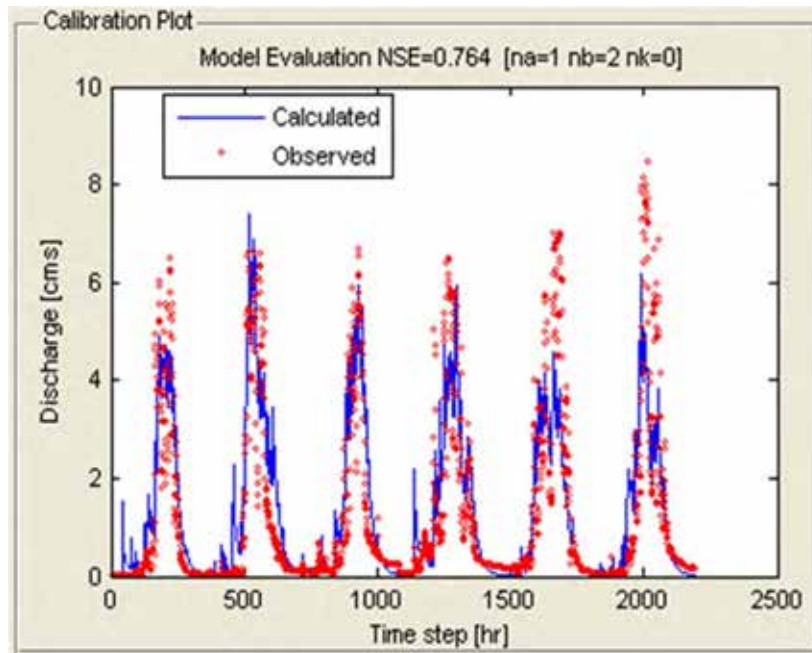
Rainfall - runoff model

- HEC-HMS-Palca Inicio



Conceptual model

$$Q_t = \frac{b_0 + b_1 z^{-1} + \dots + b_m z^{-m}}{1 - a_1 z^{-1} - \dots - a_n z^{-n}} z^{-\delta} I_t$$





CMD

Conceptual Model Developer tool V.2.2011

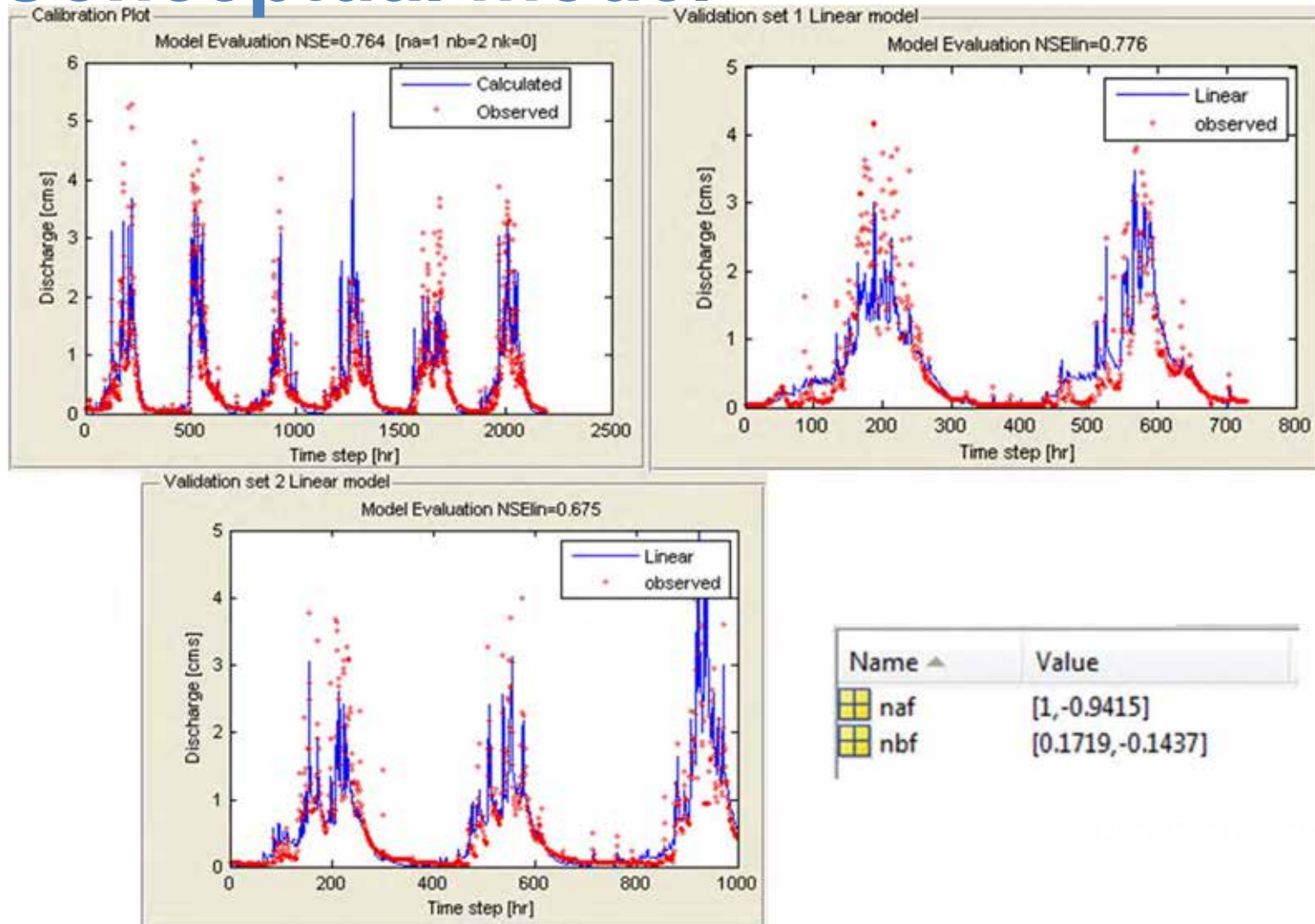
Development of CMD by : Katholieke Universiteit Leuven
Hydraulic Section
Kasteelpark Arenberg 40
BE-3001 Leuven, Belgium

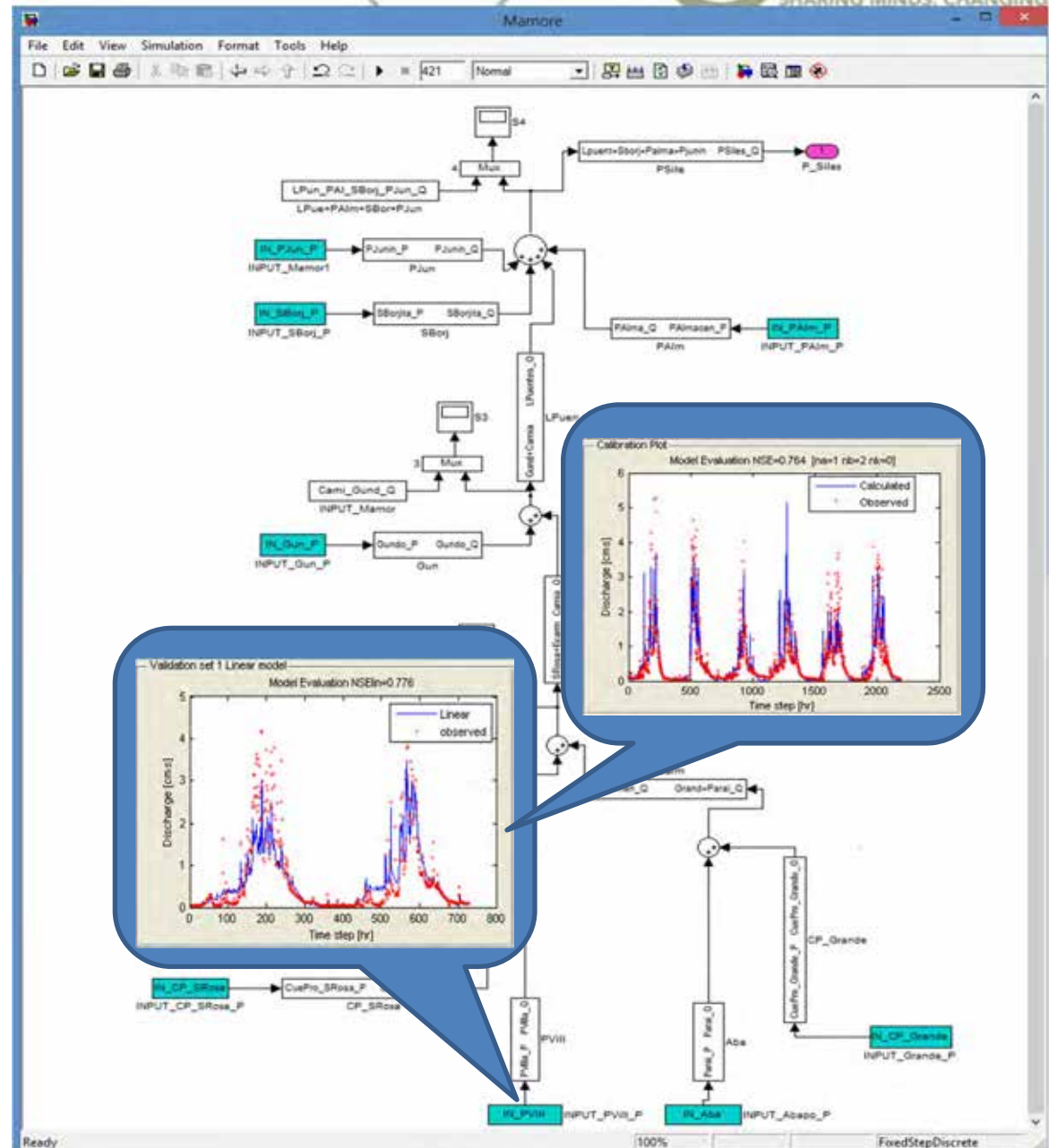
URL: <http://www.kuleuven.be/hydr>

KATHOLIEKE UNIVERSITEIT LEUVEN

Name ▲	Value
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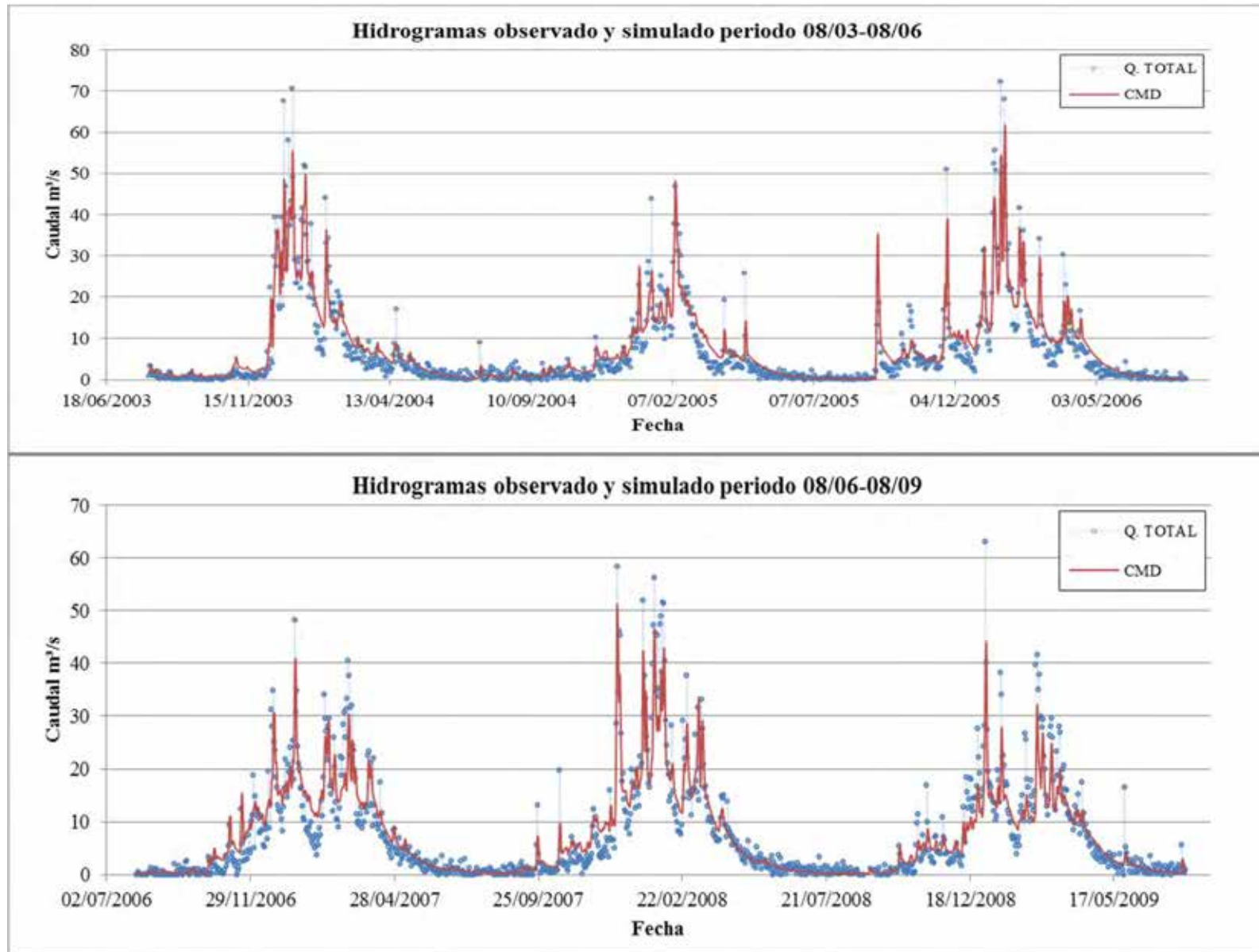
Conceptual model





Conceptual model

HEC HMS - CMD



Conceptual model

MIKE NAM - CMD results

	Inicio Palca	Pisle	Desc. Palca	Chaca- mayu	Málaga antiguos	Málaga nuevos	Desc. T1	Cuenca propia	Caudal Total
Validación 1	0.51	0.79	0.79	0.72	0.82	0.69	0.88	0.76	0.87
Calibración	0.82	0.79	0.82	0.88	0.78	0.73	0.83	0.82	0.93
Validación 2	0.83	0.72	0.50	0.88	0.57	0.52	0.55	0.78	0.89
Periodo total	0.79	0.77	0.72	0.85	0.71	0.65	0.74	0.79	0.91

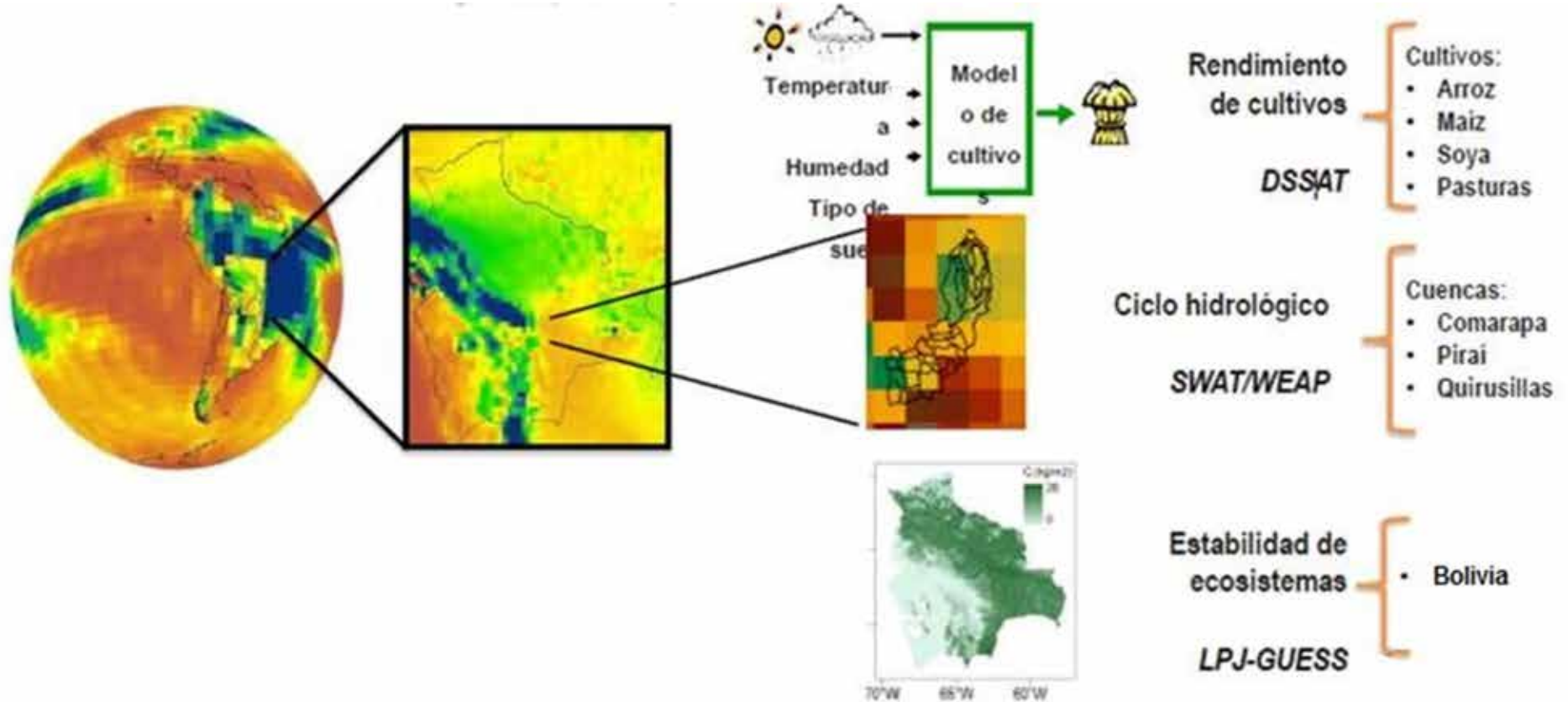
HEC HMS - CMD results

	Inicio Palca	Pisle	Desc. Palca	Chaca- mayu	Málaga antiguos	Málaga nuevos	Desc. T1	Cuenca propia	Caudal Total
Validación 1	0.28	0.78	0.84	0.63	0.80	0.60	0.79	0.72	0.84
Calibración	0.77	0.76	0.80	0.79	0.72	0.71	0.78	0.80	0.88
Validación 2	0.69	0.68	0.58	0.74	0.51	0.46	0.47	0.72	0.86
Periodo total	0.69	0.74	0.75	0.75	0.66	0.61	0.68	0.76	0.87

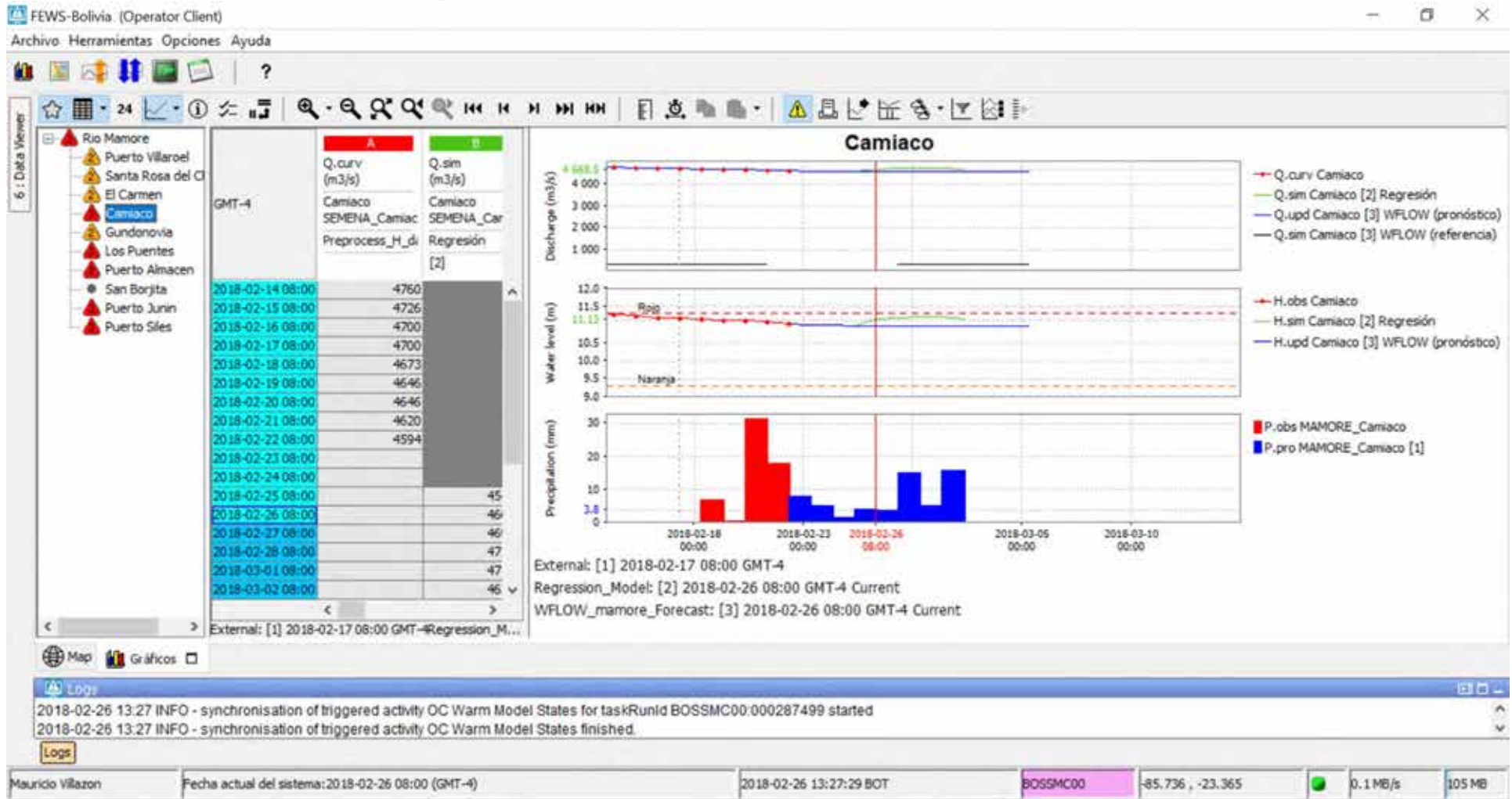
Climate change scenarios

Global Climate
Model

Regional Climate
Model



Forecast system





Thanks

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