



ANDEX *Hydroclimate Research Program*

Climate, and hydrology along the Andes cordillera

Santiago Meeting, 22-24 of October 2018

Sharing the experience of the joint laboratory Great Ice

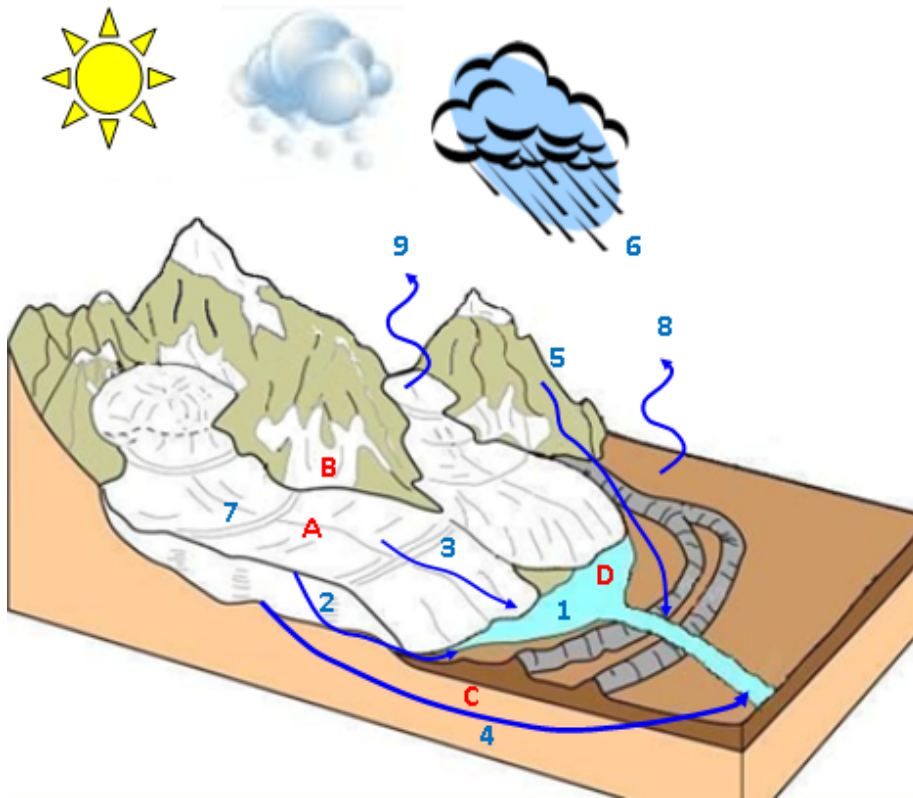
Thomas Condom et al. (IRD, Grenoble , France)

thomas.condom@ird.fr



Glaciers , Water Ressources in the Tropical Andes : Environnemental Changes

Directors : Marcos Villacis (EPN, Quito, Ecuador) & Thomas CONDOM (IRD, Grenoble, France)



WATER FLUXES

- 1 - Proglacial
- 2 - Infraglacial
- 3 - Subglacial
- 4 - Subteranean
- 5 - Superficial
- 6 - Solid/liquid precipitation
- 7 - Ice/Snow melting
- 8 - Evaporation/ evapotranspiration
- 9 - Sublimation

STORAGE :

- A** - Glacier
- B** - Snow cover
- C** - Soils/aquifers
- D** - Lakes/rivers

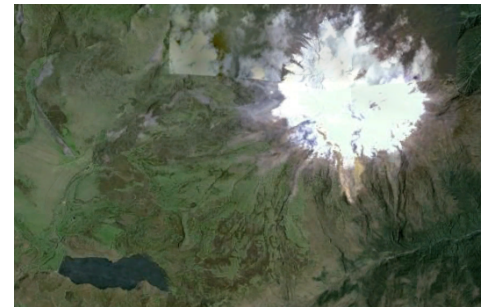
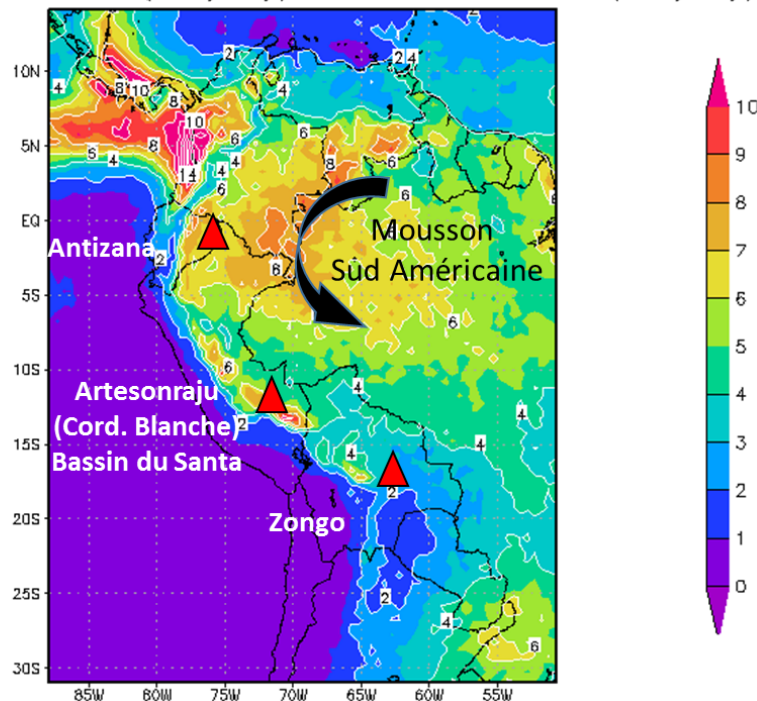
... to investigate the glacier evolution in the tropical Andes and the hydrologic response

(Topic 1) Quantitative evaluation of the glacier state (past/present/future)

(Topic 2) Energy balance and control on the mass balance – Link between regional scale vs local scale – Climate variability and its impact on the glacier functioning

(Topic 3) Impact of the glacier shrinkage over the hydrological functioning of mountainous catchments - Impact of glacier changes on terrestrial and aquatic biodiversity.

Shaded-TCC Annual(mm/day) Contour-TCC Annual(mm/day)



Climatology (1998-2012)

The objectives are to:

- (i) strengthen glaciological studies and monitoring networks in the tropical Andes
- (ii) promote collaborative projects between Andean institutions
- (iii) develop education and student training programs with local universities (from graduate to PhD students)

Membres permanents (> 0,3 équivalent temps plein) // Miembros permanente (>0.3 equivalente tiempo lleno) :

Nom//Apellido	Prénom/Nombre	Statut/Grado	Institution de rattachement//Institucion	Pays d'affectation de afectacion
Anthelme	Fabien	Chercheur IRD	AMAP	Colombie
Basantes	Ruben	Contractuel	EPN	Equateur
Biron	Romain	IE IRD	IGE (Grenoble)	France
Cáceres	Bolívar	Chercheur	INAMHI (Equateur)	Equateur
Cauvy-Fraunié	Sophie	Chercheuse	IRSTEA – Lyon	France
Ceballos	Jorge	Chercheur	IDEAM	Colombie
Cochachin	Alejo	Directeur	UGRH-ANA	Pérou
Condom	Thomas	Chercheur IRD	IGE	France
Crespo	Veronica	Esneignante-Chercheuse	PUC	Equateur
Dangles	Olivier	Chercheur IRD	Détachement à Cornell University	USA
Davila	Luzmila	Ingénieur	INAIGEM	Pérou
Espinoza	Jhan Carlo	Chercheur IRD	Programme MOPGA-IGE (Grenoble)	France
Gomez	Jesus	Ingénieur	INAIGEM	Pérou
Jomelli	Vincent	Chercheur CNRS	Paris Meudon	France
Junquas	Clémentine	Chercheur IRD	IGE	France
Lavado Casimiro	Waldo	Chercheur	SENAMHI	Pérou
Maisincho	Luis	Enseignant - Chercheur	IKIAM	Equateur
Mejia	Juana	Ingénieur	UMSA	Bolivie
Manciat	Carla	Enseignante - Chercheuse	EPN	Equateur
Mendoza	Javier	Enseignant-Chercheur	UMSA	Bolivie
Morera	Sergio	Chercheur	IGP	Pérou
Ginot	Patrick	Ingénieur de Recherche	IGE	France
Rabatel	Antoine	Physicien Adjoint	IGE	France
Sicart	Jean Emmanuel	Chercheur	IGE	France
Silva	Yamina	Chercheuse	IGP	Pérou
Soruco	Alvaro	Enseignant-Chercheur	UMSA	Bolivie
Suarez	Wilson	Chercheur	SENAMHI	Pérou
Takahashi	Ken	Chercheur	SENAMHI	Pérou
Villacis	Marcos	Enseignant-Chercheur	EPN	Equateur

Membres non-permanents :

Nom//Apellido	Prénom/Nombre	Statut/Grado	Institution de rattachement//Institucion	Pays d'affectation de afectacion
Autin	Philmémon	Doctorant	IGE (Grenoble)	France
Francou	Bernard	Chercheur émérite	IGE (Grenoble)	France
Ruiz	Jean Carlos	Doctorant	IGE (Grenoble)	France
Segura	Hans	Doctorant	IGE (Grenoble)	France
Ramseyer	Victor	V.I.	IGE (Grenoble)	Bolivie

More than 30 permanent Engineers/Scientists

9 Universities or National Institute from 4 countries

Colombia, Ecuador, Peru, Bolivia, France

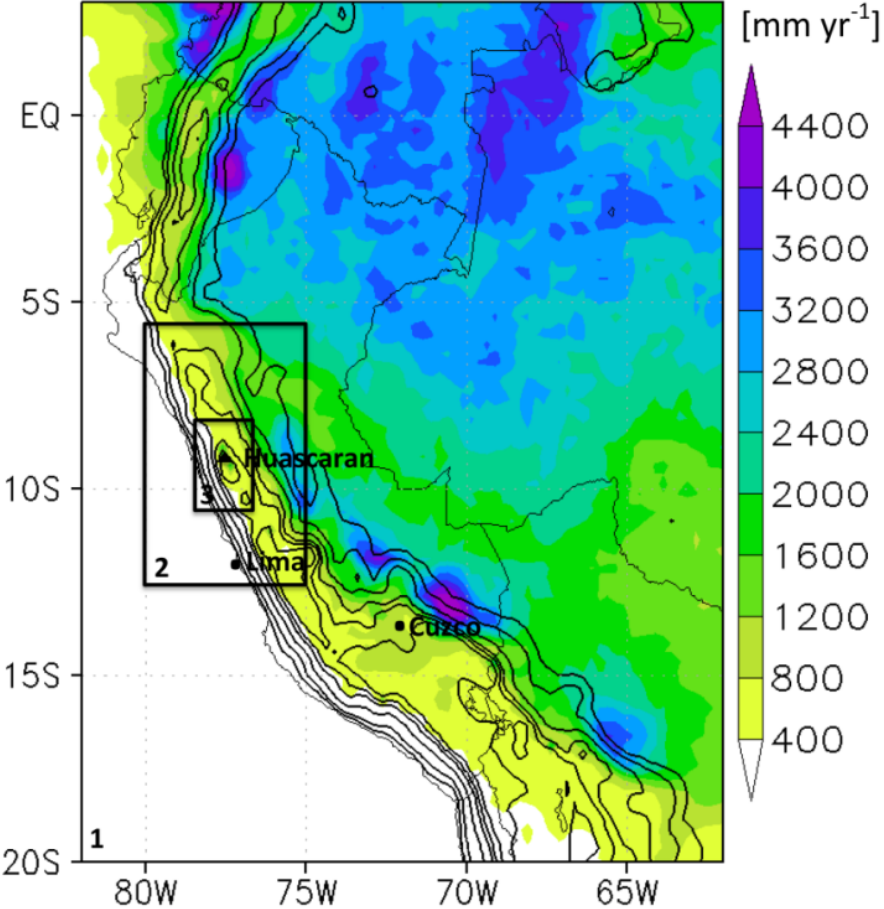
Since 2015 :

- 14 master degree (12 issued from Andean countries)
- 6 PhD (4 students from Andean countries)
- 35 publications

A hourly precipitation grid for the tropical Andes

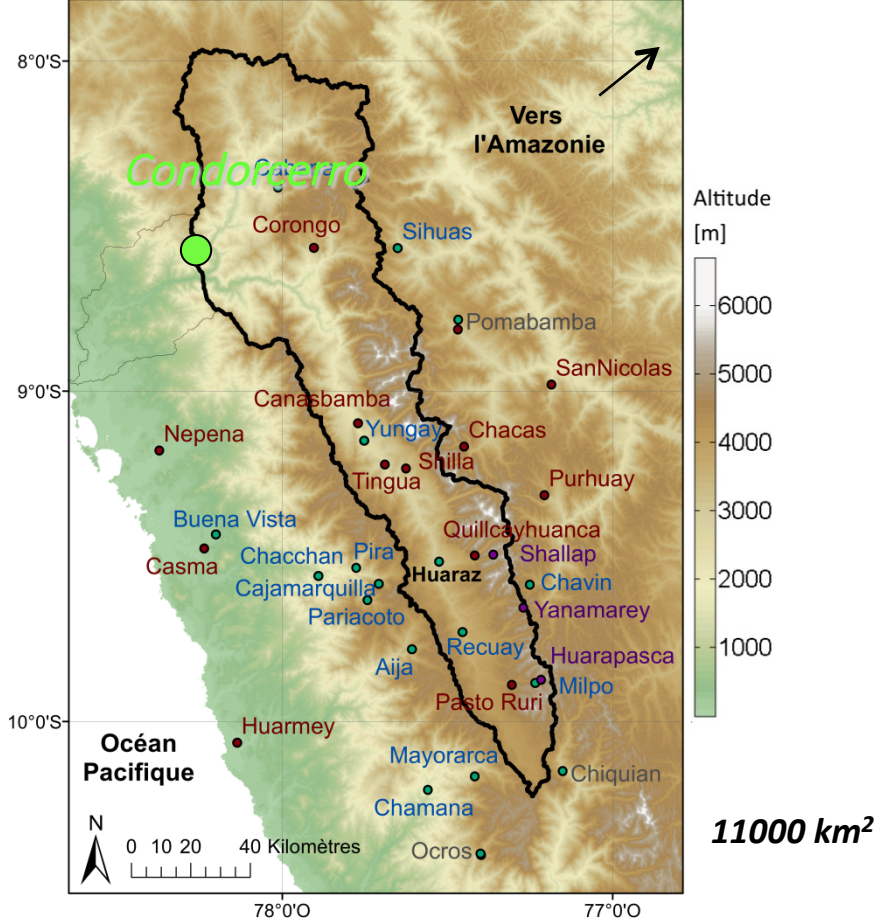
Atmospheric model WRF

Simulations WRF (2012/2013) – C. Junquas
One-Way nesting (analyses NCEP-FNL)
DX=27 km / 9 km / 3 km



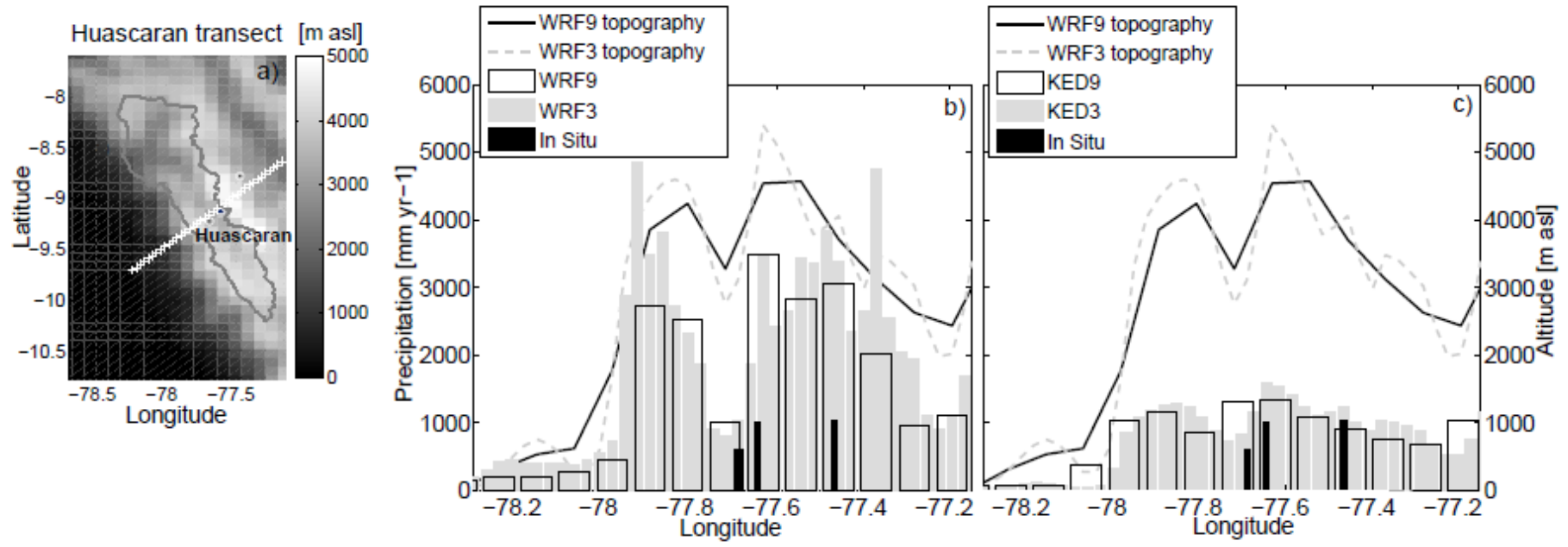
In-situ : Stations

18 SENAMHI : daily data
3 UGRH : hourly data
16 UNASAM : hourly data



An example....

A hourly precipitation grid for the tropical Andes

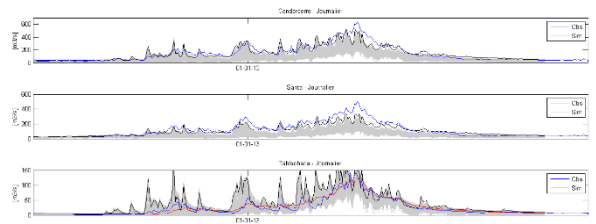


Mourre et al, 2015

Daily Précipitations

- KED (Altitude)
- KED (Annual amount of Précipitation WRF)
- Diurnal cycle from WRF

Hourly grid product



Hydro-glaciological modelling

Weaknesses // Challenges :

A lot of institutions, different countries with different development states

Link society / Science complicated to reach

There is not one “Andean Institute” Justification for the ANDEX Project

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Main Questions still remains

Local ↔ *Regional*

In-situ – Remote sensing data – Model data

Model : different complexity – Parametrization

Quantity ↔ Quality

Sediments

Pollution

Stationary ↔ Transient

Land use changes

Spatio-temporal variability of the precipitation

Diurnal cycle and impact on the hydrological functioning