WORLD METEOROLOGICAL ORGANIZATION GCW-CNSA-1 / Doc. 3.1.2

GLOBAL CRYOSPHERE WATCH (GCW)
CryoNet South America Workshop
First Session

Santiago de Chile, Chile
27-29 October 2014

Date: 20 October 2014

AGENDA ITEM: 3.1

Original: SPANISH

CRYOSPHERE ACTIVITIES IN SOUTH AMERICA

Bolivia

(Submitted by Alvaro Soruco)

Summary and Purpose of Document

This document provides a short description of cryospheric measurements and research programs conducted in Bolivia.

Summary

Short description of the site or program

The glaciological program NGT (Neiges et Glaciers Tropicaux) started in Bolivia in 1991, focused on the monitoring of two glaciers of the 1826 glaciers of Bolivia (592km^2). Since 1997, the glaciological program NGT changed to GREATICE (Glaciers et Ressources en Eau des Andes Tropicales – Indicateurs Climatiques et Environnementaux). The monitored glaciers in the Cordillera Real are Zongo Glacier representing the big glaciers (Area > 0.5 km^2), and Chacaltaya Glacier (replaced by Charquini Sur Glacier in 2002) representing the small glaciers (area < 0. 5km^2). Zongo Glacier is part of the GLACIOCLIM observatory since 2002.

Who sponsors your measurements (a national agency, a university, private company)

1. *IRD (Institut de Recherche pour le Développement) – from 1991 to 2014.*

2. *UMSA University (Universidad Mayor de San Andres) – from 1991 to 2014.*
3. *SENAMHI – National Institution (Servicio Nacional de Meteorologia e Hidrologia) – from 1991 to 2014.*
4. *COBEE – Private Company (Compañía Boliviana de Energia Electrica – from 1991 to 2005.*

What national or international networks you are already part of, if any

1. *GLACIOCLIM Observatory - France (Les Glaciers un Observatoire du Climat) (only Zongo Glacier is part of this network). This observatory is a permanent structure funded by the French Ministry of Research, the French National Center of Investigation (CNRS) and the French Institute for Research and Development (IRD).*
2. *World Glacier Monitoring Service - Switzerland (detailed information for Zongo Glacier and Chacaltaya Glacier and basic information for Charquini Sur Glacier).*

Which components of the cryosphere you measure (snow, glaciers, sea ice, etc.)

1. *Glacier monitoring – from 1991 to 2014.*
    a. *Mass balance monitoring from glaciological and hydrological methods (monthly measurements). Surface energy balance monitoring (measurements of the meteorological variables on the glacier and on the lateral moraine).*
    b. *Geodetic mass balance by optical remote sensing (decadal measurements).*
    c. *Cartography of the bedrock using GPR measurements*
    d. *Glaciers surface flow velocity using annual DGPS measurements*
    e. *Glaciers tongue topography using annual DGPS measurements*
2. *Water resources monitoring and management – from 1991 to 2014.*
3. *Ice core measurements (sporadic measurements, ex. Illimani and Sajama ice caps)*
4. *Reconstruction of glacier fluctuations from moraine dating (for the Little Ice Age on a dozen of glaciers, since the early Holocone on two glaciers)*
5. *Rock glaciers – (sporadic measurements, Caquella rock Glacier).*

Outlook for your site: will it be sustained for the long-term or is it a short-term site?

1. *The glaciological program for Zongo and Charquini Sur glaciers are funded until 2020.*

How could CryoNet help meet your national, regional or global interests?

1. *Developing scientific meetings between researchers.*
2. *Providing access to satellite data for scientific purposes.*
3. *Providing standards of measurements.*

2. What could you or your organization contribute to the implementation of CryoNet?

1. *Cooperation on scientific skill of our team (methodologies and experiences).*
2. *Provide published data for scientific purposes.*

3. What do you see as the benefits of CryoNet: (e.g. for operational and research network operators, scientific and decision/policy making community, environmental monitoring and modelling, scientists, satellite data providers, etc.)?

1. *Obtaining a label that would help to continue to get supports from the national agencies sustaining our glacier monitoring*
2. *Helping obtaining satellite data from different providers.*
3. *Scientist's cooperation (cooperation between expertise teams).*
4. *Training of scientist on expertise teams.*
5. *Scientific decision community.*

4. What do you see as existing gaps in cryospheric observations (e.g. thematic, spatial, temporal, availability, exchange, data policy, etc.) and how might CryoNet address these?

1. *Spatialized measurements.*
2. *Mass balance data homogenization.*
3. *Verification of mass balance time series by independent methods (ex. volumetric method).*
4. *Glacier energy balance modelling.*
5. *Glacier dynamics characterization.*

5. Please prioritize CryoNet activities according your personal view (indicate HIGH/MEDIUM/LOW for each)

Establishment of CryoNet network: ***HIGH***

Standards, guidelines and training for observations: ***HIGH***

Inter-comparison experiments (e.g. sensors, methods): ***HIGH***

Cooperation with existing networks: ***MEDIUM***

Data policy on archiving, accessibility and exchange: ***HIGH***

Support national needs: ***LOW***

6. Please share any other thoughts for participants to consider at the meeting.

B. Site Questionnaire

In order to have site information readily available at the workshop, it would be helpful if you could complete our Global Cryosphere Watch Site Questionnaire. It is an online form for providing many details on your site and what you measure. It also serves as an "application" to become a GCW site, if desired. The questionnaire is at

http://globalcryospherewatch.org/cryonet/questionnaire/

CRYONET Site Questionnaire

If you operate one or more sites, please complete the tables below. If you already have a site description in another format, feel free to submit that instead.

Site specific metadata:
Name of site: ZONGO GLACIER
Latitude/Longitude/Altitude: **16°15' S / 68°10' W / Altitude between 6000 and 4900 m a.s.l.**
Landscape type (e.g. arctic coastal, tundra, alpine…): **Alpine**
Onsite technical staff: **2 AWS (one on the glacier, one outside), ablation stakes network**
All-year round observations y/n: **YES** Year established: **1991**
Link to website if available: **http://www-lgge.ujf-grenoble.fr/ServiceObs/SiteWebAndes/index.htm**
Station manager (Email): **rabatel@lgge.obs.ujf-grenoble.fr**
Organisation in charge of station: **IRD (France) + UMSA (Bolivia)**
Other information

Monitoring of the atmosphere:
Solid precipitation: **YES** Snowfall: **YES**
Trace gases: **YES at the close GAW Chacaltaya observatory**
Aerosols: **YES at the close GAW Chacaltaya observatory**
UV, stratospheric ozone: **YES at the close GAW Chacaltaya observatory**
Radiation (longwave, shortwave): **YES**

Others:	**Temperature, Humidity, Wind**

Snow cover

Physical parameters: **YES (daily photagraphs)**

Chemical parameters:**NO**

Others:

Glaciers and ice caps

Mass balance (measured parameters): **YES (monthly measurements in the ablation zone)**

Ice flow (measured parameters): **YES (yearly measurements of surface flow velocity with DGPS)**

Basal water pressure (measured parameters): **NO**

Others: **Contour line of the glacier tongue (measured yearly with a DGPS)**

Mapping of the bedrock by RADAR measurements

Sea ice

Mass balance (measured parameters):

Meteorology: radiation, air temperature, humidity, wind speed and direction, air pressure (measured parameters):

Snow on ice (measured parameters):

Ice chemistry (measured parameters):

Others:

Permafrost

Borehole measurements (measured parameters):

Meteorology: radiation, air temperature, humidity, wind speed and direction, air pressure (measured parameters):

Snow on ground (measured parameters):

Active layer thickness (measured parameters):

GST:

Others:

Ice sheet

Mass balance (measured parameters):

Meteorology: radiation, air temperature, humidity, wind speed and direction, air pressure (measured parameters):

Snow on ice (measured parameters):

Ice chemistry (measured parameters):

Others:

Other measurements (hydrological, ecological, oceanographic, etc)

Hydrology (measured parameters): **YES (streamflow measurements)**

Ecology (measured parameters): **YES (plant species colonization on the proglacial margin)**

Oceanography (measured parameters):

Other thematic linkages:

Linkages to satellite data (describe validation programs, applications of satellite data, etc.)

Glacier volume changes computed by aerial photogrammetry (1956, 1963, 1975, 1983, 1997, 2006)

Equilibrium-line altitude measurements using satellite images

Participation in international monitoring programmes such as GAW, GTN-G, GTN-P, ….

Networks and start of contribution:

French glacier observatory: GLACIOCLIM

World Glacier Monitoring Service

Atmospheric and Aerosol monitoring: Regional GAW Chacaltaya station