



CORDEX Empirical Statistical Downscaling (ESD): Overview

Maria Laura Bettoli

**CORDEX Central America and South America
Training Workshop on Downscaling Techniques
La Paz, Bolivia, June 25-27 2018**

CORDEX AND CORDEX-ESD

CORDEX is a well established program of the WCRP that was launched in 2009

CORDEX AND CORDEX-ESD

CORDEX is a well established program of the WCRP that was launched in 2009

The RCM community is globally organized and connected via CORDEX.

CORDEX AND CORDEX-ESD

CORDEX is a well established program of the WCRP
launched in 2009

However, for different reasons, the ESD
community lacks global coordination.

The RCM community is globally
organized and connected via CORDEX.

CORDEX AND CORDEX-ESD

CORDEX is a well established program of the WCRP launched in 2009

The RCM community is globally organized and connected via CORDEX.

However, for different reasons, the ESD community lacks global coordination.

It is important for the ESD community to organize itself and progress toward a framework compatible with CORDEX-RCM development.

CORDEX-ESD

ESD methods are recognized as of **equivalent skill with different advantages** (some of special relevance to adaptation issues) and **also different shortcomings compared to using RCMs**.

CORDEX-ESD

ESD methods are recognized as of **equivalent skill with different advantages** (some of special relevance to adaptation issues) and **also different shortcomings compared** to using RCMs.

However, **ESD's potential** has not been explored as substantially or as systematically as that of RCMs, creating a gap in overall assessment for the application of downscaling by the impacts and adaptation communities.

CORDEX-ESD

ESD methods are recognized as of **equivalent skill with different advantages** (some of special relevance to adaptation issues) and **also different shortcomings compared** to using RCMs.

However, **ESD's potential** has not been explored as substantially or as systematically as that of RCMs, creating a gap in overall assessment for the application of downscaling by the impacts and adaptation communities.

CORDEX-ESD was launched in 2013

CORDEX AND CORDEX-ESD

A series of three workshops with broad participation from the international ESD community was organized.



Trieste, Sept 2013

CORDEX AND CORDEX-ESD

A series of three workshops with broad participation from the international ESD community was organized.



Trieste, Sept 2013



Buenos Aires, Jul 2014

CORDEX AND CORDEX-ESD

A series of three workshops with broad participation from the international ESD community was organized.



Trieste, Sept 2013



Buenos Aires, Jul 2014



Cape Town, Jun 2015

CORDEX AND CORDEX-ESD

A series of three workshops with broad participation from the international ESD community was organized.



These workshops helped to stimulate and coordinate initial discussions regarding CORDEX-ESD organization and activities.

CORDEX-ESD

As a first coordinated activity, a prototype experiment was designed:

- for La Plata Basin
- to encourage collaboration and coordinate an inter-comparison of methods.

Protocols for CORDEX ESD Experiment 1

This protocol document defines the initial experimental framework for the ESD counterpart to the RCM activities within the CORDEX programme.

Please register for CORDEX ESD Experiment 1 at the following URL:

<http://www.csag.uct.ac.za/cordex-esd/>

General Concept

The CORDEX-ESD Experiment 1 is a method evaluation experiment; that is, it focuses on the historical period¹ and does not use data from GCM climate change simulations². The experiment seeks to engage as broadly as possible with the ESD community and provide opportunities to address dual objectives: characterizing optimal ESD skill under the constraints of intended transferability to using GCM predictors, and exploring the ESD limits in resolving the signal of the large-scale conditioning of local scale climate.

More specifically, the primary objectives are:

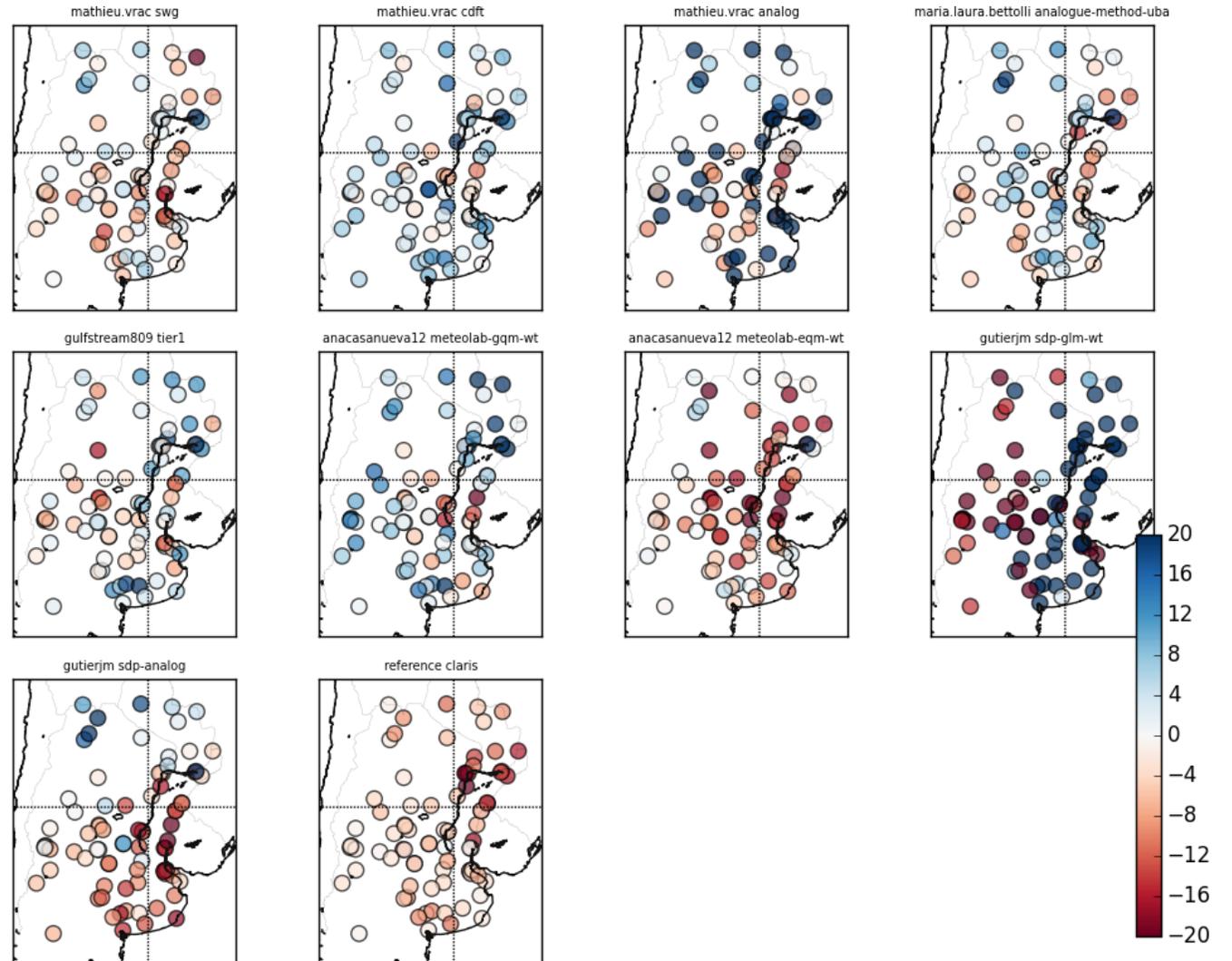
- (1) to delineate the relative skill attributes of different statistical downscaling approaches when applied to a common source of predictors and predictands, and
- (2) to assess the added-value³ that ESD can provide from coarse scale predictor fields taken from GCMs.

With that in mind, the protocol permits a relatively straightforward application of an ESD method with the intent to include participation from as many of the ESD community as practical. The protocol gives flexibility in the choice of predictor variables within the limits

CORDEX-ESD

As a first coordinated activity, a prototype experiment was designed:

- for La Plata Basin
- to encourage collaboration and coordinate a inter-comparison of methods.



Tier 1 monthly mean rainfall

CORDEX-ESD

As a result of these activities and discussions a CORDEX-ESD Reference Document establishing its mission, objectives, organization and mid-term plans was developed.

Reference Document on CORDEX-ESD Mid-term Plans

Authors

Douglas Maraun, Bruce Hewitson, Bill Gutowski, Rasmus Benestad, Maria Bettolli, Chris Jack, Bertrand Timbal, Tannecia Stephenson, Jose Gutiérrez, Tristan Hauser, Katherine Hayhoe, Radan Huth, Frank Kreienkamp, Willem Landman

Background

There is a growing demand for plausible, defensible and actionable region-specific information on potential future climate change. Such information might be obtained from various sources, including raw projections from global coupled atmosphere ocean general circulation models (in the following GCMs), dynamical downscaling of GCM projections (in the following RCMs) , and statistical downscaling (often called empirical statistical downscaling, ESD) including classical perfect prognosis approaches and the so-called bias correction of GCM and RCM projections. All downscaling approaches suffer from a range of shortcomings and limitations. For statistical downscaling a variety of methods and sub-methods exist, each designed for different purposes and user problems, often without clearly formulating and testing the underlying assumptions.

CORDEX-ESD: Mission and Objectives

The mission of CORDEX-ESD is to **guide and coordinate** the development, validation and use of statistical downscaling methods, and also to **contribute to the generation and interpretation** of region-specific climate change projections.

CORDEX-ESD: Mission and Objectives

The specific objectives of CORDEX-ESD are:

- to foster communication, collaboration and coordination within the ESD community,
- to improve collaboration with the RCM and GCM communities and with stakeholders;
- to produce an authoritative description of a technique family tree;
- to develop a framework for ESD studies;
- to develop a protocol for validation of regional climate projections and assessment of added value, with a focus on statistical downscaling and correction methods;
- to contribute to a framework for high-end regional climate change studies, including CORDEX Flagship Pilot Studies (FPS) and WGRC Frontiers of Climate Information (FOCI) projects;
- to contribute to the international archives of regional projections (e.g. Copernicus.eu);
- to provide cohesion across the ESD community towards major scientific questions

CORDEX-ESD: Organization

CORDEX-ESD is currently organized as an ad-hoc global community, coordinated by an executive committee.

CORDEX Central America and South America Training Workshop on Downscaling Techniques La Paz, Bolivia, June 25-27 2018

CORDEX-ESD: Organization

CORDEX-ESD is currently organized by an executive committee.

ains/cordex-esd/

The screenshot shows the website for CORDEX-ESD. The navigation bar includes links for Home, About, Domains, Experiment Guidelines, Data access, News & Events, and Publications. The main content area is titled 'Cordex ESD' and features a section for 'Experiment protocol – Empirical statistical downscaling' with a list of links: ESD Overview, ESD Background, ESD Experiment1 protocols, ESD Reference Document, and Register for CORDEX ESD Experiment 1. Below this is a list of 'SAT responsible and point of contact' with names and email addresses: William Gutowski (Iowa State University, USA), Bruce Hewitson (University of Cape Town, South Africa), Rasmus Benestad (Norwegian Met Service, Norway), Maria Laura Bettolli (University of Buenos Aires, Argentina), Chris Jack (University of Cape Town, South Africa), and Douglas Maraun (Wegener Center for Climate and Global Change). To the right, there is a 'CORDEX DOMAINS' section listing 14 regions from South America to South-East Asia.

Cordex ESD

Experiment protocol – Empirical statistical downscaling

- ESD Overview
- ESD Background
- ESD Experiment1 protocols
- ESD Reference Document
- Register for CORDEX ESD Experiment 1

SAT responsible and point of contact:

- **William Gutowski** – Iowa State University, USA
gutowski (at) iastate.edu
- **Bruce Hewitson** – University of Cape Town, South Africa
hewitson (at) csag.uct.ac.za
- **Rasmus Benestad** – Norwegian Met Service, Norway
rasmus.benestad (at) met.no
- **Maria Laura Bettolli** – University of Buenos Aires, Argentina
bettolli (at) at.fcen.uba.ar
- **Chris Jack** – University of Cape Town, South Africa
cjack (at) csag.uct.ac.za
- **Douglas Maraun** – Wegener Center for Climate and Global Change
douglas.maraun (at) uni-graz.at

CORDEX DOMAINS

Domains

- CORDEX domain description
- Cordex ESD
- Domain Activities 2017/2018
- Region 1: South America
- Region 2: Central America
- Region 3: North America
- Region 4: Africa
- Region 5: Europe (EURO)
- Region 6: South Asia
- Region 7: East Asia
- Region 8: Central Asia
- Region 9: Australasia
- Region 10: Antarctica
- Region 11: Arctic
- Region 12: Mediterranean (MED)
- Region 13: Middle East North Africa (MENA)
- Region 14: South-East Asia (SEA)

CORDEX-ESD: Ongoing activities

Design of the CORDEX-ESD CORE, which objective is to provide a downscaled climate data from a subset of CORDEX-ESD methods that are [consistently implemented for all continental regions](#), and which provide a completed matrix of GCM-ESD pairings.

Supporting regional ESD coordinated activities: for instance [the outcomes of this workshop!](#)

CORDEX-ESD: Ongoing activities

THANK YOU!!