CORDEX Scientific Vision

To advance and coordinate the science and application of regional climate downscaling through global partnerships

Goals:

- To better understand relevant regional/local climate phenomena, their variability and changes, through downscaling.
- To evaluate and improve regional climate downscaling models and techniques
- To produce coordinated sets of regional downscaled projections worldwide
- To foster communication and knowledge exchange with users of regional climate information

CORDEX – Scientific Challenges

✧ Added value

Internal variability & added value as functions of scale; Bias correction uncertainties and consistency; User-oriented metrics

✧ Human element

Coupling of regional climate and coastal megacities; Bridging with urban parameterisation development; Land use change

✧ Coordination of regional coupled modelling

Ocean-ice-atmosphere; Lakes; Dynamic land surface; Cryosphere; Natural fires; Atmospheric chemistry; Carbon cycle; Aerosols; Marine biogeochemistry

✧ Precipitation

Convective systems; Coastal storm systems; MJO/Monsoon

✧ Local wind systems

Wind storms; Strong regional winds; Wind energy

WCRP CORDEX

CORDEX – Scientific Challenges

✧ Added value

Internal variability & added value as functions of scale; Bias correction uncertainties and consistency; User-oriented metrics

1. How do we define added value?
2. What are physical measures of added value (added processes, accuracy of added processes, geographical features relevant to the processes)?
3. What are statistical measures of added value?
4. How does AV vary with spatial and temporal scale?
5. What are sufficient observations to evaluate AV?
6. How can we determine the AV in climate change?
7. How does internal variability affect added value, perhaps masking it at fine scales?
8. Can any or some types of bias correction improve added value? Or can they degrade AV?
9. How does AV depend on resolution?
10. Can AV be found only in higher order statistics (e.g., correlations, variances, high extreme events, etc.) or also in basic statistics such as seasonal means?
11. How much should downscaling correct large-scale biases in GCMs and can such a correction be called AV?

CORDEX – Scientific Challenges

✧ Human element

Coupling of regional climate and coastal megacities; Bridging with urban parameterisation development; Land use change

Mega-cities - Issue to be considered:

- What resolution is required for RCMs to make a useful contribution
- Are there ESD approaches which are relevant? Do the observations exist?
- Often mega-cities are coastal: facing concurrent climate pressure and risks
- Accounting for remote sources of city resources
- Parameterization schemes relevant to urban centres for dynamical downscaling

Land usage and changes - Issues to be considered;

- Impact of regional land change on regional and remote climate
- Impact of a warmer climate on land usage and productivity
- Local and remote effects of biomass burning
- Effect of LULCC on evaporation and evapotranspiration

Possible additional directions to consider:

Impact of human transportation on regional climate:

Regional impact for sea-level rise:

Impact of climate change on human health

CORDEX – Scientific Challenges

✧ **Coordination of regional coupled modelling**

- Ocean-ice-atmosphere
- Lakes
- Dynamic land surface
- Cryosphere
- Natural fires
- Atmospheric chemistry
- Carbon cycle
- Aerosols
- Marine biogeochemistry
- Wind storms
- Strong regional winds
- Wind energy

CORDEX – Scientific Challenges

✧ Precipitation

Convective systems

Coastal storm systems

MJO/Monsoon

(a) Large-scale organization of monsoon convective systems on sub-seasonal

(b) Flow dependent extreme precipitation events during the monsoon season

(c) Role of narrow mountains on orographic monsoon precipitation

(d) Monsoon and extra-tropical interactions during extreme precipitation events

(e) Heavy precipitation in meso-scale convective systems

(f) Interaction between MJO, Cold Surges and Borneo

(g) Roles of MJO in Precipitation diurnal cycles in the Maritime Continent

CORDEX – Scientific Challenges

✧ Local wind systems

Wind storms; Strong regional winds; Wind energy

1. How well does the regional downscaling replicate the pdf of observed wind speeds?
2. How well does the downscaling replicate the pdf of wind directions?
3. Can the downscaling replicate the flow characteristics of specific mesoscale phenomena? These include mesoscale convective systems, strong, localized downslope winds, such as the Bora, Chinook, etc., local mesoscale jets, strong, straight-line winds
4. How well do RCMs reproduce the main features of wind-storms occurring over specific regions?
5. How well do RCMs represent **wind** characteristics of monsoon systems?

6a. How does enhanced horizontal and vertical resolution improve the replicability of local wind phenomena?

7. Is there threshold resolutions in the horizontal and vertical that need to be achieved before local wind studies provide information that is useful for wind energy resource mapping?
8. Are there important teleconnective couplings of local wind phenomena (ENSO, SAM, NAO, etc.)?
9. Can RCMs replicate diurnal, seasonal and interannual characteristics of regional winds?
10. How can ESD methodologies contribute to regional wind studies?