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# The Global Weather, Climate and Water Enterprise: Helping to build Resilient Communities

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March 22, 2016

## STORY BOARD

- Climate Resilience
- WMO plays key enabling role
- Growing sense of urgency for action to address climate and weather extremes
- Focus on resilience through International Actions
- Climate Services
- Importance of Cooperation at all Levels



#### WHAT'S CLIMATE RESILIENCE?

- Capacity of socio-ecological system to adapt now and in the future...
- Successfully adapt to stressors while maintaining well being in face of adversity
- Adapt, reorganize, and evolve into more desirable configurations that improve the sustainability of the system, leaving it better prepared for future climate change impacts



### APPROACH TO CLIMATE RESILIENCE

- 1. Understanding Your Risk
- 2. Mainstreaming Risk Management within the Community
- 3. Fostering a Culture of Prevention and Response
- 4. Building Capacity to Effectively Prepare and Respond... now and in the future
- 5. Investing in Science and Technology to Underpin Success
- 6. Implementing Multi-Hazard Early Warning System... longer lead times to permit time to act
- 7. Being Ready!





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# WMO is a contributor...

 UN's Authoritative voice on state and behaviour of the atmosphere... weather, climate and water resources

 WMO enables its 191
 Members to be cost effective in providing meteorological, hydrological and related environmental services





Facilitates collaboration/cooperation for observations, data and knowledge exchange, setting standards and coordinating scientific and technical methods

#### WMO STRATEGIC PLAN 2016–2019

## PRIORITIES...

- High Impact Weather and Early Warning Systems
- Climate Services 5 sectors
- Integrated Global Observing System
- Aviation Meteorological Services
- Polar and High Mountains Regions
- Capacity Development
- Improved Governance





# **Urgency to Act...**

#### BEING COGNIZANT OF THE IMPLICATIONS OF THE CHANGING CONTEXT...

- A warming atmosphere, oceans and climate...
- Observed changes in Polar regions having significant impact on global weather patterns
- Increase in frequency and magnitude
   of extreme events

September 16, 2012

#### Trend in global average surface temperature



### Greenhouse gases concentrations: new record





Water vapour and  $CO_2$  are the major greenhouse gases, with  $CO_2$  the main driver of climate change. Water vapour changes largely happen as a response to the change in  $CO_2$ .



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# Global average temperature anomaly (1850 – October 2015)



# Global surface temperature anomalies 1950-2015



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# Global ocean heat content 1955-2015





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#### CLIMATE AND WEATHER EXTREMES ARE SIGNIFICANTLY IMPLICATING SOCIETY...



# Impacts of hydrometeorological and climatological hazards (1955–2014)



Epidemics and insect infestations are not included

Reduction of the number of victims thanks to greater effectiveness of early warning systems and prevention measures



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# Global Impacts of Hydrometeorological and Climatological Hazards(1970–2014)



- Climatological (droughts, wildfires), hydrological (floods, landslides), meteorological (extreme temperatures, storms)
- Geophysical (earthquakes, mass movements dry, volcanic activity)
- Biological (epidemics, insect infestations)





#### **GROWING SENSE OF URGENCY....** COMBINED EFFECT OF NATURAL AND ANTHROPOGENIC FORCING MAY GIVE RISE TO UNPRECEDENTED EXTREMES



Protecting society against extreme weather and climate induced events in the future requires predicting climate at regional and local scales







## WHAT IS SHAPING OUR CLIMATE RISKS?

- Where we live
  - migration to coasts/flood plains
  - increasing our *Exposure*
- How we live
  - urbanization and population
  - increasing our Vulnerability
- Rising (unmet) <u>Demands</u> for resources
  - Pressures on energy, food and water supply
  - challenging ecosystem services
- Our <u>Readiness</u> to adapt
  - understanding your risk
  - capacity now and in the future to adapt



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# International Actions for Strengthening Community Resilience to Extremes...

### "BUILD BACK BETTER"

#### Priorities for Action...

- Understanding Disaster Risk
- Strengthening Risk
   Governance to Manage DR
- Investing in DRR for Resilience
- Enhancing Disaster
   Preparedness for Effective
   Response and Recovery,





WMO weather, climate and water enterprise contributes to almost all of these goals, especially 3, 6, 9 and 11

# PARIS... COP 21

# December 12, 2015: 195 countries adopted the Paris Climate Agreement, a historic agreement to combat climate change.

- Widely recognized that the earth's atmosphere is growing warmer due to GHG emissions generated by human activity.
- Confirms a target of keeping the rise in temperature below 2°C preindustrial levels and establishes that we should be aiming for 1.5°C.
- Addresses mitigation, adaptation and minimizing loss and damage.
- Paris Agreement, Article 7.7(c): Parties should strengthen their cooperation on enhancing action on adaptation, with respect to strengthening scientific knowledge on climate, including research, systematic observation of the climate system and early warning systems, in a manner that informs climate services and supports decision-making.



**PARIS 2015** 



# COP21- CMP11 PARIS 2015 UN CLIMATE CHANGE CONFERENCE

# WMO Worked with Members at COP21

- Maintaining and strengthening climate observations including of GHG concentrations
- Climate services for mitigation (energy)
- Climate services for adaptation
- Reduced loss and damage through DRR
- Development and application of climate knowledge
- Strengthening the WMO network's role in the above using climate finance

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# COP21- CMP11 PARIS 2015

# Climate Risk Early Warning Systems (CREWS)

More than US\$80 million to equip up to 80 countries (SIDS / LDCs) with better CREWS.

### • CREWS:

- will generate and communicate impact-based early warnings and deliver risk information for hazardous hydro-meteorological and climate events.
- can reduce loss of life and economic hardship caused by meteorological hazards.



### EFFECTIVE MULTI HAZARD EARLY WARNING SYSTEMS...

To provide extra lead time to alert and prepare

Effective EWS include four components:

- 1. Detection, monitoring and forecasting the hazards;
- 2. Analysis of risks involved;
- 3. Dissemination of timely and authoritative warnings; and
- 4. Activation of emergency preparedness and response plans.



### EFFECTIVE MULTI HAZARD EARLY WARNING SYSTEMS...

- Root in sound science and technological advances
- Impact-based weather, water and climate service over varying time scales, to reduce vulnerability in a changing climate.
- Information that can be acted on (responsive to users needs)
- Integrated weather, water and climate information across borders
- Effective access and dissemination mechanisms



#### **Global Framework for Climate Services (GFCS)**

- GFCS provides a coordination mechanism building on existing initiatives and infrastructure in support of decision-making in climate sensitive sectors.
- To enable better management of the risks of climate variability and change and adaptation to climate change through the development and incorporation of sciencebased climate information and prediction into planning, policy and practice at global, regional & national scales.







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# Science is Ready for Supporting Climate Services...

# **Climate Services: Key Drivers**

#### **Delivering resilience and preparedness**

•Climate extremes are causing devastating socio-economic impacts.

# Supporting growth, responsible resource development and the green economy

•Climate change is recognized as an intensifying factor of climate variability <u>and</u> a source of uncertainty to climate-sensitive economic sectors.

#### Making wise choices for future adaptation

•Current trends indicate that the past is no longer a good indicator of the future.







Global total economic losses by decade and by hazard type in USD billions adjusted to 2011 (during the period 1970-2009 (Source: WMO and CRED, 2013)

# **Pre-requisites for Climate Services**

- Available
- Dependable
- Usable
- Credible
- Authentic
- Responsive and flexible
- Sustainable





# Climate Services: An Evolution in the Application of Climate Science



## **Climate Science is Ready....**

- Market' for Climate Services is emerging
- Climate service vs. weather service
- Need to:
  - understand user needs
  - manage expectations
  - make the socio-economic case
  - implement a framework for Climate Services at National. **Regional & Global Scales**

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#### Seamless Prediction and Early Warning Services

Forecast lead-time								
Observations and past data	Hour	Day	Week	Month	Season	Year	Decade	Century
							Mitigation policies	
							Infrastructure planning	
						Homeland & international security		
						Adaptation strategies		
						Regulator standards		
Climate vulnerability analysis					Financial & property portfolio risk management			
						Investmer	nt strategy	
				Aid agencies & international development				
					Market trading			
				Ma	intenance plann	ing		
Scenario planning					Insuran	ce/re-insurance	hazards	
				Resource planning: energy, water, food				
	Operation			ns planning				
	Di	sruption plannir	ng					
Weather warnings								
Emergency response								

## Weather-to-climate: seamless framework





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# Importance of Cooperation at all Levels

## **Regional Association-IV (RA-IV)**

- RA-IV Task Team for GFCS implementation has a thematic work plan:
  - Theme 1: Assessment of Climate Service Capacity
  - Theme 2: Regional Climate Centers
  - Theme 3: Regional Climate Outlook Forums
  - Theme 4: Research, Prediction and Tools



### North American Climate Services Partnership (NACSP)

Builds upon existing transboundary collaborations, enhances the co-production of user-driven products and services, and shares lessons learned.





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# What NACSP is doing, where it is going

#### **Recent accomplishments:**

Science-informed decision making
Improving place-based information
Sharing lessons learned

#### **Examples: 2016 Focus areas**

•Expanding and improving forecast information

 Developing transboundary heat and humar health information systems

Integrating drought and wildfire products







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# **Arctic - Integrated Science and Services**

# A unique territory calling for integrated actions

•Vast territory with distinctive climate zones and user requirements.

 Rapidly changing ecosystems with increased economic activities.



#### Scoping Workshop on Climate Services for Polar Regions (Geneva, Nov. 2015)

•Discussions to establish Polar Regional Climate Center (PRCC) networks for the Arctic, Antarctic and the 3<sup>rd</sup> Pole.







# **Arctic - Integrated Science and Services**

#### • WMO Polar Prediction Project (PPP) 2013-2022

To enable a significant improvement in environmental prediction capabilities for the polar regions and beyond.

WMO Polar Climate Predictability Initiative (PCPI)

Focuses on finding elements of the climate system that contribute to predictability.

International Ice Charting Working Group (IICWG)

Promotes cooperation between the world's ice centers on all matters concerning sea ice and icebergs.

 The North American Ice Service (NAIS)
 Canada-US partnership to deliver seamless ice information and services.









# Future of Climate Services: Unlocking the potential

- Increasingly complex:
  - science, modelling and prediction systems.
  - user requirements, requiring multi-disciplinary and multi-scale approaches.
  - Improve information for strategic dissemination of climate data in decision making.
- Partnerships in science and delivery are essential.
- Dialogue with end users is vital.



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# Not all hazards are this **easy to see...**

# ...what are you **not** prepared for?

### QUESTIONS