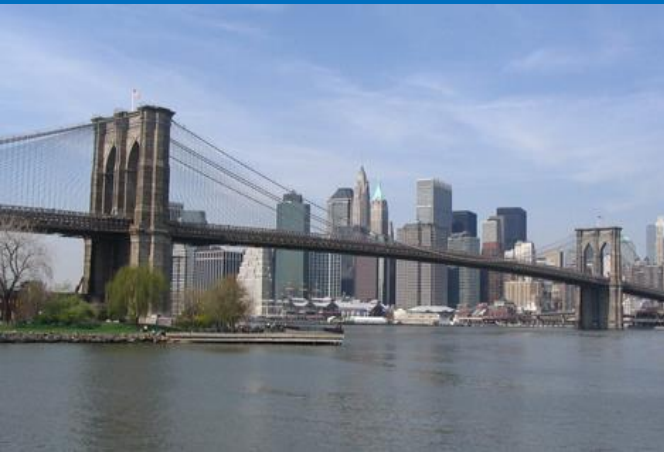# The Vulnerability, Impacts, Adaptation, and Climate Services (VIACS) Advisory Board for CMIP6

Building bridges between the Modeling and Applications communities

Co-Chairs: Alex Ruane[1,2] and Claas Teichmann[3]
and the VIACS Advisory Board

[1]*NASA Goddard Institute for Space Studies, New York City*
[2]*Columbia University Center for Climate Systems Research*
[3]*Climate Service Center, HZG, Hamburg*

US CLIVAR Summit, August 10th, 2017

VIACS Advisory Board - Overview

Designed to help form more coherent and productive link between the climate modeling community and users of CMIP6 outputs from the applications community.

➢ **Facilitates two-way communication around science and application goals:**
- construction of model scenarios and simulations
- informed use of model outputs
- design of online diagnostics, metrics, and visualizations of relevance to society.

Endorsed by CMIP6 and PROVIA

Vulnerability, Impacts, Adaptation

Charged with understanding how climate changes affect natural and human systems

- ➤ **VIA Sectors:**
  - ▪ Agriculture
  - ▪ Forestry
  - ▪ Energy
  - ▪ Water Resources and Hydrology
  - ▪ Oceans/Fisheries
  - ▪ Coastal
  - ▪ Biomes/Ecology
  - ▪ Urban
  - ▪ Health
  - ▪ Infrastructure/Transportation
- ➤ **Projects and Programs:**
  - ▪ TGICA, CORDEX, ICONICS
  - ▪ WCRP Working Group on Regional Climate
  - ▪ ISI-MIP, AgMIP, WaterMIP
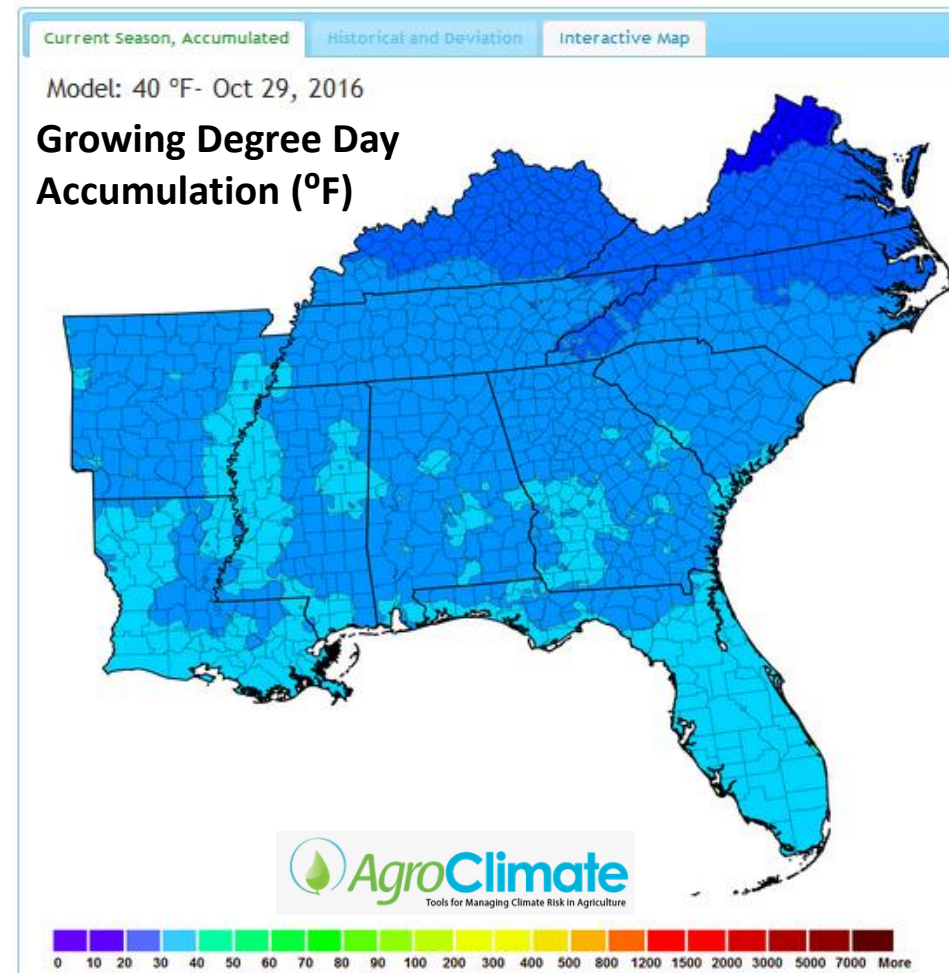 - ▪ Others…

Climate Services

Operationalizes climate and VIA information as user-oriented products and tools.

➢ **Climate Service Organizations:**
- Public Agencies
- Private Organizations
- Academic Institutions
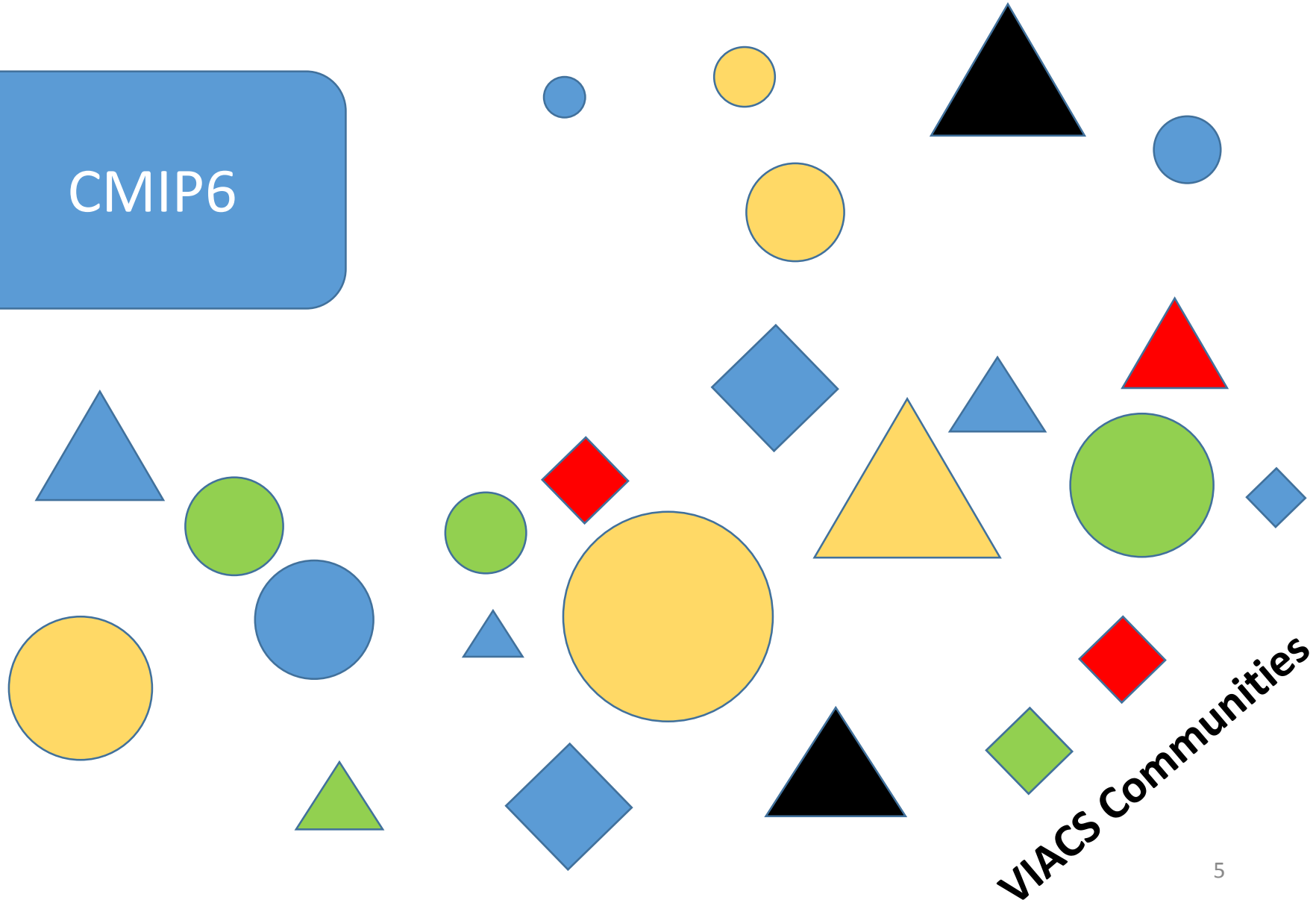
➢ **Projects and Programs:**
- Climate Services Partnership
- Global Framework for Climate Services
- Others…

Current Season, Accumulated | Historical and Deviation | Interactive Map

Model: 40 °F- Oct 29, 2016

Growing Degree Day Accumulation (°F)

AgroClimate
Tools for Managing Climate Risk in Agriculture

0 10 20 30 40 50 60 70 80 90 100 200 300 400 500 800 1200 1500 2000 3000 5000 7000 More

VIACS Community is Diverse and Largely Independent
Different regions, projects, sectors, scales, organization levels

CMIP6

VIACS Communities
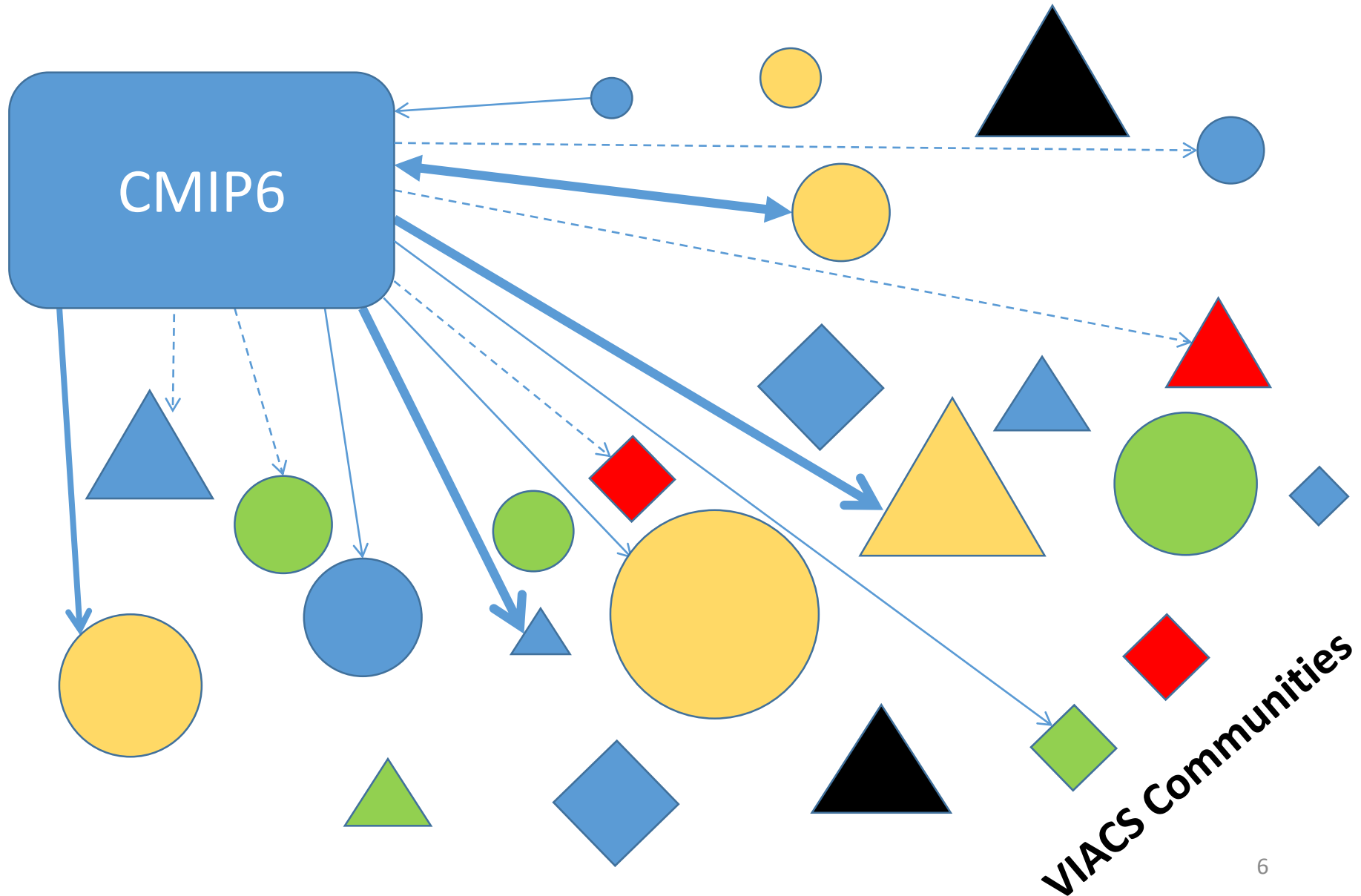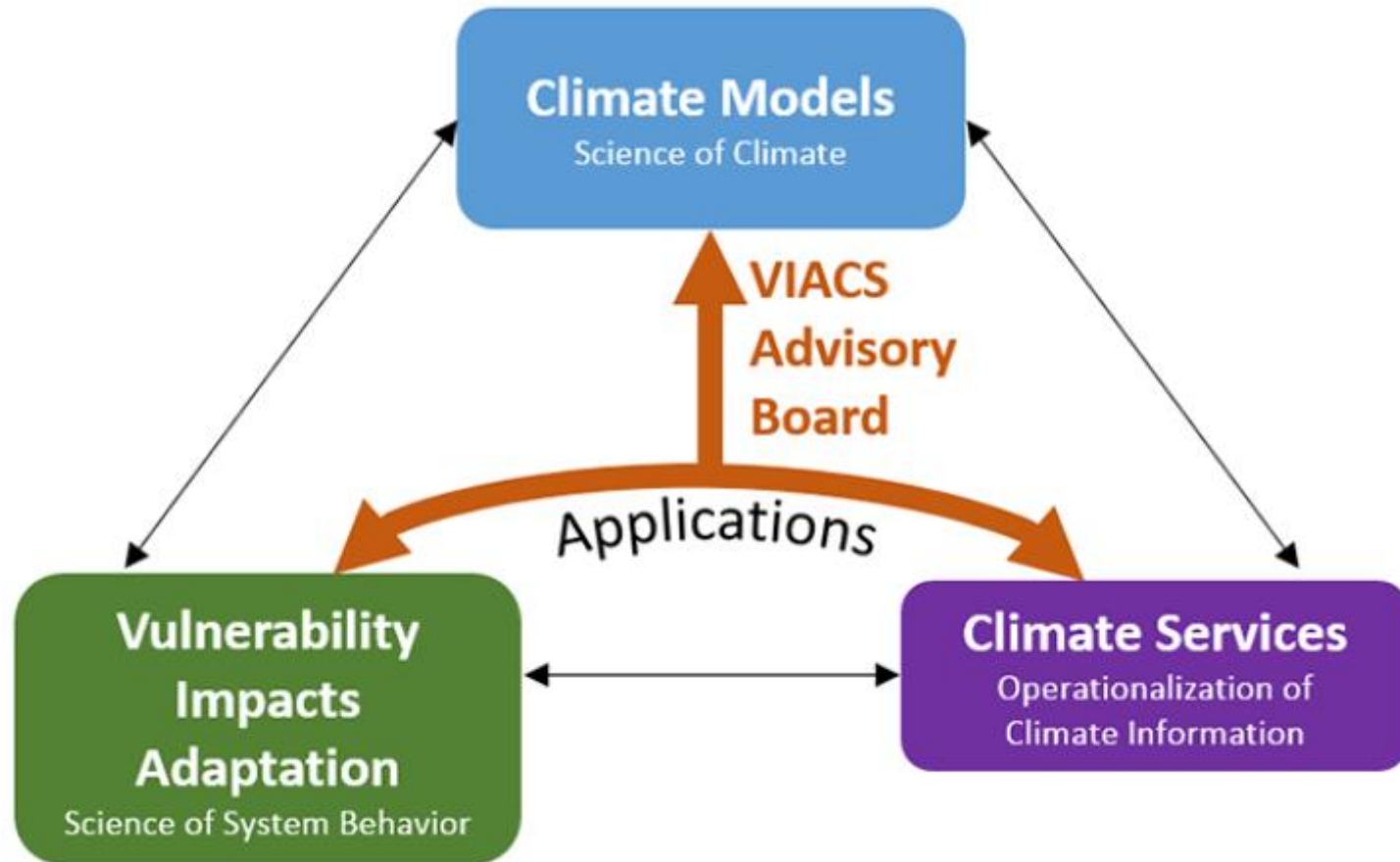
CMIP6

VIACS Communities

6

VIACS Advisory Board

Name	Community	Institution
Alex Ruane (co-chair)	*Agriculture/AgMIP*	NASA Goddard Institute for Space Studies, USA
Claas Teichmann (co-chair)	*Climate Services*	Climate Service Center, Hamburg, Germany
Nigell Arnell	*WaterMIP*	University of Reading, UK
Tim Carter	*TGICA*	Finnish Environment Institute (SYKE), Finland
Kristie Ebi	*ICONICS/Health*	University of Washington, USA
Katja Frieler	*ISI-MIP*	Potsdam Institute for Climate Impacts Research, Germany
Clare Goodess	*WGRC*	University of East Anglia, UK
Bruce Hewitson	*CORDEX*	University of Cape Town, South Africa
Radley Horton	*Urban/Coastal*	Columbia University, USA
Sari Kovats	*Health*	London School of Hygiene and Tropical Medicine, UK
Heike Lotze	*Oceans/Fisheries*	Dalhousie University, Canada
Linda Mearns	*ICONICS*	National Center for Atmospheric Research, USA
Antonio Navarra	*Climate Services*	Istituto Nazionale di Geofisica e Vulcanologia, Italy
Dennis Ojima	*Land Ecosystems*	Colorado State University, USA
Keywan Riahi	*Energy/IAMs*	International Institute for Applied Systems Analysis, Austria
Cynthia Rosenzweig	*PROVIA/AgMIP*	NASA Goddard Institute for Space Studies, USA
Matthias Themessl	*Climate Services*	Climate Change Centre Austria, Austria
Katharine Vincent	*Climate Services*	Kulima Integrated Development Solutions, South Africa

VIACS Advisory Board

Geoscientific
Model Development

Open Access

The Vulnerability, Impacts, Adaptation and Climate Services Advisory Board (VIACS AB v1.0) contribution to CMIP6

Alex C. Ruane[1], Claas Teichmann[2], Nigel W. Arnell[3], Timothy R. Carter[4], Kristie L. Ebi[5], Katja Frieler[6], Clare M. Goodess[7], Bruce Hewitson[8], Radley Horton[9], R. Sari Kovats[10], Heike K. Lotze[11], Linda O. Mearns[12], Antonio Navarra[13], Dennis S. Ojima[14], Keywan Riahi[15], Cynthia Rosenzweig[1], Matthias Themessl[16], and Katharine Vincent[17]

➢ **Motivation, initial activities, and plans for VIACS Advisory Board**

VIACS Advisory Board Engagement with CMIP6 Variable Design

900+ CMIP5 Variables assessed for VIACS applications

- Necessary variables for most applications already exist
- Determined priorities – strong desire for more validation studies
- Identified complete sets needed to allow particular applications (e.g., ocean ecosystems requires many unique variable sets)
- Variables may now be downloaded from the CMIP6 Data Request according to community (e.g., several AgMIP packages)

Variable Category	Time Resolution	Long Name	Units	Variable Set Requests/Categorization			FISH-MIP
				AgMIP	CSP	Arctic	FISH-MIP
2(e) Monthly land biogeochemistry, soil and land cover data							
CMOR Table Lmon: Monthly Mean Land Fields, Including							
Physical, Vegetation, Soil, and Biogeochemical Variables							
@Lmon	monthly mean	Moisture in Upper Portion of Soil Column	kg m-2	2	2	0	0
	monthly mean	Total Soil Moisture Content	kg m-2	1	1	0	0
	monthly mean	Soil Frozen Water Content	kg m-2	2	2	0	0
	monthly mean	Surface Runoff	kg m-2 s-1	2	2	0	0
	monthly mean	Total Runoff	kg m-2 s-1	2	2	0	2
	monthly mean	Precipitation onto Canopy	kg m-2 s-1	3	3	0	0
	monthly mean	Evaporation from Canopy	kg m-2 s-1	3	3	0	0
	monthly mean	Water Evaporation from Soil	kg m-2 s-1	3	3	0	0
	monthly mean	Transpiration	kg m-2 s-1	3	3	0	0
	monthly mean	Water Content of Soil Layer	kg m-2	1	1	0	0
	monthly mean	Temperature of Soil	K	3	3	1	0
	monthly mean	Tree Cover Fraction	%	4	4	0	0
	monthly mean	Natural Grass Fraction	%	4	4	0	0

VIACS Advisory Board Engagement with CMIP6 Variable Design

60+ new variables requested (and more continuously coming in)

- Requirement of different time periods or heights

- Need for low-frequency reports of high-frequency statistics, e.g.:
  - monthly output file showing number of hours where precipitation exceeded a given heavy rain threshold
  - separation of variables by wet and dry days

- Interest in tile information, if simulated (e.g., agricultural tile of broader grid box)

Photo: constructionweekonline.com

Time resolution	Name (plus description as needed)	Units	Additional notes
New variables requested by the agricultural sector (for Historical, DECK, and ScenarioMIP experiments, as well as requests for experiments within AerChemMIP, C^{4}MIP, DAMIP, DCPP, GeoMIP, LUMIP, and VolMIP).			
Monthly	Surface concentration of ozone	ppm	Also for use ecosystem and health sectors
Daily, monthly	Cropland tile maximum temperatures	K	Tile contains information from agricultural
Daily, monthly	Cropland tile minimum temperatures	K	fraction of land in a given GCM
Daily, monthly	Cropland tile precipitation	$kg\,m^{-2}\,s^{-1}$	grid box.
Daily, monthly	Cropland tile minimum relative humidity	%	
Daily, monthly	Cropland tile wind speed	$m\,s^{-1}$	
Monthly	Number of precipitation days where accumulation was above $1\,kg\,m^{-2}$	No.	These two variables combine to describe the intensity of rainfall when it does occur.
Monthly	Average precipitation accumulation on days where accumulation was above $1\,kg\,m^{-2}$	$kg\,m^{-2}$	

VIACS Advisory Board Engagement with CMIP6 MIP Application

## 188 MIP Experiments assessed for VIACS applications

- Determined priorities for various application packages
- Identified specific experiments within MIPs that VIACS community is interesting in exploring for broader implications

- Historical and ScenarioMIP experiments most widely sought, followed by Decadal Climate Prediction Project (DCPP)
- Nearly all MIPs had at least one experiment that generated VIACS interest

Experiment group	Experiment short name	Experiment Description / Design			AgMIP
CMIP6 MIP Experiments that you plan on exploring (see full names of MIPs in next tab):					
@EXPT			188		
Diagnostics, Evaluation, and Characterization of Klima (DECK)-1	AMIP	observed SSTs and sea ice prescribed	24	0	1,2,3
DECK-2	control	coupled atmosphere/ocean pre-industrial control run	26		1,2,3
DECK-3	1pctCO2	impose 1%/yr increase in CO2 to quadrupling*	25		1
DECK-4	abrupt4xCO2	Abruptly quadruple CO2, then hold fixed**	24		1
DECK-5	historical	emission- or concentration-driven simulation of the recent past (~165 years)	26		1,2,3,4,5
AerChemMIP-1	RFDOC-01	Perturbation from 1850 control using PD aerosol and ozone precursor emissions (all aerosols interact with radiation)	23		1, 5
AerChemMIP-1	RFDOC-02	Perturbation from 1850 control using PD aerosol and ozone precursor emissions (only BC aerosols interact with radiation)	21		0

Summary and Continuing Work

The Vulnerability, Impacts, Adaptation, and Climate Services (VIACS) Advisory Board of CMIP6 is designed to enhance communication between the climate modeling and climate applications communities.
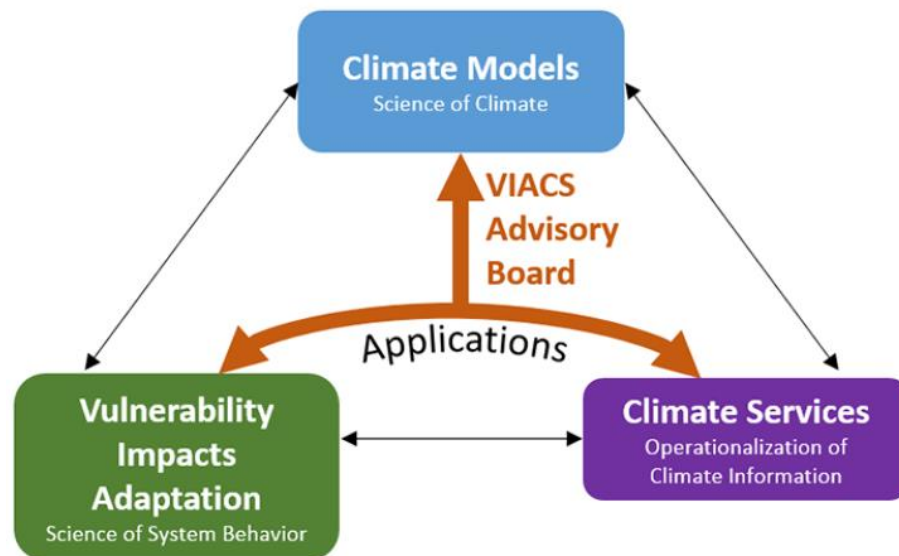
➤ **Facilitating applications for climate monitoring, climate variability/extremes, and climate change**

➤ **Currently working to construct and process VIACS-relevant metrics for ESM evaluation**
(e.g., precipitation distributions, 100 meter winds, and 2D surface fields)
Aspen Global Change Institute Workshop on ESM Evaluation this July/August

➤ **Expect new energy for VIACS as CMIP outputs become increasingly available**

➤ **Parallel efforts within CLIVAR and USGCRP encouraged**

Thanks!

alexander.c.ruane@nasa.gov