

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 Teichmann³
and the VIACS Advisory Board

¹NASA Goddard Institute for Space Studies, New York City

²Columbia University Center for Climate Systems Research

³Climate Service Center, HZG, Hamburg



WCRP Working Group on Coupled Modeling
Princeton, USA, November 1st, 2016

VIACS Advisory Board - Overview

- **No unique model experiments requested**

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.

Anchored in the Program for Research on Climate Change Vulnerability, Impacts, and Adaptation (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

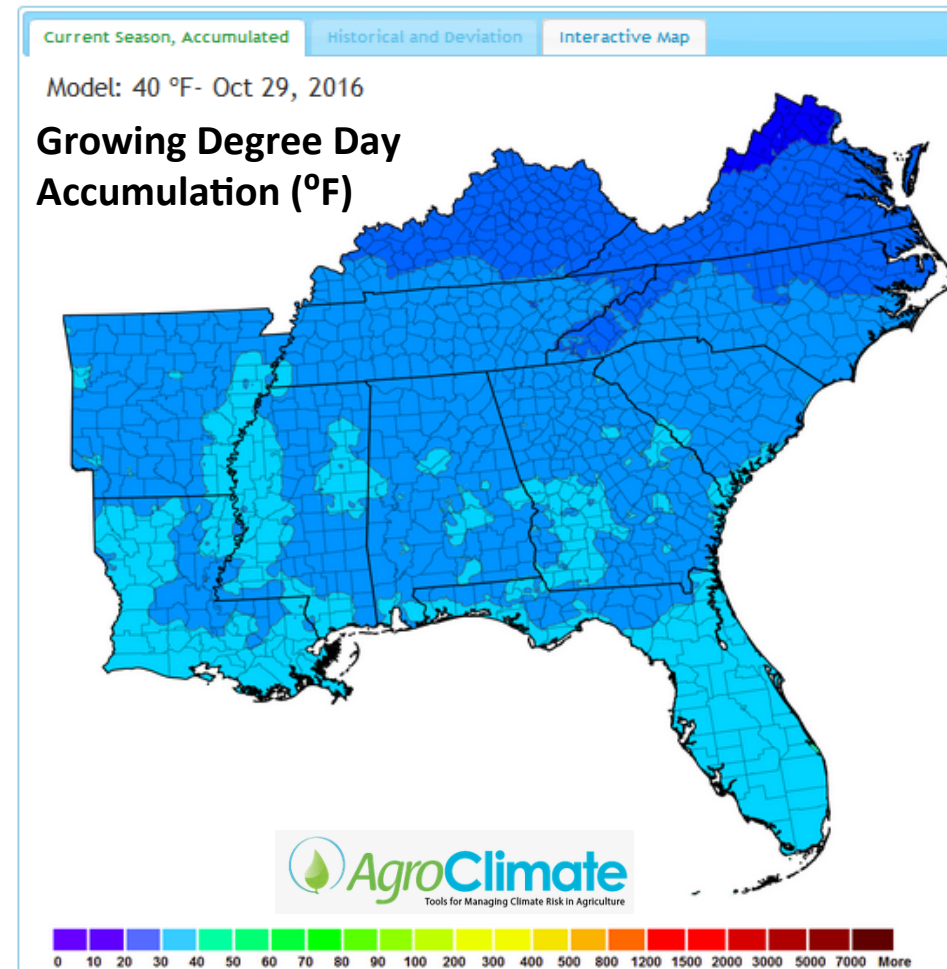
Operationalizes climate and VIA information as user-oriented products and tools.

➤ **Climate Service Organizations:**

- Public Agencies
- Private Organizations
- Academic Institutions

➤ **Projects and Programs:**

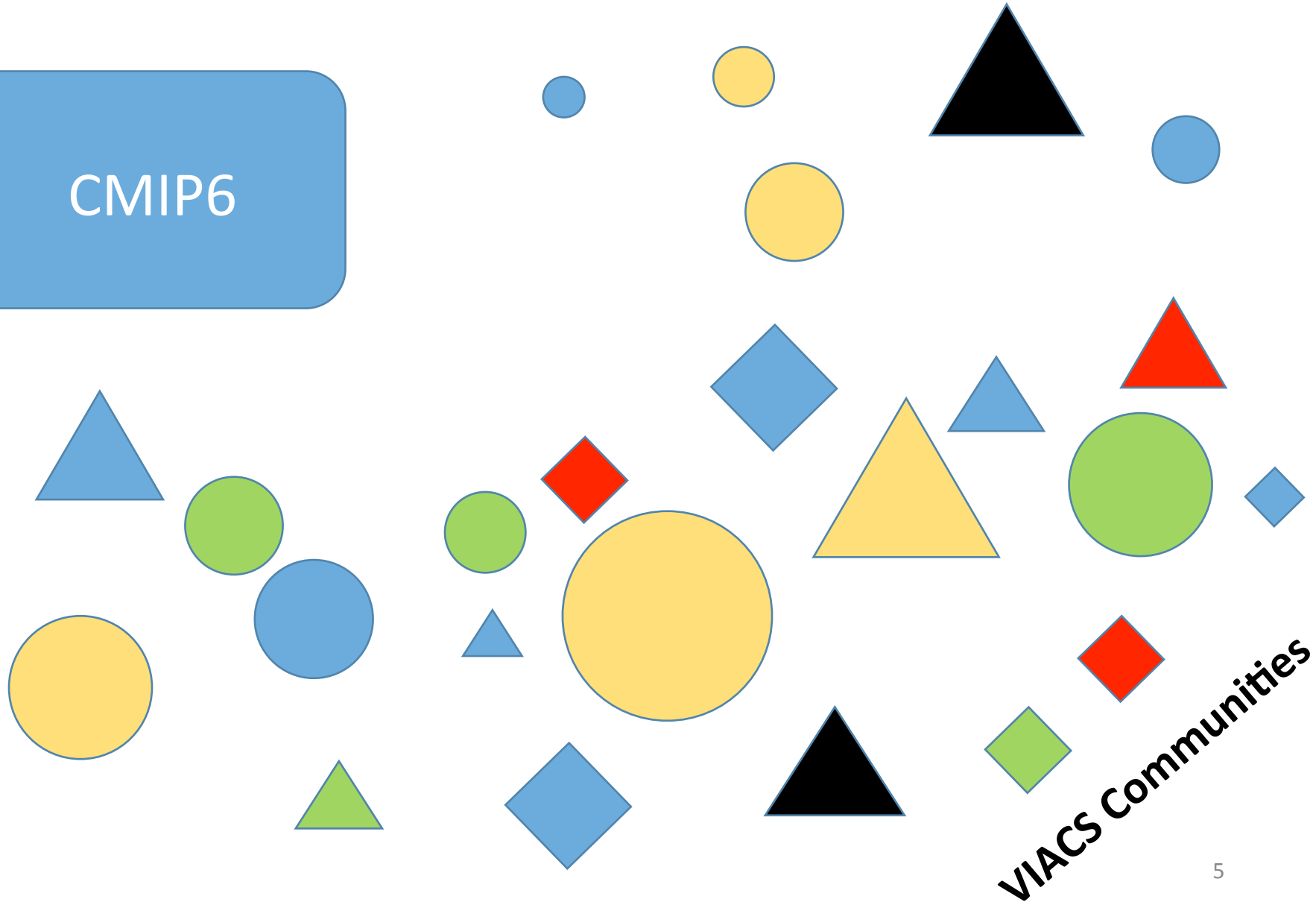
- Climate Services Partnership
- Global Framework for Climate Services
- Others...



VIACS Community is Diverse and Largely Independent

Different regions, projects, sectors, scales, organization levels

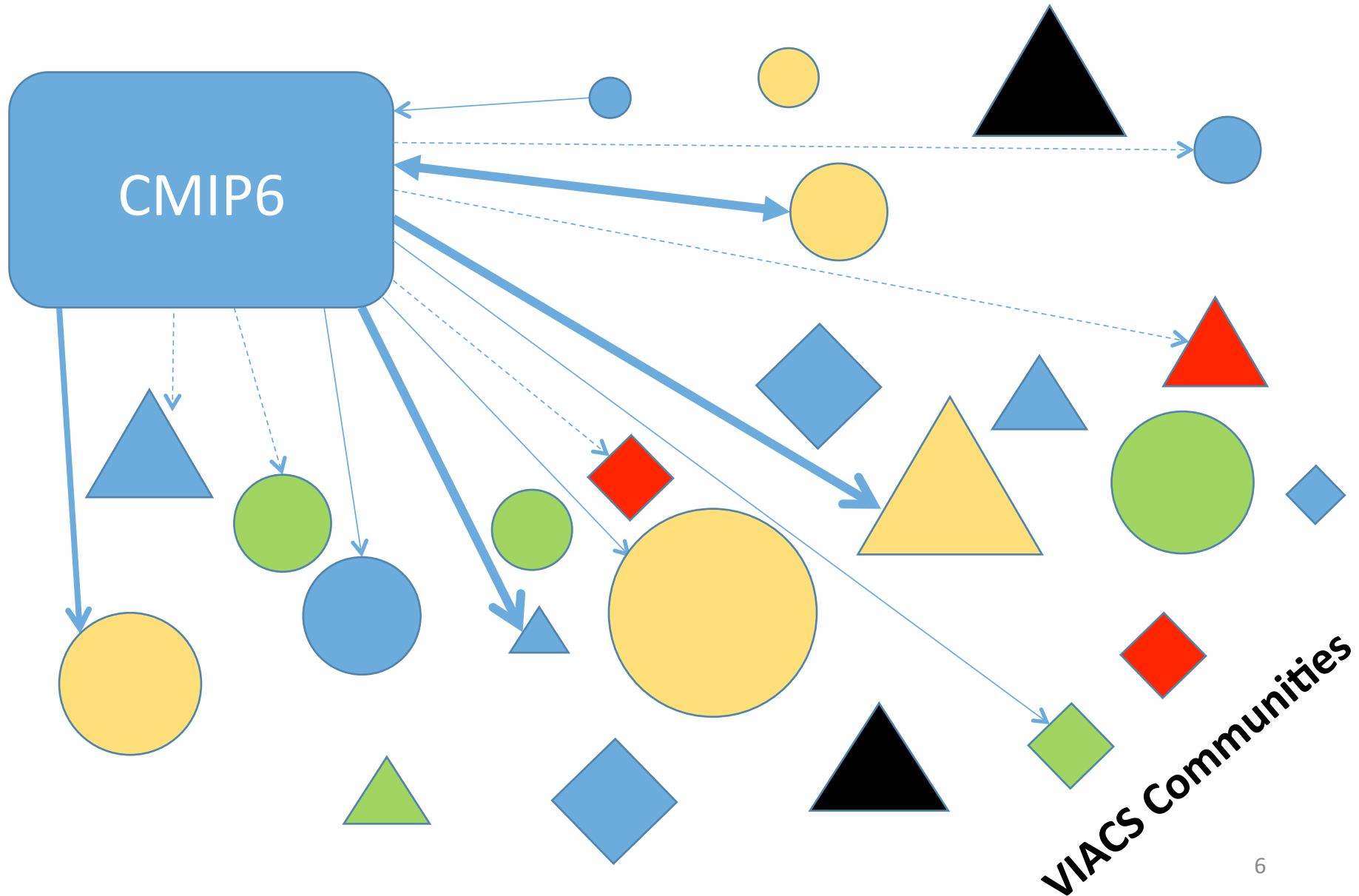
CMIP6



VIACS Communities

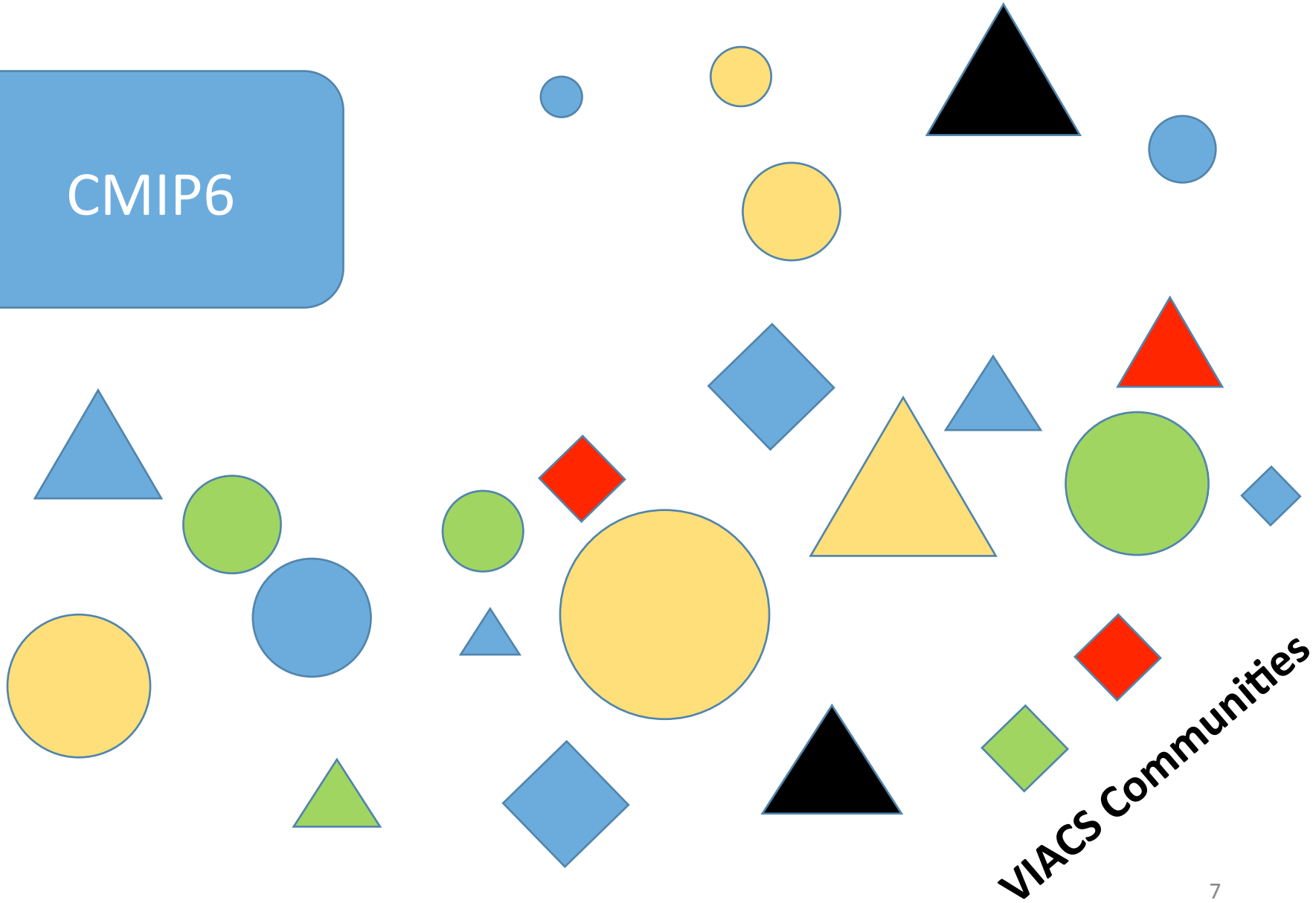
VIACS Community is Diverse and Largely Independent

Interactions with CMIP6 diverse, difficult and inefficient

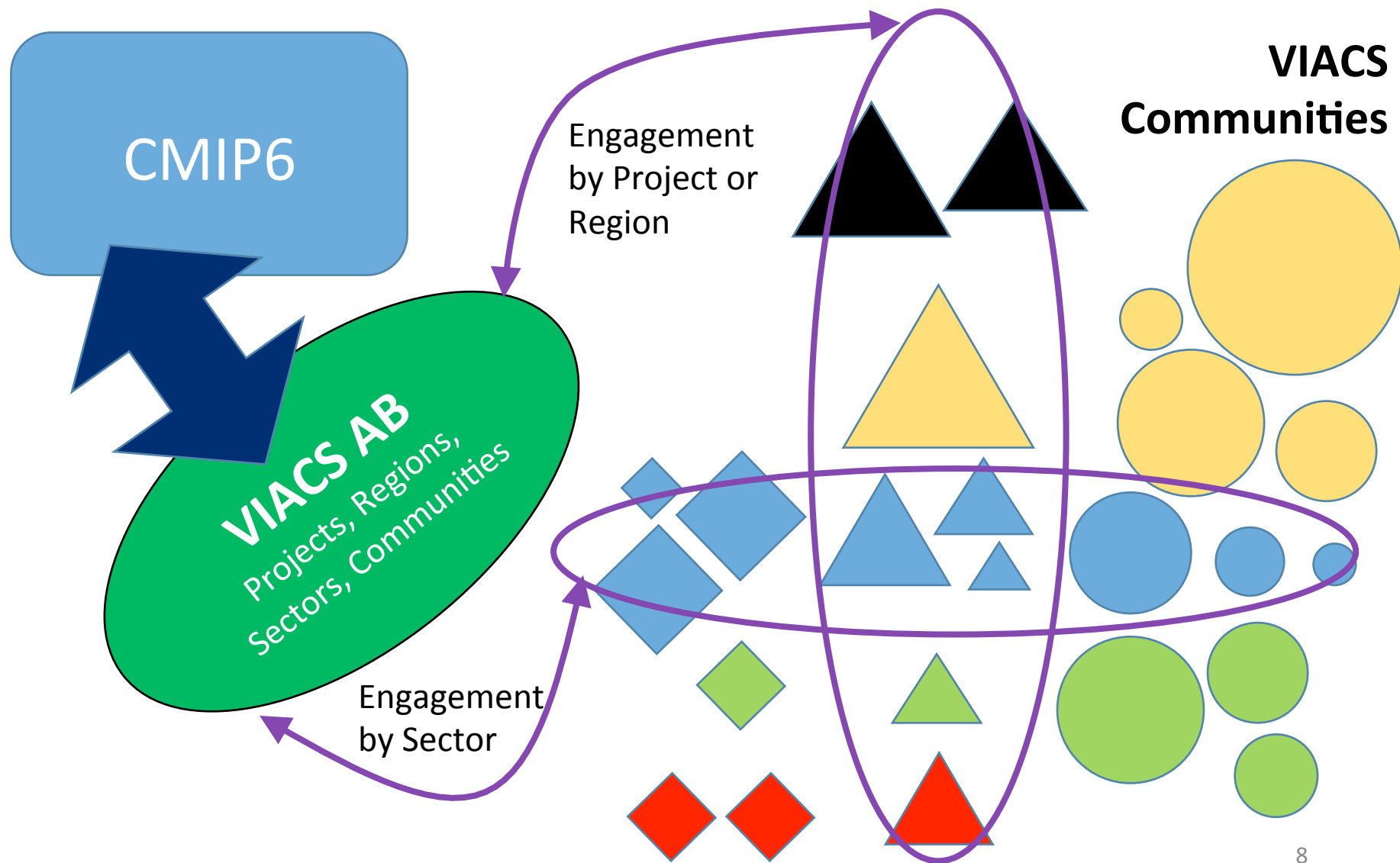


Mutual Benefit to Coordinated Interactions

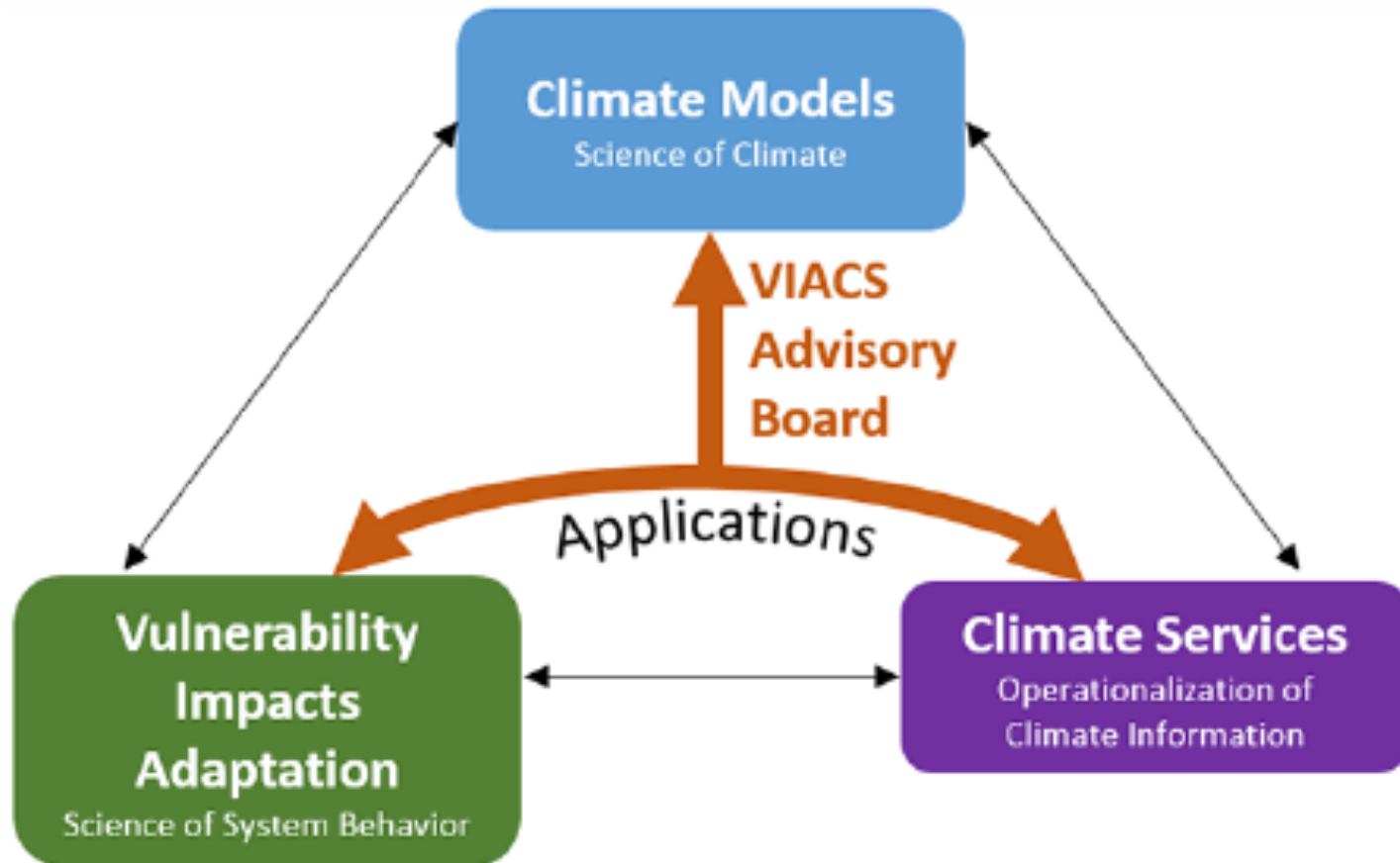
CMIP6



VIACS Advisory Board – Allows for additional coordinated interaction between CMIP6 and VIACS Communities



VIACS Advisory Board



VIACS Advisory Board

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

VIACS Advisory Board - Operation

Board members serve two-year terms with rotating co-chairs

Current co-chairs:

Alex Ruane – alexander.c.ruane@nasa.gov, and
Claas Teichmann - claas.teichmann@hzg.de

The VIACS Advisory Board will convene on a regular basis:

- 1) VIACS Advisory Board Co-Chairs **reach out to CMIP6 representatives** to solicit input, requests, or questions to propose to the VIACS Advisory Board.
- 2) VIACS Advisory Board Co-Chairs **prepare summary documents** or worksheets that provide a coherent template for the solicitation of input across the VIACS communities.
- 3) The **VIACS Advisory Board holds a teleconference** to discuss the CMIP6 questions, request solicitation of information using the provided templates, and raise issues from the VIACS communities.
- 4) **Board members survey their respective networks** of colleagues and provide collated responses back to the Co-Chairs.
- 5) Co-Chairs **submit a summary** of the CMIP6/VIACS community interactions, solicitation results, and action items identified by the board to all board members and the CMIP6 leadership (to be shared with MIP leaders as needed).

VIACS Advisory Board

Geosci. Model Dev., 9, 3493–3515, 2016
www.geosci-model-dev.net/9/3493/2016/
doi:10.5194/gmd-9-3493-2016
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Geoscientific
Model Development



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

Alex C. Ruane¹, Claas Teichmann², Nigel W. Arnell³, Timothy R. Carter⁴, Kristie L. Ebi⁵, Katja Frieler⁶,
Clare M. Goodess⁷, Bruce Hewitson⁸, Radley Horton⁹, R. Sari Kovats¹⁰, Heike K. Lotze¹¹, Linda O. Mearns¹²,
Antonio Navarra¹³, Dennis S. Ojima¹⁴, Keywan Riahi¹⁵, Cynthia Rosenzweig¹, Matthias Themessl¹⁶, and
Katharine Vincent¹⁷

- **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	
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

- Requirement of different time periods or heights
- Need for low-frequency reports of high-frequency statistics (e.g., monthly output file showing number of days where precipitation exceeded a given heavy rain threshold)
- 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, DCP, 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 fraction of land in a given GCM grid box.
Daily, monthly	Cropland tile minimum temperatures	K	
Daily, monthly	Cropland tile precipitation	$\text{kg m}^{-2} \text{ s}^{-1}$	
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
- 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

CMIP6 MIP Experiments that you plan on exploring (see full names of MIPs in next tab):						AgMIP
Experiment group	Experiment short name	Experiment Description / Design				
@EXPT			188			
Diagnosics, 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	RFD0C-01	Perturbation from 1850 control using PD aerosol and ozone precursor emissions (all aerosols interact with radiation)	23			1, 5
AerChemMIP-1	RFD0C-02	Perturbation from 1850 control using PD aerosol and ozone precursor emissions (only BC aerosols interact with radiation)	21			0

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Other Activities Identified

Obs4VIACS?

- Collect datasets to standardize calibration and validation of climate vulnerability, impacts and adaptation.
- E.g., crop yields, biomass, fluorescence on gridded basis for agriculture
- Operate in parallel to Obs4MIPs

Website

- Link with PROVIA and help VIACS community find CMIP6 and related resources

Re-gridding

- General consensus was that a standard grid would be helpful, but must be high resolution for select variables and many users would want to see native files as well

Online Metrics and Visualizations

- Help design user-relevant and accessible tools for CMIP6 data distribution and publicizing
- Post-processing pipelines and cloud-based workflows to create standardized products

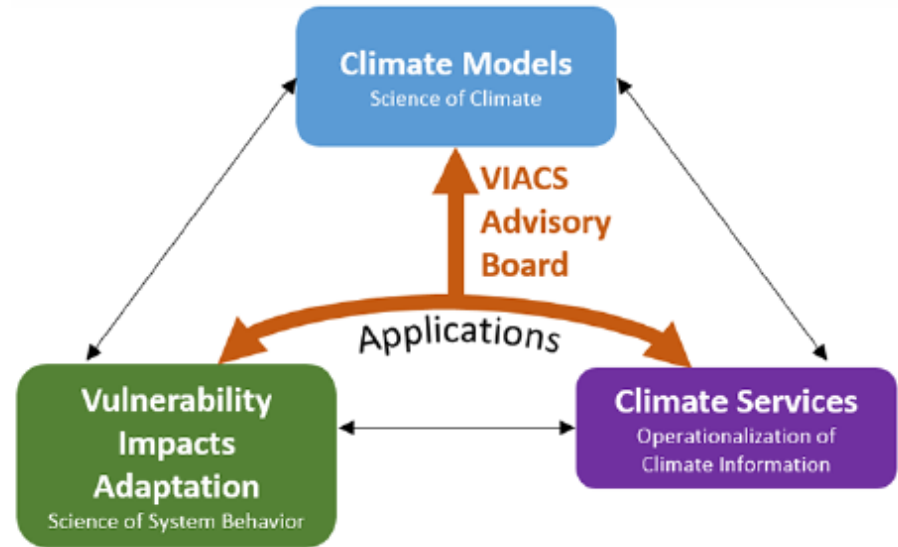
VIACS Advisory Board

Convened Tuesday, October 25th:

- **ScenarioMIP Participation?**
- **IPCC Special Reports on +1.5 °C and Land-Use**
- **Interest in post-processing for applications**
 - Summary variables
 - Accessibility (not just huge NetCDFs)
 - Presentation and description
- **Strong need for enhanced description of model differences so that VIACS community can respond to common stakeholder/policymaker questions.**
- **Eager to write papers with VIACS and MIP leaders describing the potential relevance and application of MIP outputs**
 - ScenarioMIP and HighResMIP often requested
 - Other MIPs also have experiments of interest

Summary

The Vulnerability, Impacts, Adaptation, and Climate Services (VIACS) Advisory Board is a Diagnostic MIP within CMIP6 designed to enhance communication between the climate modeling and climate applications communities.



- Provided feedback on variables and MIP experiments of interest to climate application community
- Eager to engage coupled modelers and VIACS experts for more robust and societally-relevant climate applications
- Interested in developing collaborative papers where modeling groups and VIACS experts describe best practices for application of MIP outputs