

CASCaDE

Computational
Assessments of
Scenarios of
Change for the
Delta
Ecosystem

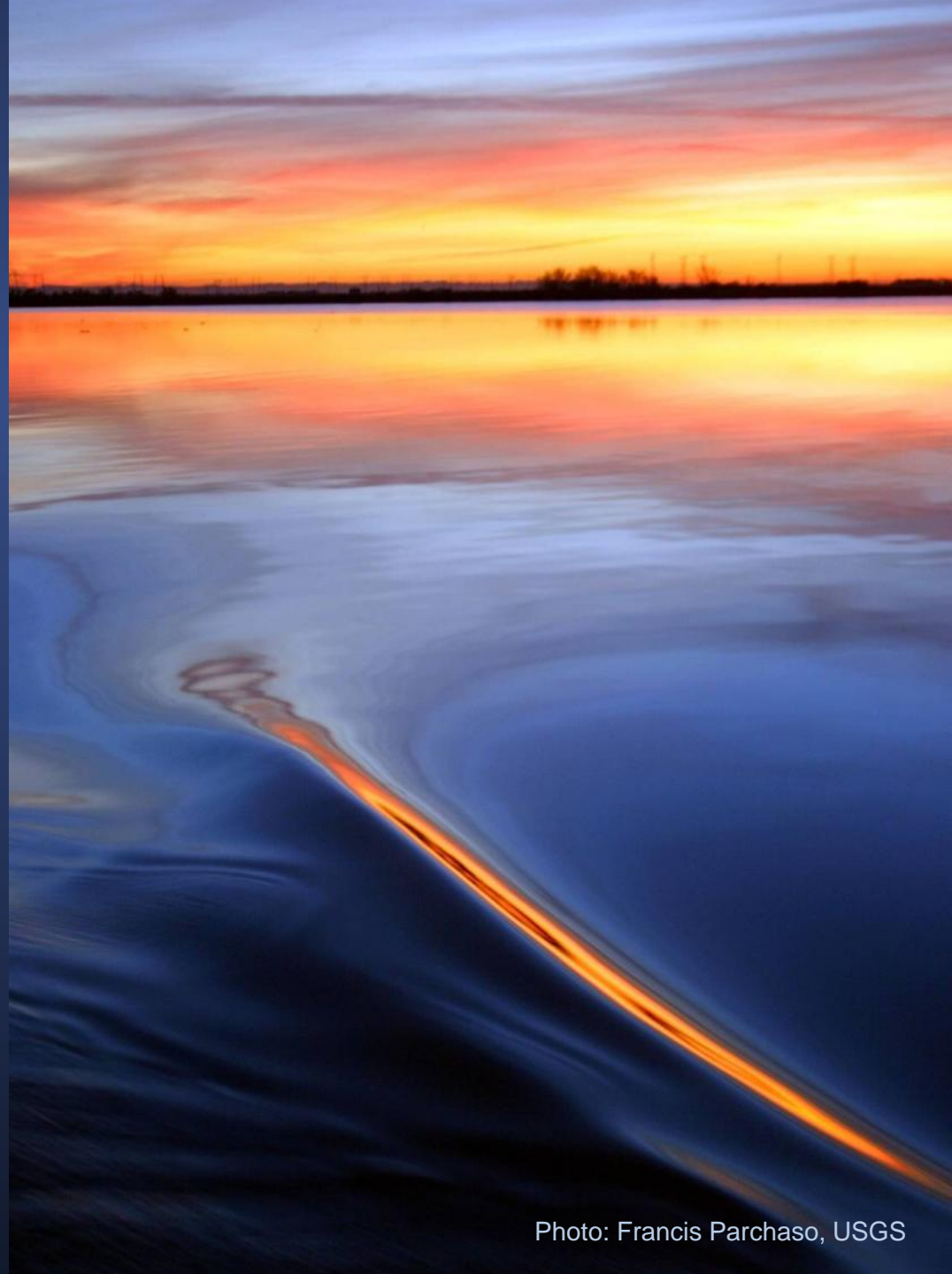


Photo: Francis Parchaso, USGS

Many forces of change

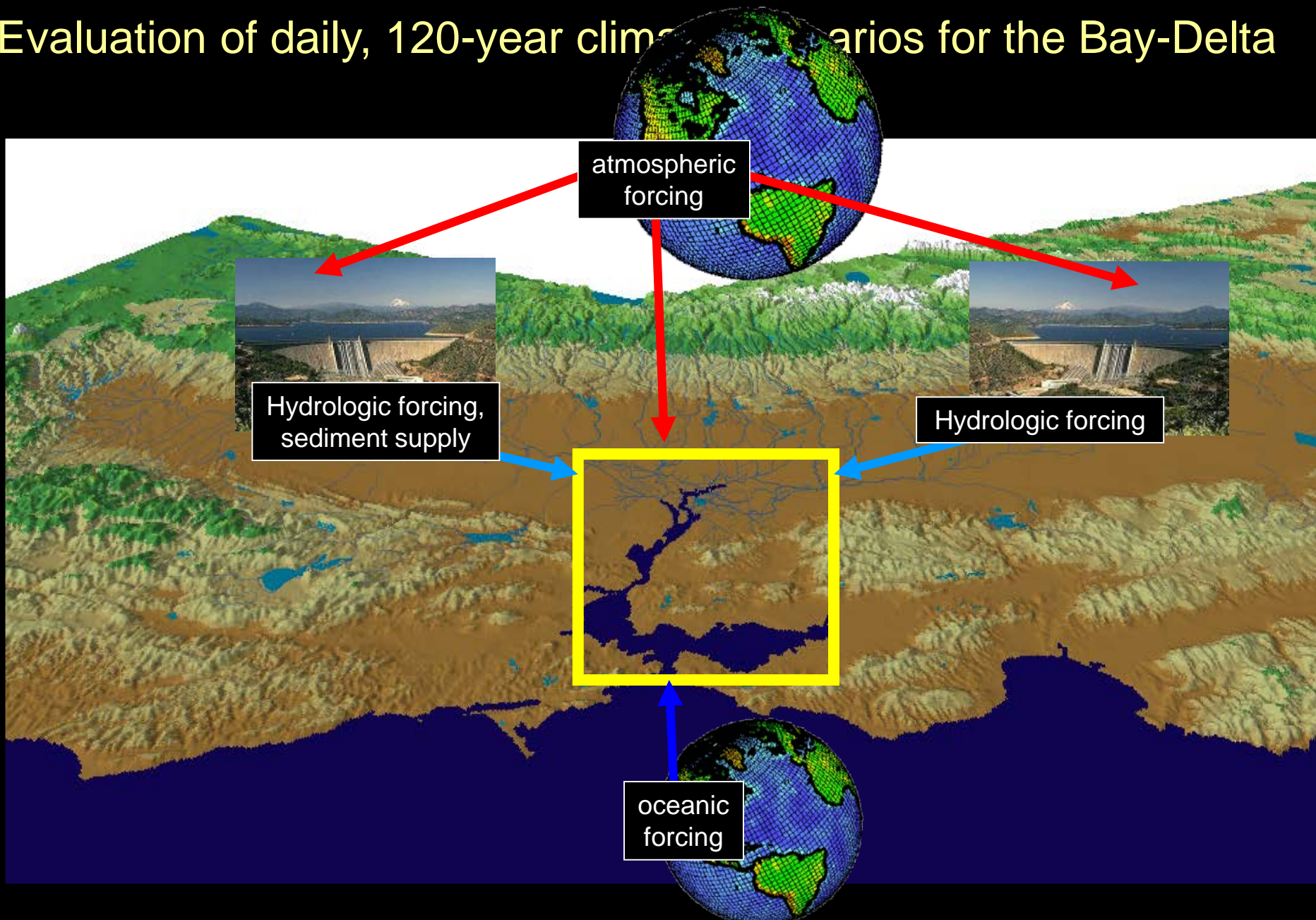


Climate: sea level rise, precipitation & resultant streamflows, direct atmospheric forcing over the Delta

Infrastructure: alternative conveyance, island flooding, ecosystem restoration

Pollution/Water Quality: invasive species, contaminants, decreasing turbidity

Evaluation of daily, 120-year climate scenarios for the Bay-Delta

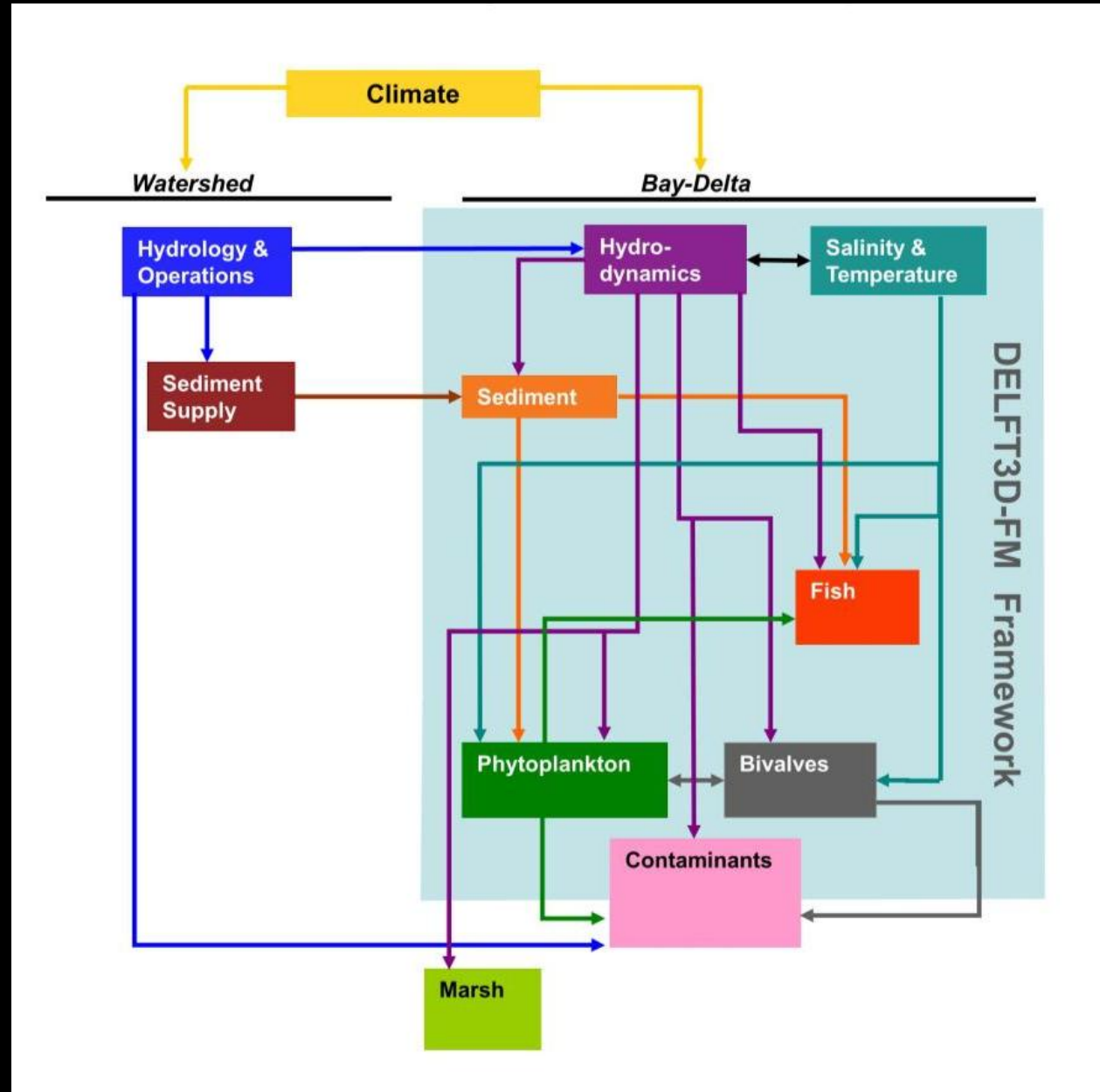


The Global Climate Model outputs are used to provide daily, 120-year climate scenarios (via the use of the

CASCade 2:

Linked modeling framework to evaluate Delta responses to multiple forces of change

- 36 scientists
- 3 USGS offices
- 4 academic institutions
- 1 non-profit (Deltares)
- 2 graduate students
- 2 postdocs



CASCaDE 2 Scenarios of Change

Global Climate Change

Climate change only

Tunnels



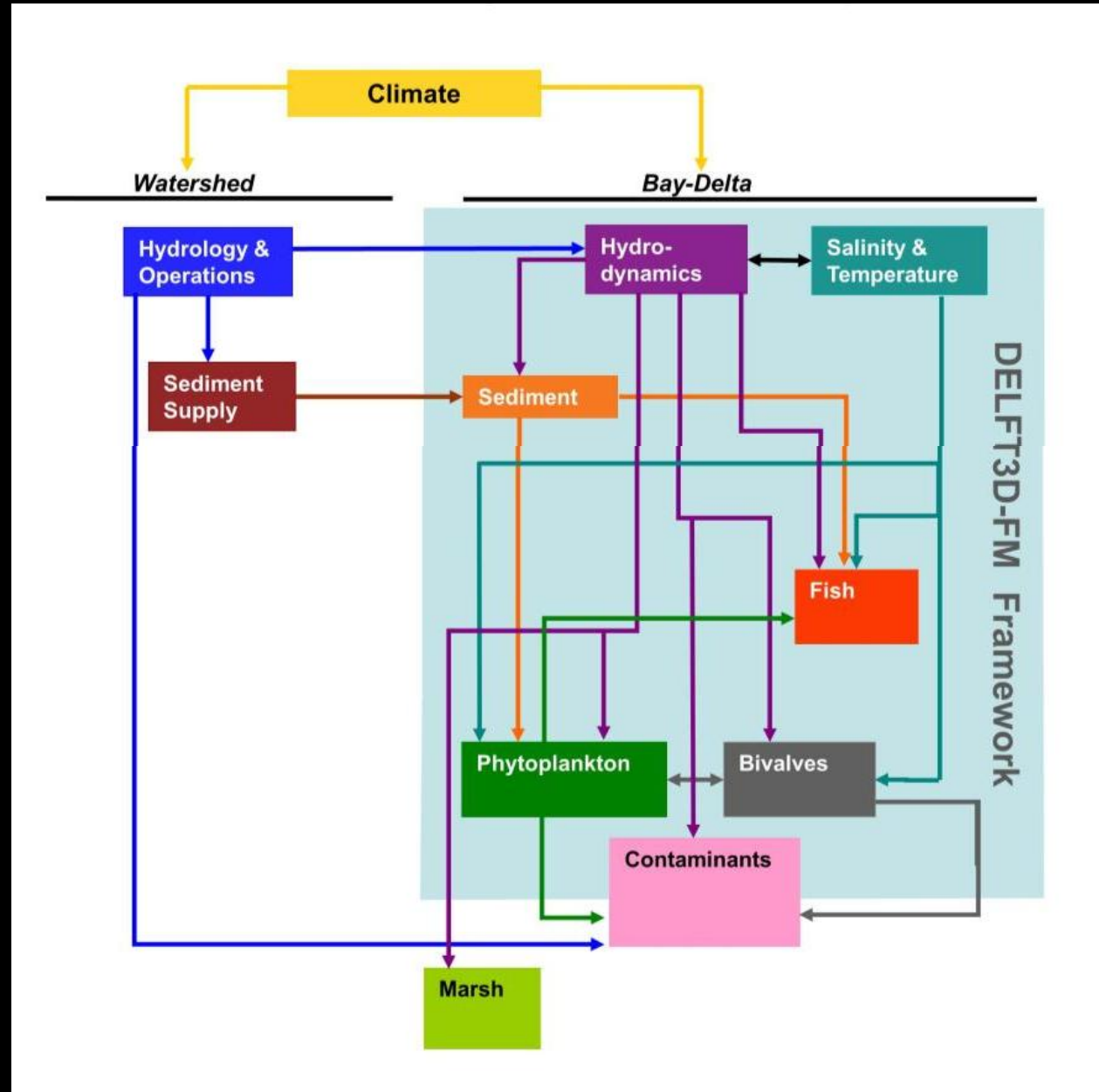
Multiple Flooded Islands

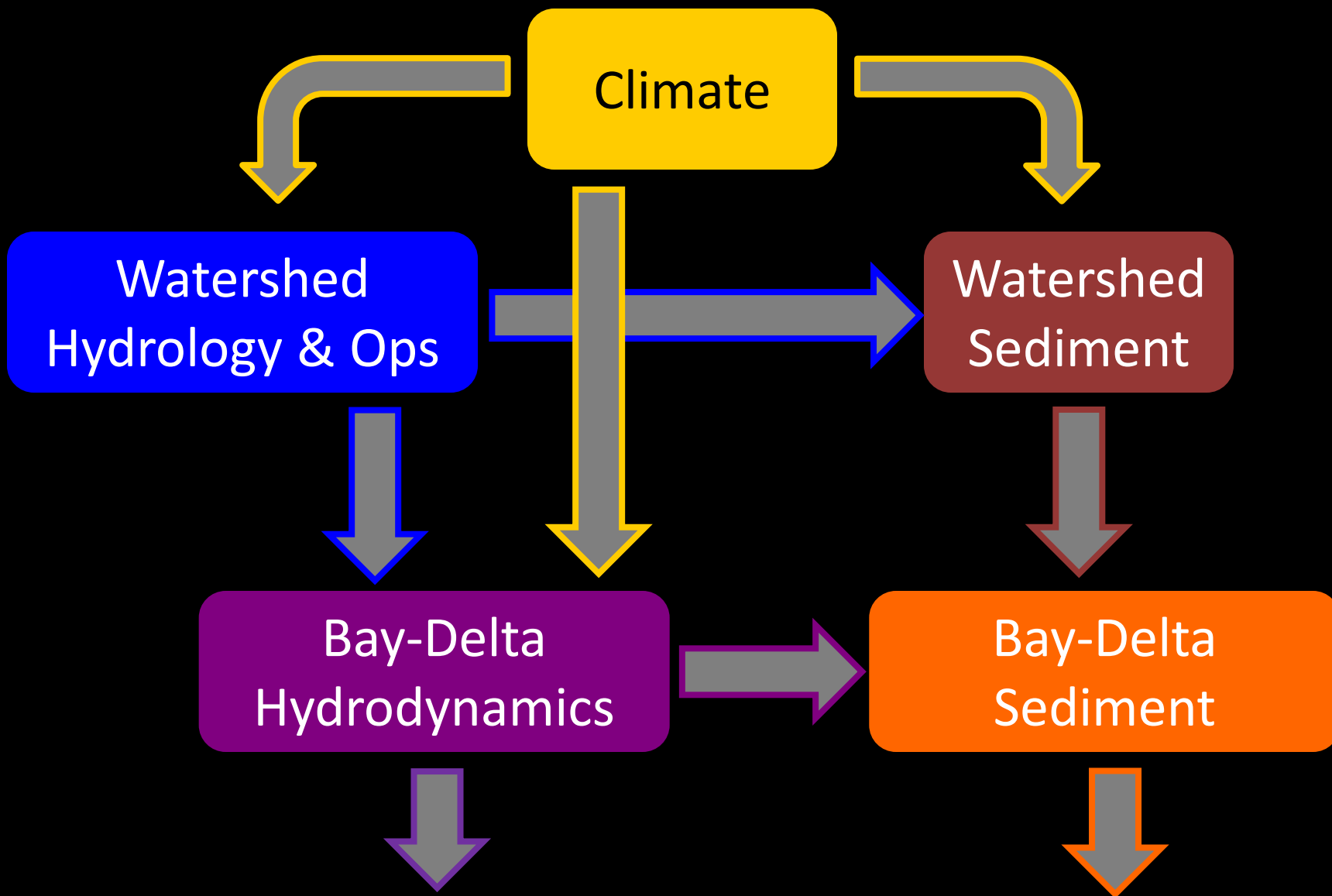


CASCade 2:

Linked modeling framework to evaluate Delta responses to multiple forces of change

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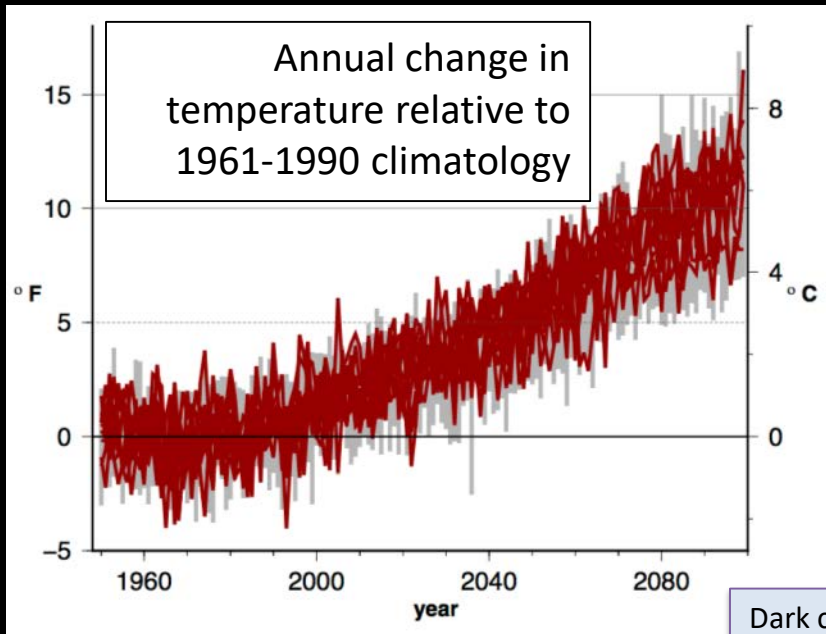




Climate Forcings—Meteorology

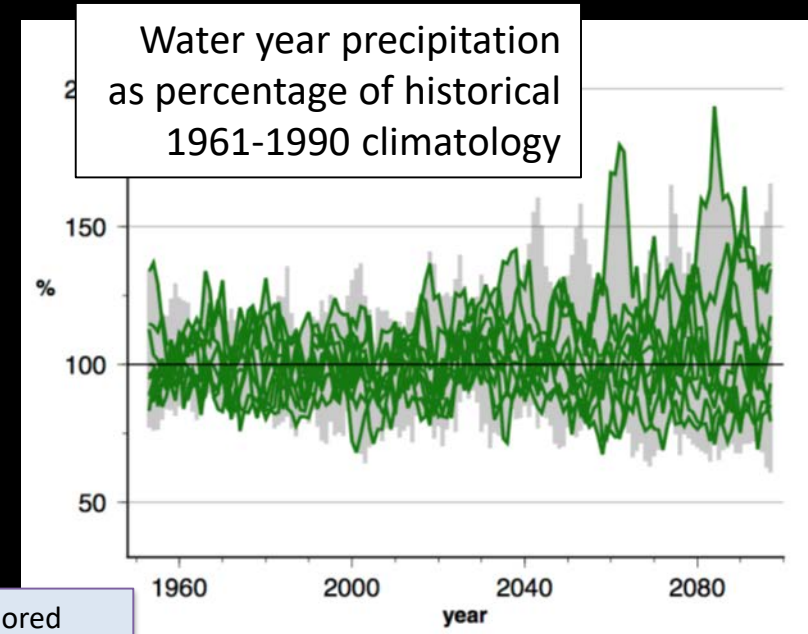
Cayan, Pierce, Tyree, Dettinger

10 CMIP5 Global Climate Models (GCMs) selected
From more than 30 GCMs, 10 were identified as suitable for California
water resources vulnerability and adaptation planning.

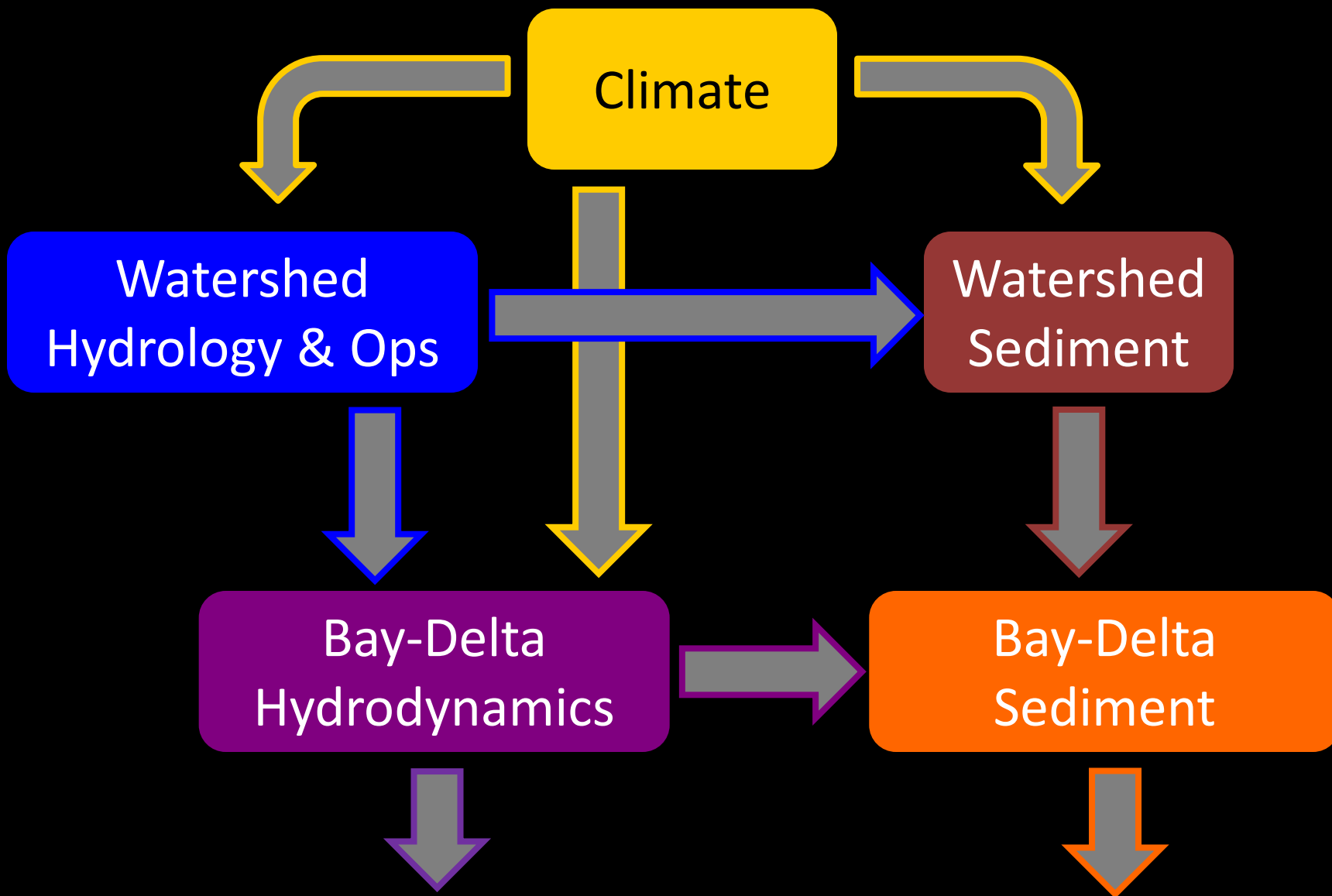


■ 10 selected GCMs [5-year smoothed (centered) annual time series]
■ Envelope of temperature change from 31 CMIP5 models

Dark colored traces are 10 selected GCMs

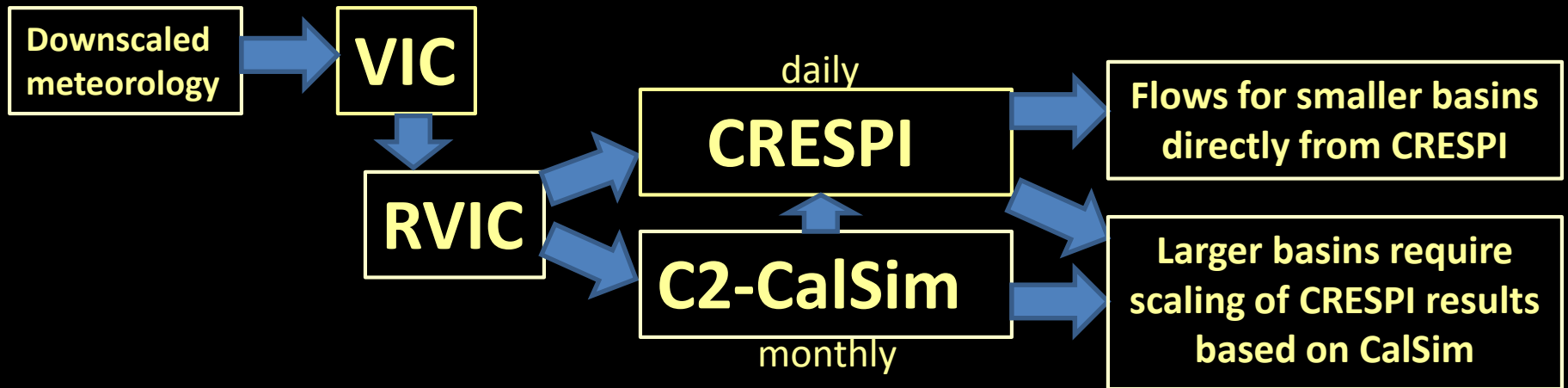


■ 10 selected GCMs [5-year smoothed (centered) annual time series]
■ Envelope of precipitation change from 31 CMIP5 models



Projecting Managed Flows

Noah Knowles, Collin Cronkite-Ratcliff



MODELS (red means new for CASCade)

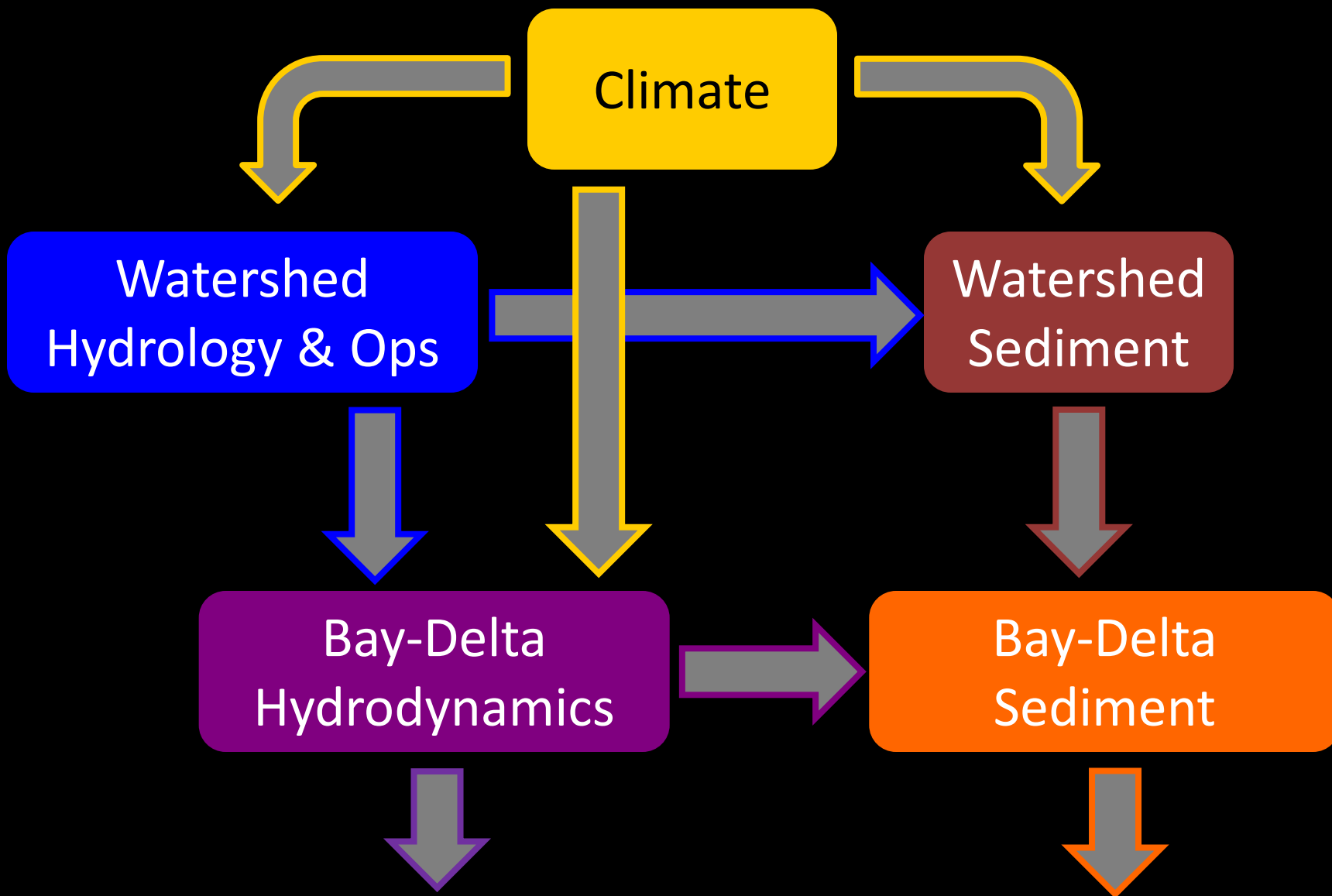
VIC: gridded hydrology

RVIC: streamflow routing

C2-CalSim: modified DWR operations model

CRESPI: new method for producing daily managed flow estimates

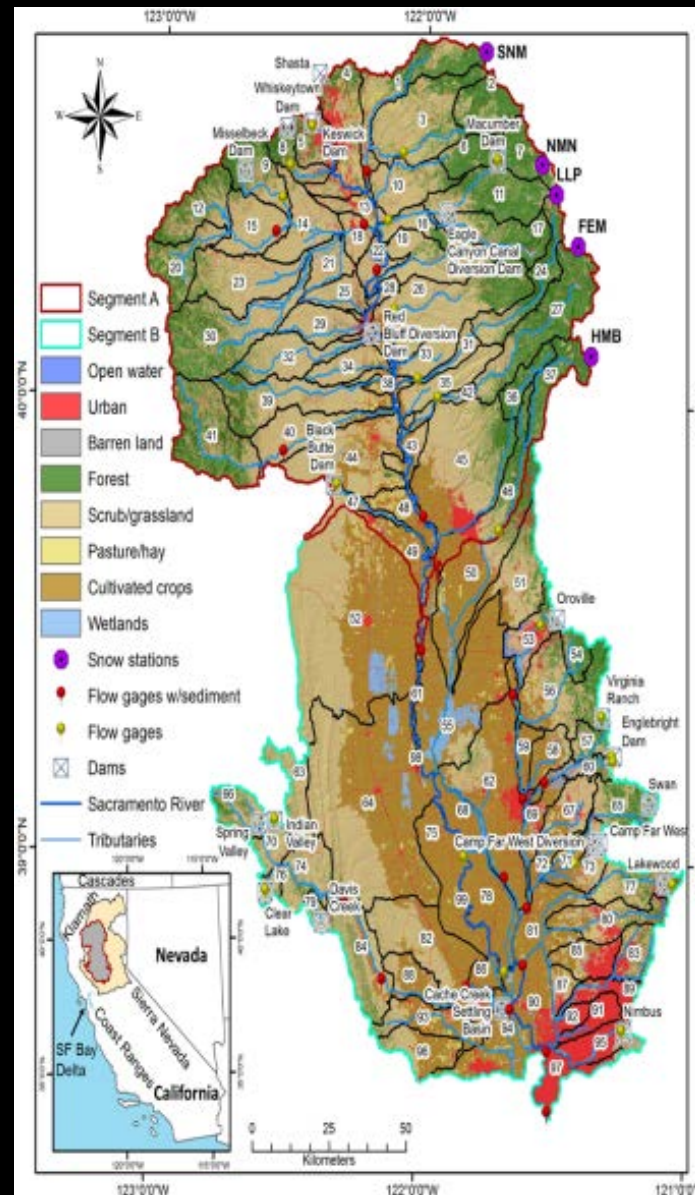
OUTPUTS: 20 scenarios (each 1980-2099) of daily flows and operations throughout the watershed and estuary

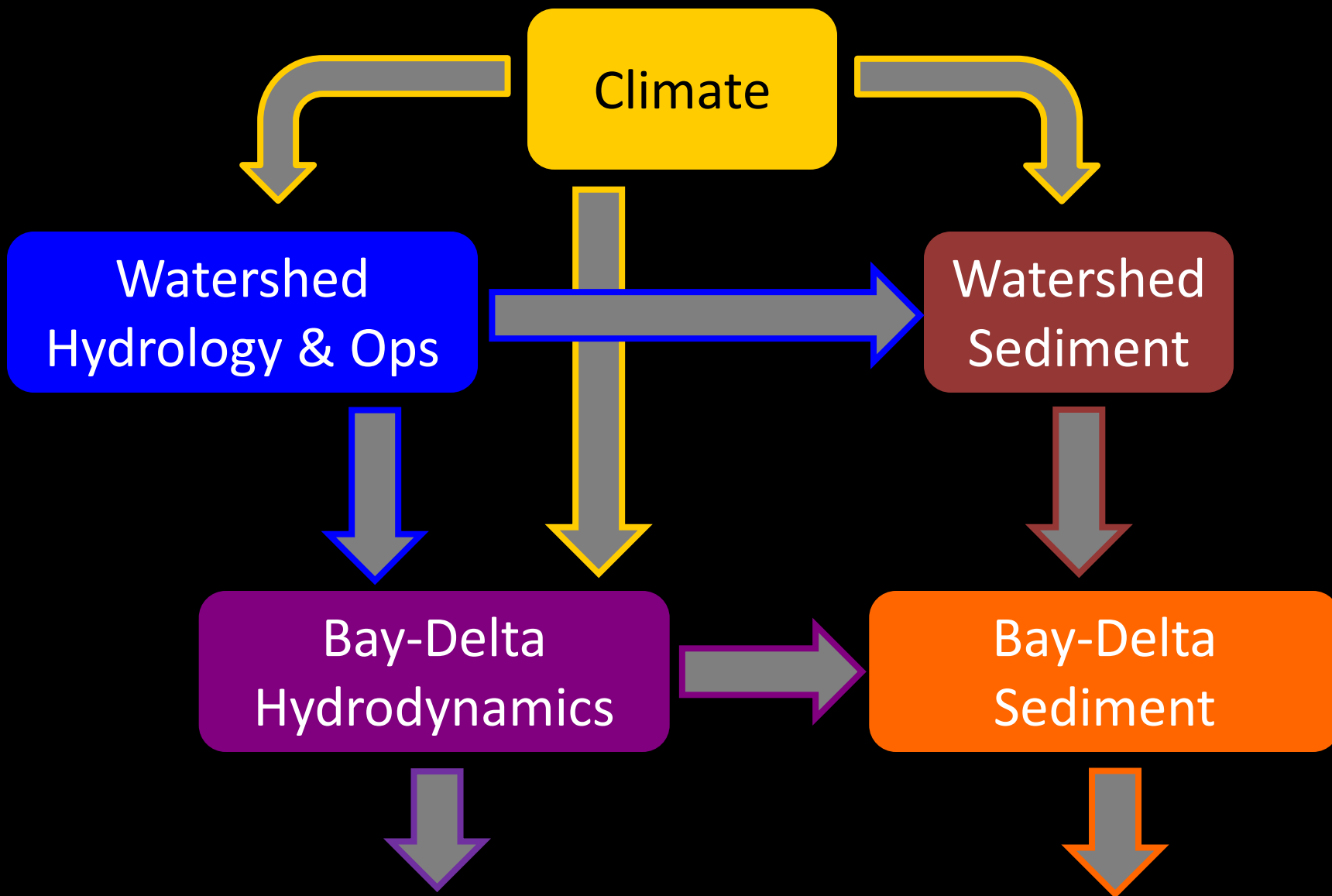


Modeling Sacramento basin daily sediment output

Stern, Flint, Minear and Wright

- Project future sediment supply from the Sac. River to Delta
- HSPF (Hydrologic Simulation Program-Fortran) Model
- Produces daily suspended sediment throughout basin
- Driven by: daily flows & meteorology, dams/diversions/impairments, channel geometry, land use, soil types





Hydrodynamic Model: DFLOW-FM

Deltares: Arthur van Dam, Sander van der Pijl, Herman Kernkamp
UNESCO-IHE: Mick van der Wegen, Fernanda Achete, Ali Dastgheib, Johan Reyns, Dano Roelvink
UCSD: Rose Martyr, John Helly
USGS: Bruce Jaffe, Theresa Fregoso, Noah Knowles, Lisa Lucas

30.9 mi

Image © 2012 TerraMetrics
Data SIO, NOAA, U.S. Navy, NGA, GEBCO
Data MBARI

Hydrodynamic Model Boundary Condition Time Series

Horizontal BCs:

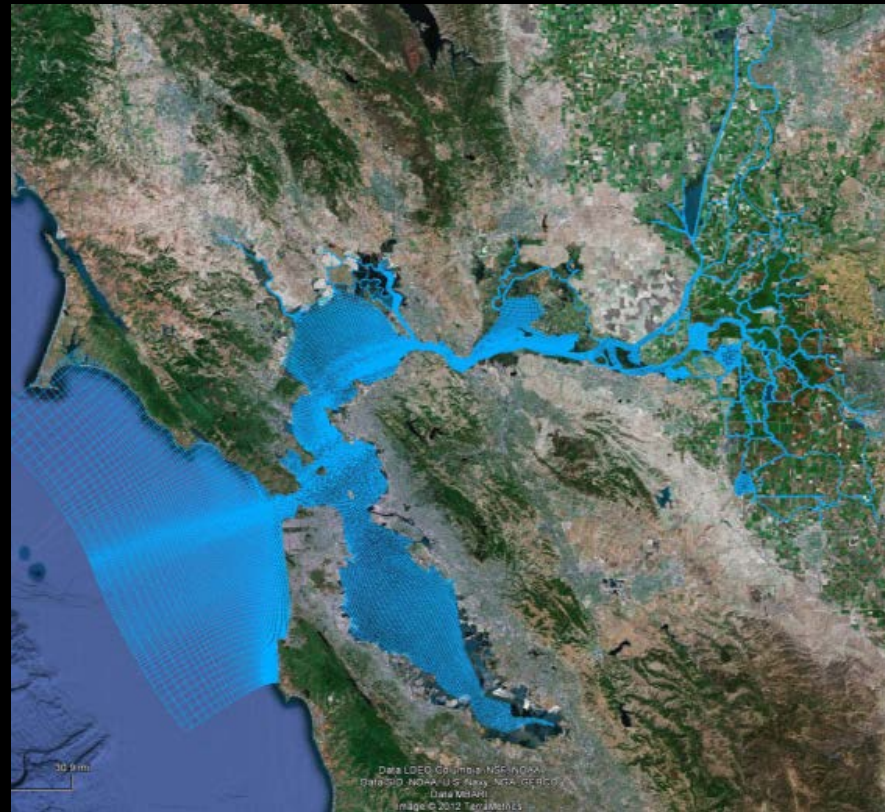
- ✓ **Upstream inflows (7 locations)**
- Water temperature (6 locations):**
 - ✓ river
 - ✓ ocean boundary
- Salinity (2 locations):**
 - ✓ ocean boundary
 - ✓ river (Vernalis)
- ✓ **Sea level**
- ✓ **Watershed sediment flux**

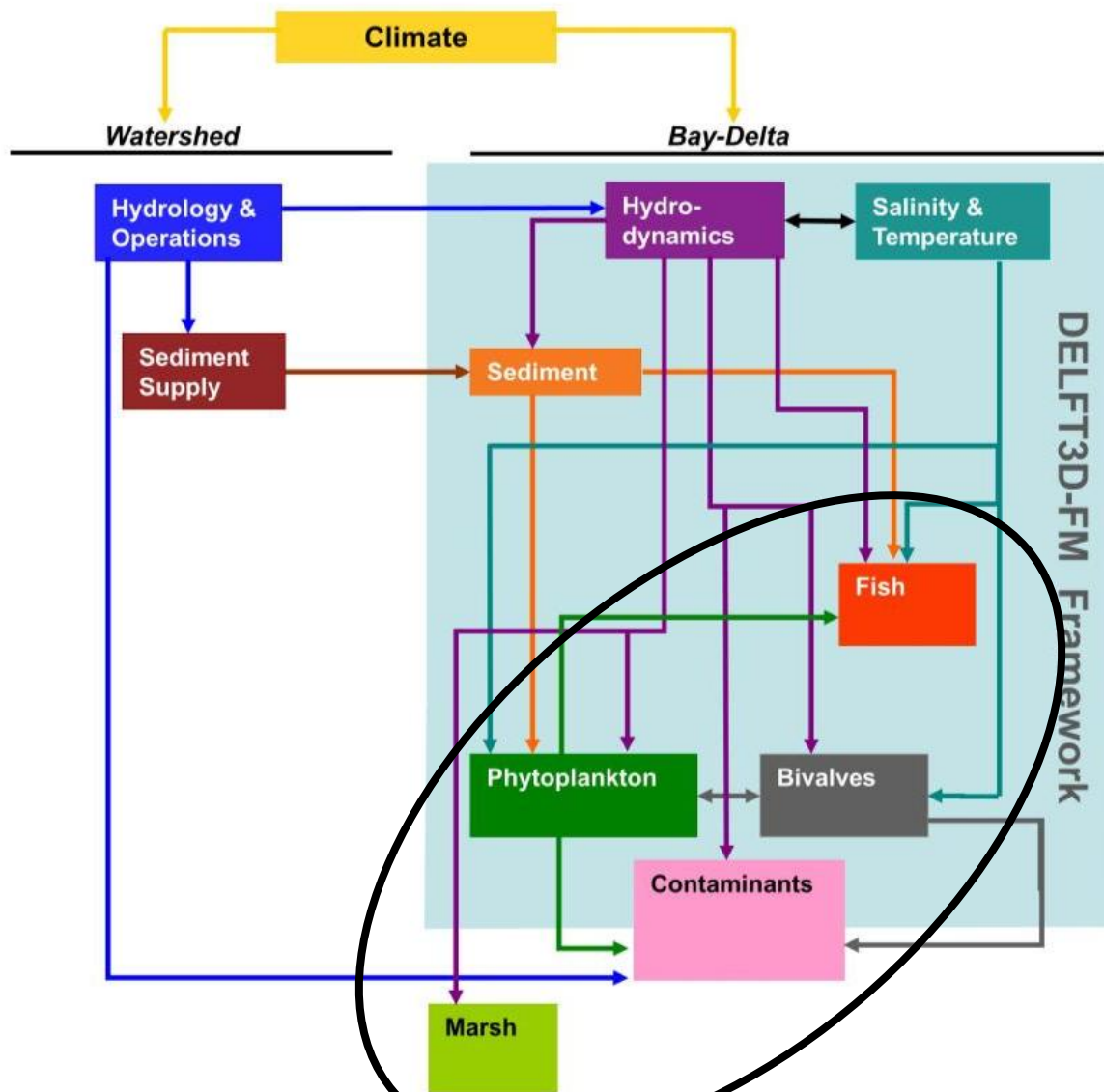
Management Controls:

- ✓ **Exports (7 locations)**
- ✓ **Sac Weir Flows**
- ✓ **Gates (DCC and Suisun Marsh)**
- ✓ **Barriers (4 locations)**

Vertical BCs (gridded over domain):

- ✓ **Air temperature**
- ✓ **Precipitation**
- ✓ **Wind speed/dir**
- ✓ **Relative humidity**
- ✓ **Cloudiness**
- ✓ **Surface pressure**





Data publishing: californiacoastalatlascas.net

CASCaDE II | Californi: x

californiacoastalatlascas.net/?q=projects/cascade-ii

California Coastal Atlas

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CASCaDE II

Bay Delta Projects SFO

Computational Assessments of Scenarios of Change for the Delta Ecosystem

1. Project Purpose

In recent years, two guiding principles have been established regarding the future management of the Sacramento-San Joaquin Delta. First, Governor Schwarzenegger's Blue Ribbon Task force recommended that "the Delta ecosystem and a reliable water supply for California are the primary, co- equal goals for sustainable management of the Delta" [36], and this principle recently became state law [14]. Second, fundamental changes in the external forcings (e.g. climate) and physical configuration of the Delta are inevitable [33,52]. These guiding principles lead to the fundamental **question** we propose to address:

How will future changes in physical configuration and climate affect water quality, ecosystem processes, and key species in the Delta?

In particular, we propose to test the **hypothesis** that: *Climate induced changes in hydrology, sea level, and local meteorology, combined with new water conveyance structures or increased numbers of flooded islands, will impact water transport and water quality (e.g. salinity, temperature, and turbidity) in the Delta. These changes will further influence ecological processes and key species (e.g. primary productivity, distributions and effects of invasive bivalves, marsh sustainability, contaminant dynamics, and success of native and alien fish populations).* We propose to test this hypothesis by building on the work of the CASCaDE I project. CASCaDE I was conceived as a step toward developing the capabilities and understanding needed to assess potential responses of the Bay-Delta ecosystem to external (climate) and internal (e.g., Delta configuration) changes over the long term. Model simulations and results from CASCaDE I focused on climate as the primary driver. The approach taken was to link numerical and statistical models of the major components of the Bay-Delta-River-Watershed (BDRW) system, representing both physical and biological aspects.

A large part of the effort in CASCaDE I was devoted to numerical model development and linkage, as appropriate

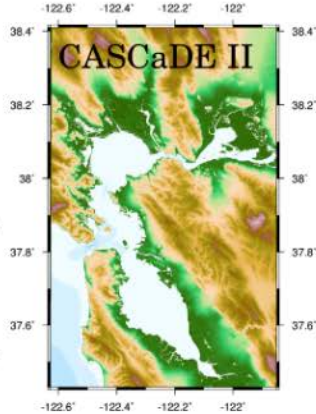


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User login

Username or e-mail: *

Password: *

Log in

Create new account

Request new password

Search for Data

- Data Collections Browser
- Search for Data

CCA Published Data

- Hypoxia Collection

Community Hydrodynamic Model

Our shared vision is of a research/management community built around the Bay-Delta D-Flow FM model we've developed.

www.d3d-baydelta.org

San Francisco Bay Delta Community Model

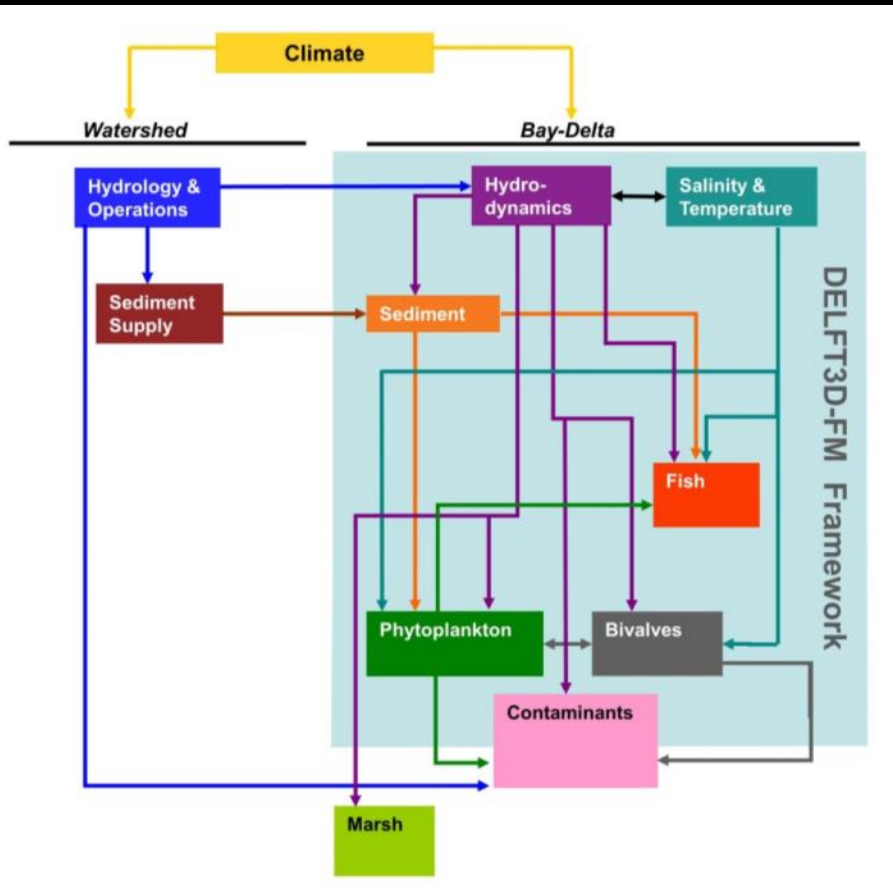
Home Demo Downloads Model Spec Development Framework Parties Involved

The grid on a Google Earth base map

Berkeley UNIVERSITY OF CALIFORNIA CA-LCC Deltaires USA SFEI AQUATIC SCIENCE CENTER STANFORD UNIVERSITY USGS science for a changing world UNESCO-IHE Institute for Water Education SDSC THE STATE UNIVERSITY OF CALIFORNIA

Summary

- Ecosystem modeling toolbox for CASCaDE & beyond
- Tools needed to inform ecosystem restoration & mgmt
- Stakeholders include:



*Delta Stewardship Council
USBR
USEPA
USFWS
USACE
CA 4th Climate Assessment
Bay Area Environmental Climate Change Coalition
CA DWR
CA Nat Res Agency
CA Coastal Conservancy
CA State Wat Res Cont Board
CA Dept of Fish & Wildlife
BCDC
SF Reg Water Qual Control Board
San Francisco Estuary Institute/
SF Bay Nutrient Management Strategy
Nature Conservancy
Academia, Consultants*

End