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Managing Water in the West

Hood River County Monthly Meeting Presentation

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U.S. Department of the Interior
Bureau of Reclamation

Agenda

- Overview of process and goals for today (Toni)
- Overview of climate change decision process (Toni)
- Stepping through the selection of climate change metrics for Hood River Study (Jon)
- Review of Basin Study Goals and alternatives / scenarios analysis (Toni/Niklas)
- Water Conservation Study (Niklas)
- Next Steps (Toni)

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Overview of Process and Goals for Today

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Overview of Process

- Tasks by others
  - Data collection
  - Water Needs Assessment
  - Water Conservation Assessment
  - IFIM Study
  - Reservoir Study
- Reclamation efforts
  - Preliminary Storage Study Analysis (Roger Wright)
  - Data integration
  - Model construction (review Model Connections Schematic)
    - MODFLOW - Groundwater (Jon/Jennifer)
    - DHSVM - Surface Water (Taylor/Bob)
    - MODSIM - Water Resource Model (Taylor/Toni)
    - Climate Change (Jon/Taylor/Toni)
  - Analysis and reporting

Status of Modeling Efforts

- DHSVM (Taylor)
- MODSIM (Taylor)
- GW - steady state and transient models (Jennifer/Jon)
- Climate Change (Jon/Toni – more to follow!)
  - Automation of climate change data process complete

Overview of Process

- Data analysis
  - September – December 2013
- Reporting
  - January – March 2014
- Review process
  - March – May 2014
- Project wrap-up
  - June 14, 2014 (extension underway)

Goals for Today

- **Confirm climate change decisions**
  - **Future period to evaluate against historical period**
  - **Climate uncertainty characterization**
  - **Climate characterization**
  - **Ensemble vs. individual projection selection**
- **Establish a sub-committee for more regular meetings**
  - **Need names of participants (have one)**
  - **Hopefully get an idea of best time for meeting every other week or so (webinars)**

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Overview of Selection of Climate Change Information and Decision Process

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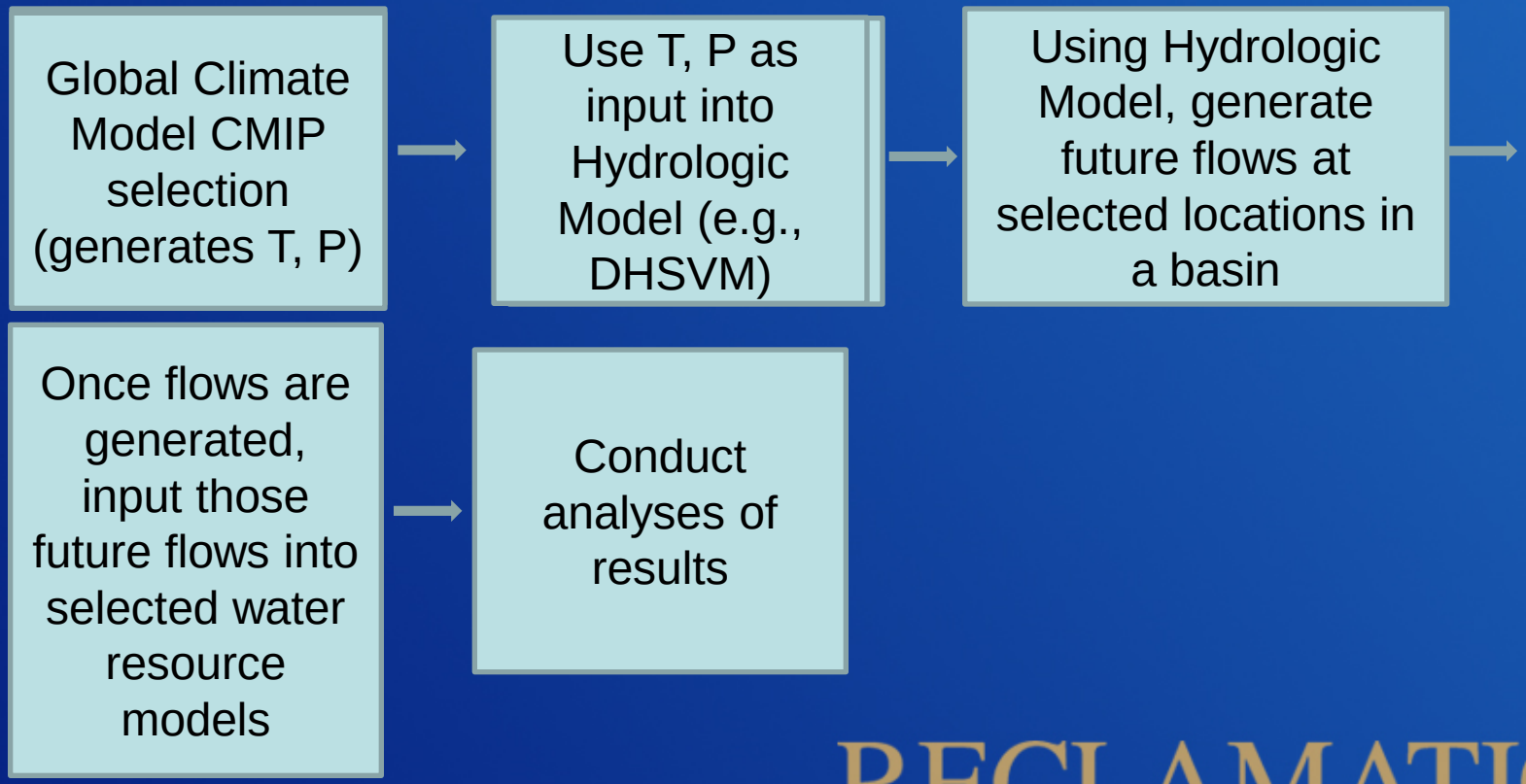
Overview of Selection Choices

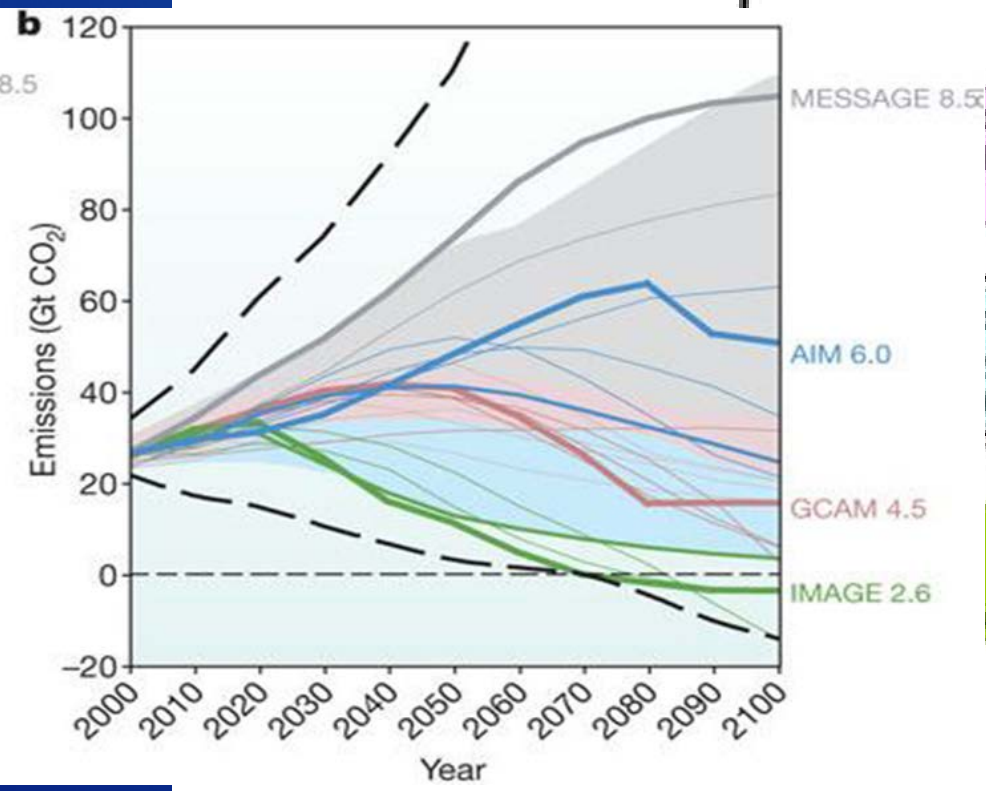
- Overview of Process
- Source of Climate Change Data
  - Climate or Hydrology Data or Both
  - Hydrologic Model Selection
- Global Climate Models (GCMs) from Coupled Model Intercomparison Project (CMIP) Phase 3 or Phase 5 (or both)
  - Emission Scenarios (SRES)
  - Representative Concentration Pathways (RCPs)
- Period Composite (Change) or Transient
  - Bias Correction and Spatial Downscaling Method
  - Historical and Future Reporting Time Periods
  - Quantity of Projections (individual or ensemble)
  - Uncertainty Range

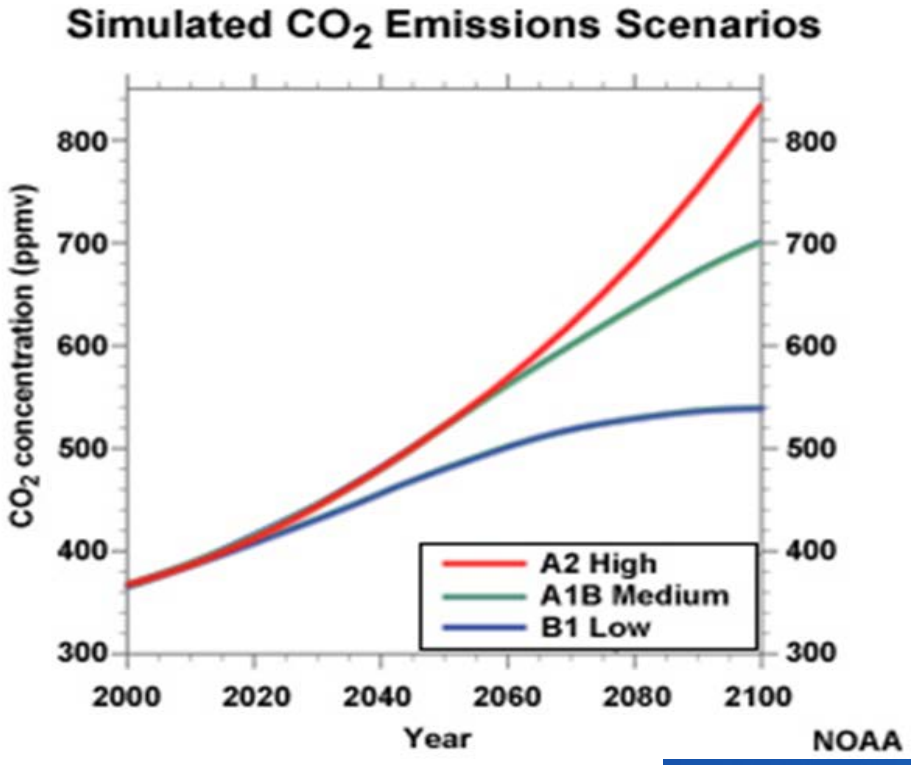
Overview of Process

- **CMIP3 or CMIP5 => T and P generation => Hydrologic Model => Future flow generation => water resource model analyses => results reporting**



CMIP3 vs. CMIP5





IPCC 2008: Towards New Scenarios for Analysis of Emissions, Climate Change, Impacts, and Response Strategies, IPCC Expert Meeting Report, Figure I.1. Intergovernmental Panel on Climate Change, Geneva, Switzerland.

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Source Selection

- Data from Reclamation's Archive (LLNL)
  - CMIP3
    - 19 of 23 GCMs available, 3 emission scenarios (A1, A1b, B1), total of 112 projections
    - Flow generated at 1/8th degree (~12KM)
    - Period of coverage is 1950-2099 at a monthly time step
  - CMIP5
    - 100+ GCMs, 4 representative concentration pathways, total of 234 projections
- Data from UW Climate Impacts Group
  - CMIP3
    - 19 of 23 GCMs, 3 emission scenarios, total of 57 projections
    - Flow generated at 297 locations in CRB
- Others

Spatial Downscaling

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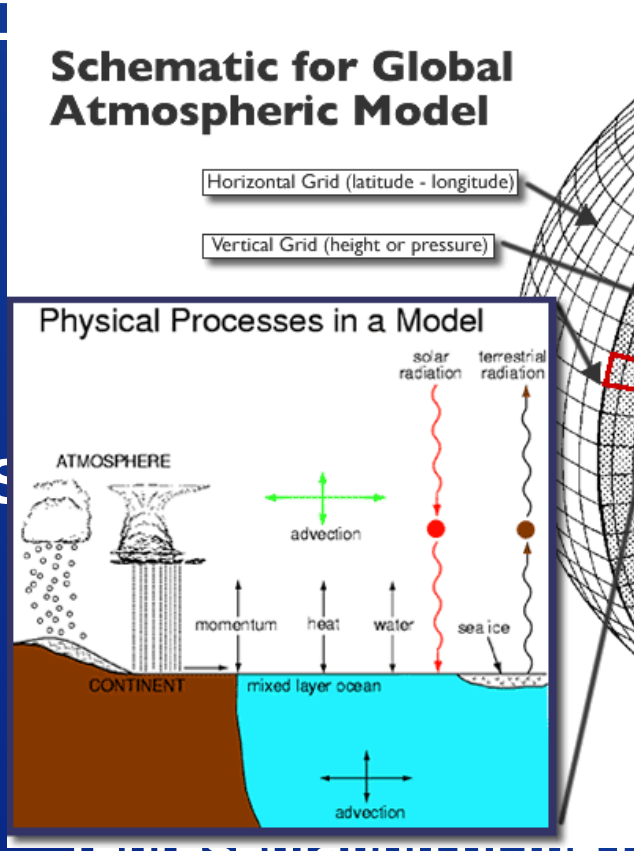
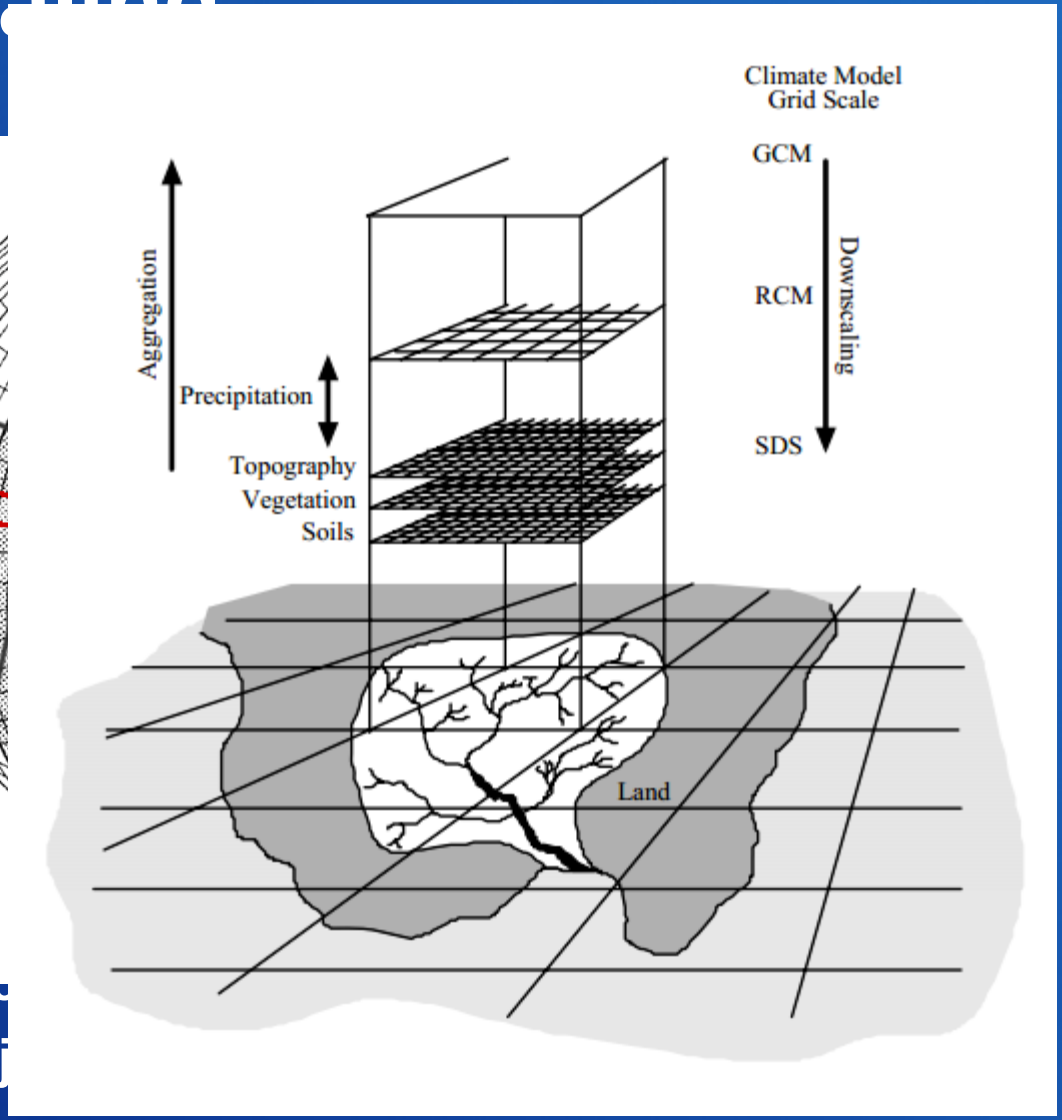
- S
  - representation of the
  - Use same factor to adj





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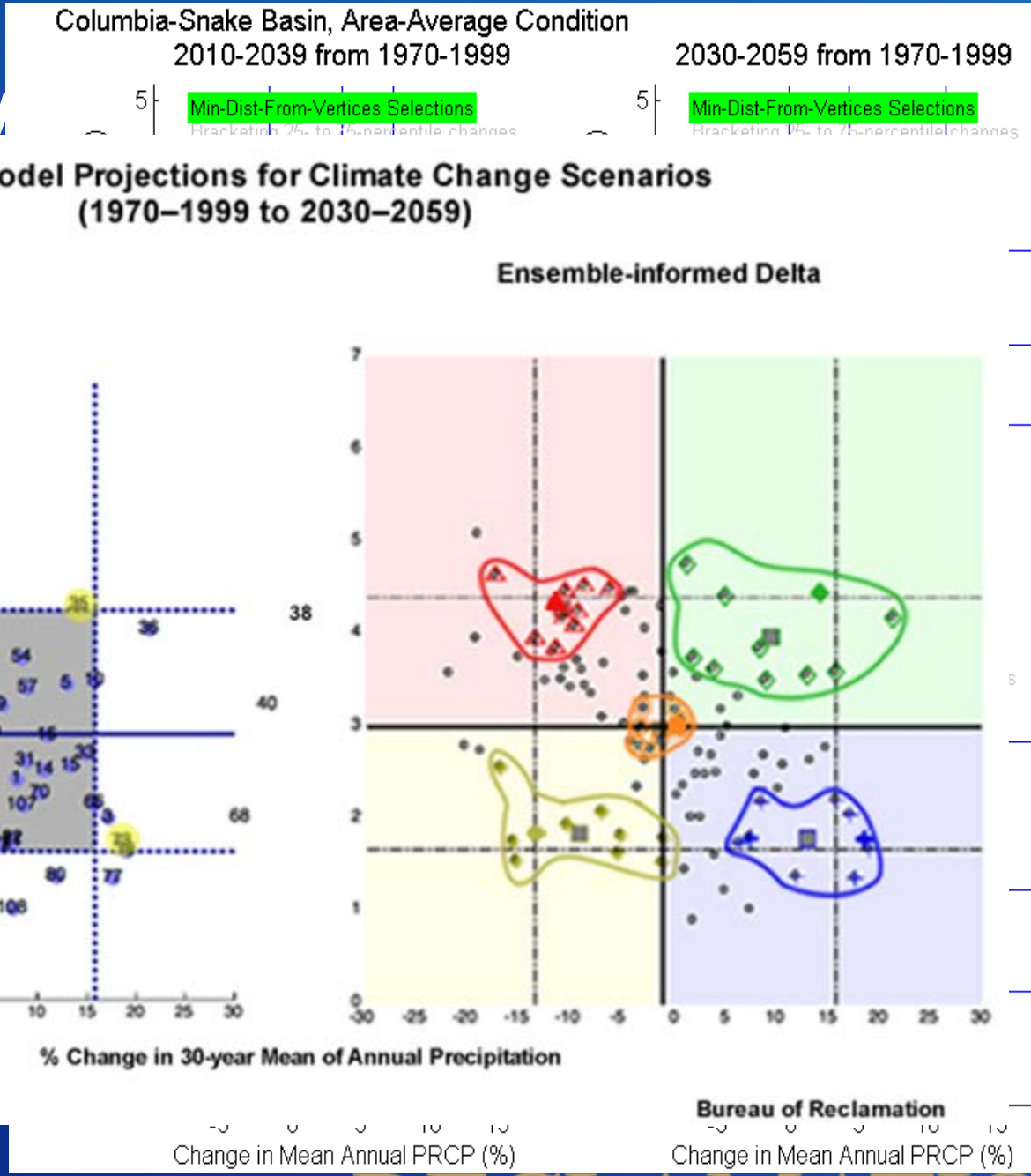
Period Composite or Transient

- **Period Composite (e.g., Delta or Hybrid-Delta {HD})**
  - **2 projections compared – one future and one historical**
  - **Delta is a shift in T/P statistics; HD is a shift in the "distribution" of the T/P**
  - **Usually timeframes are 30yrs (e.g., 1970 – 1999 compared to some future 2030 – 2059)**
  - **Report change in the metric (e.g., metric can be a percent change in flow, storage volume, etc.)**
  - **Distribution of wet/dry patterns representative of historical record**
- **Transient**
  - **1 projection used**
  - **Timeframe spans 150 years**
  - **Distribution of patterns not related to historical patterns**
  - **Great for threshold evaluation**

Uncertainty



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Decision looks something like this…

- Source and Model Phase
  - GCMs from CMIP3 from LLNL site (get Phase 3 GCM data, downscaled over the CRB at a 1/8th degree scale)
- Technique
  - Hybrid-Delta ensemble method (compare 1970-1999 to 2030 to 2059) using more than one projection
- Uncertainty Characterization
  - 20%/50%/80%
- Climate Characterization
  - MW/D, C, and LW/W ?? Or MW/W, C, LW/D ??
- Hydrologic Model
  - Use DHSVM hydrologic model to evaluate T/P output from GCM (in this case)

…and finally…

- Route flows to some determined number of locations
- Import results from that routed flow into water resource model (e.g., ModSim)
- Determine metrics to analyze (end-of-month storage) in the water resource model
- Conduct comparisons (e.g., simulated historical and simulated future of existing conditions) and report results

Jon Rocha

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Basin Study Goals and Alternative Analysis

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Basin Study Goals

1. Define current and future basin water supply and demands, with consideration of potential climate change impacts

2. Determine the potential impacts of climate change on the performance of current water delivery systems (e.g., infrastructure and operations)

3. Develop options to maintain viable water delivery systems for adequate water supplies in the future

4. Conduct an analysis and modeling scenarios of the options developed, summarize findings and make recommendations on preferred options

Alternatives for Evaluation

- **Existing Conditions**
  - **Baseline Existing Conditions**
    - **Simulated historical climate**
  - **Future Existing Conditions**
    - **Simulated future climate**

- **Potential Alternatives - Future Conditions (3 max)**
  - **Future with changes to storage**
  - **Future with increased demands**
  - **Future with increased conservation**
  - **Future with some combination**

Next Steps

- Presentation Oct, Nov, Dec
- Jan-Mar
  - Draft reports written and distributed for review
- Apr – May
  - Draft Finals of reports (revisions occur during this time and another review if necessary)
- June 15, 2014
  - Project complete (some internal Reclamation steps may still be completed post-deadline, but report will be finalized)

Niklas

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Extras

Status of Modeling Efforts

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Basin Study Goals

1. **Define current and future basin water supply and demands, with consideration of potential climate change impacts**
   - **Develop Water Needs and Water Conservation reports**
   - **Conduct *Existing Conditions* MODSIM modeling to evaluate historical + 1 future window (e.g., 2040s) with three future climates (MW/W, C, and LW/D)**
   - **This provides the necessary range of uncertainty for results (1 historical + 3 futures = 4 runs)**
   - **Compare results**

Basin Study Goals

2. Determine the potential impacts of climate change on the performance of current water delivery systems (e.g., infrastructure and operations)
   - Complete this effort using the existing conditions model
   - Evaluate all or some of the following (as applicable):
     - Ability to deliver water (will be performed)
     - Hydroelectric power generation facilities (will be performed)
     - Recreation (N/A)
     - Fish and Wildlife habitat (Reclamation will perform using instream water rights analysis; Normandau will perform using output from Reclamation)
     - ESA (will perform using instream water rights)
     - Water quality (N/A – not enough information for Reclamation – may be part of IFIM work??)
     - Flow and water dependent ecological resiliency (not sufficient information - Normandau)
     - Flood control management (N/A)

Basin Study Goals

3. Develop options to maintain viable water delivery systems for adequate water supplies in the future
   - Identify structural and non-structural options
     - Structural changes include dam construction simulation and dam raise simulations
     - Non-structural changes include changes in demands (one alterative) and changes in conservation (another alterative)
   - Adaptive Management Strategies (no analysis, just discussion based on what we know at the end of the study)
     - Habitat Restoration Plans
     - Improved models or other DSS
     - Others identified by the County
4. Conduct an analysis and modeling scenarios of the options developed, summarize findings and make recommendations on preferred options.