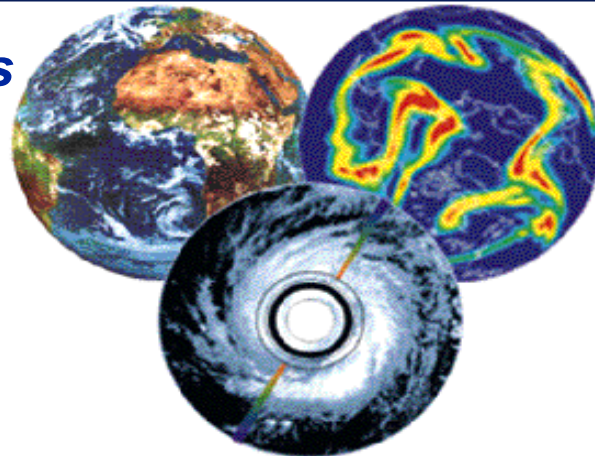


***Some Thoughts About
Hydrological Ensemble
Prediction Experiment (HEPEX)***

March 8-10, 2004, ECMWF, Reading

Observations



Models

Products

Soroosh Sorooshian, Chair GEWEX-SSG

GEWEX view of HEPEX

*-GEWEX sees **HEPEX** as a possible element of achieving one of its key objective:*

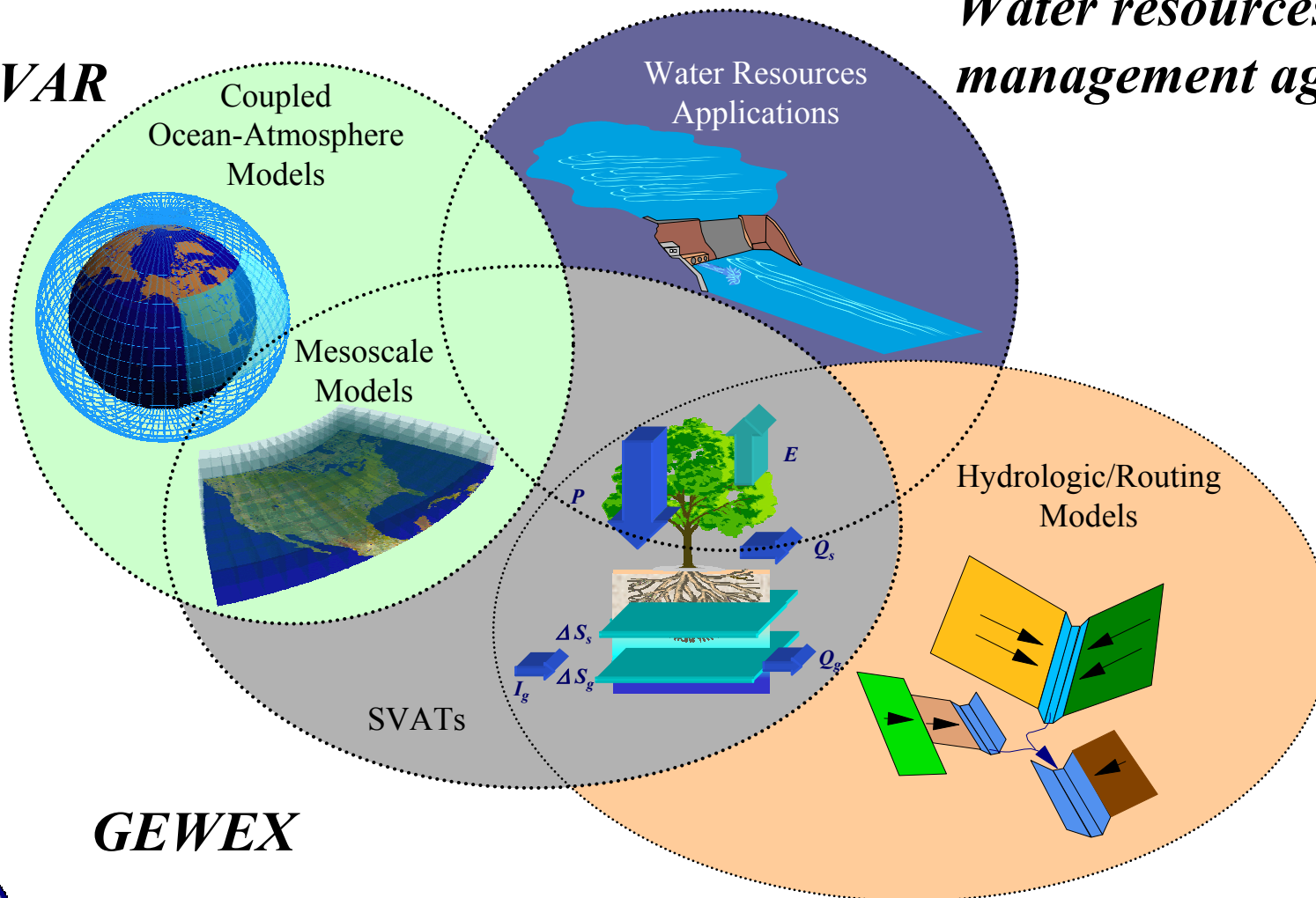
- **Develop the ability to predict the variations of global and regional hydrological processes and water resources, and their response to environmental change.**

GEWEX is Therefore highly supportive



Model Coupling, Downscaling, and Water Resources Applications

CLIVAR



Water resources management agencies

GEWEX

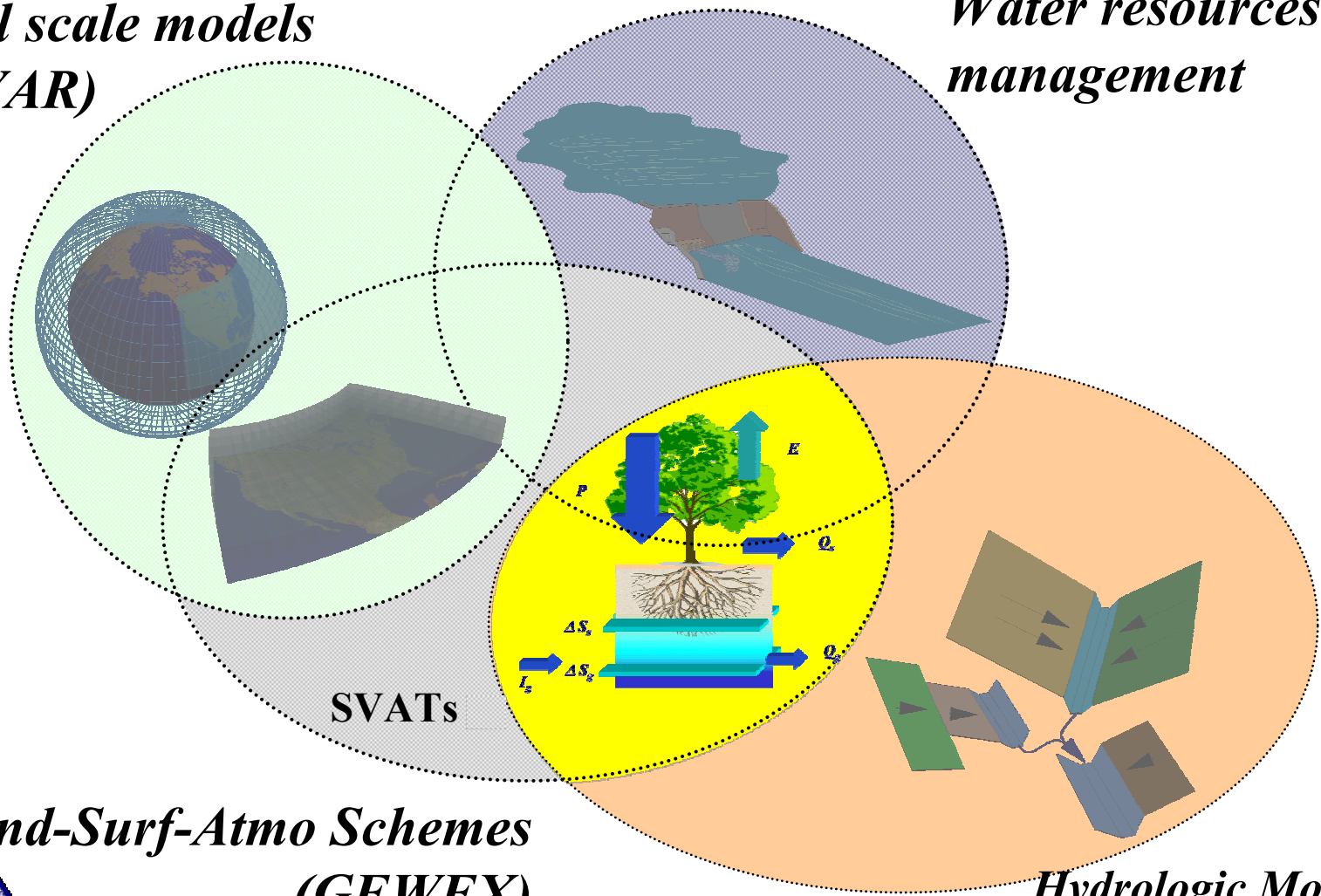
Hydrologic Services



GEWEX Phase II focus: The Hydrology Interface

Global scale models
(CLIVAR)

Water resources
management



SVATs

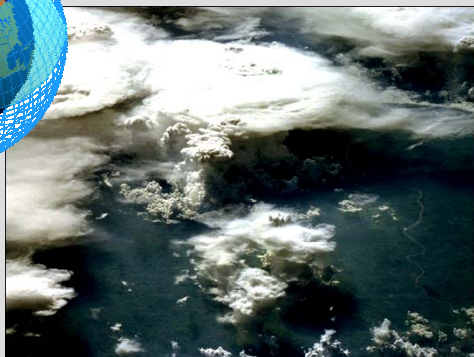
Land-Surf-Atmo Schemes
(GEWEX)

Hydrologic Models
(Hydrologic Services)

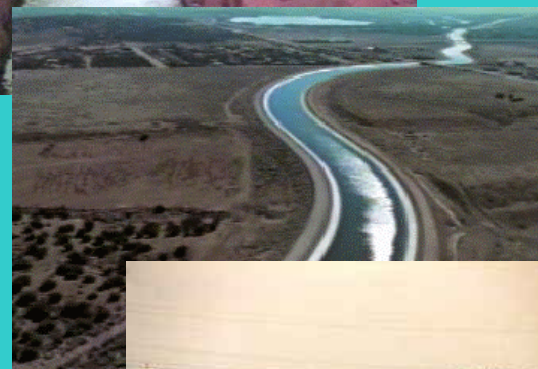


Meteorology, Hydrology, and Water Resources

Meteorology



Water Resources

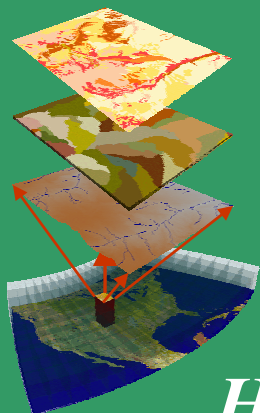


Science

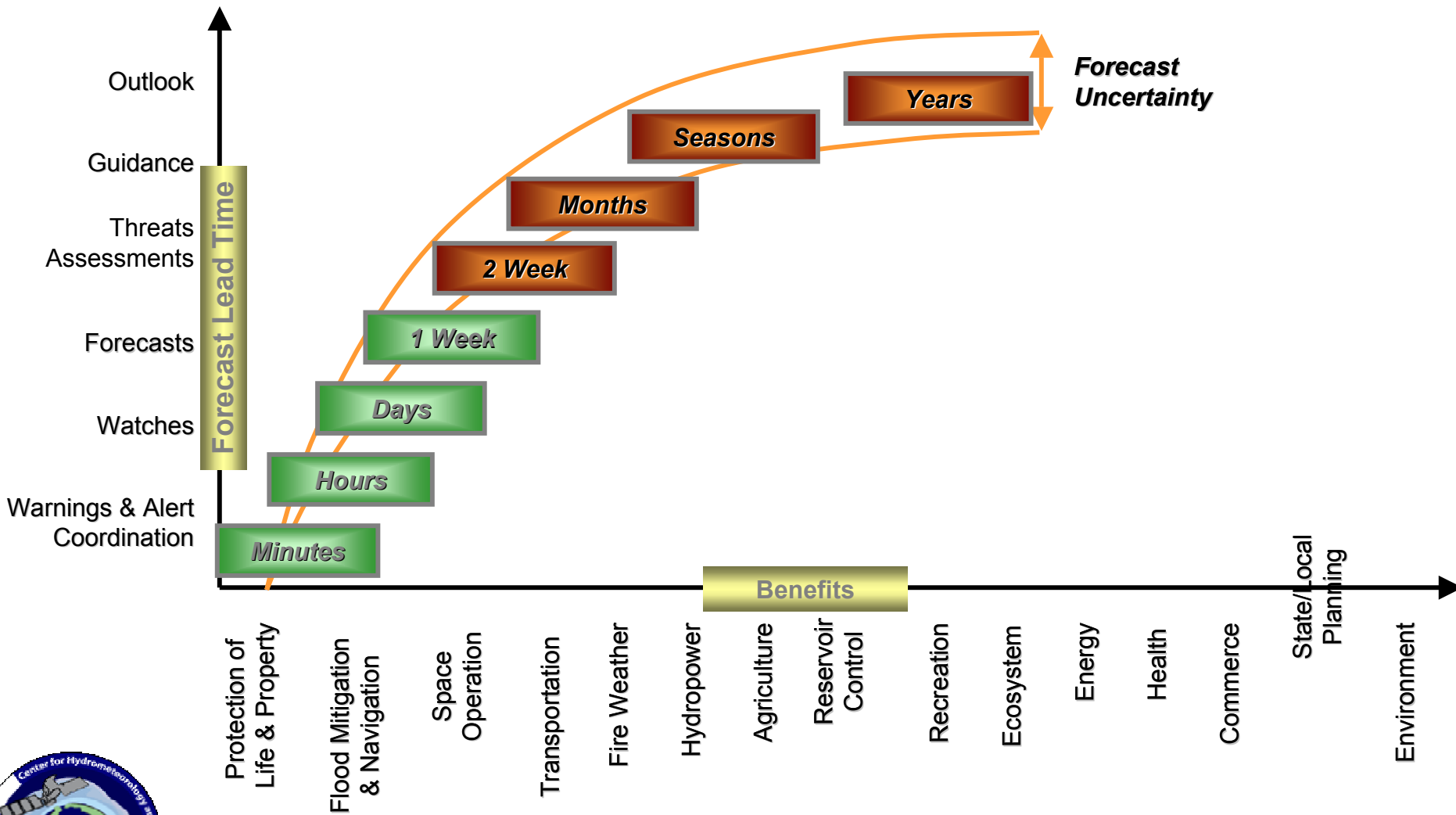
Science

Engineering

Hydrology



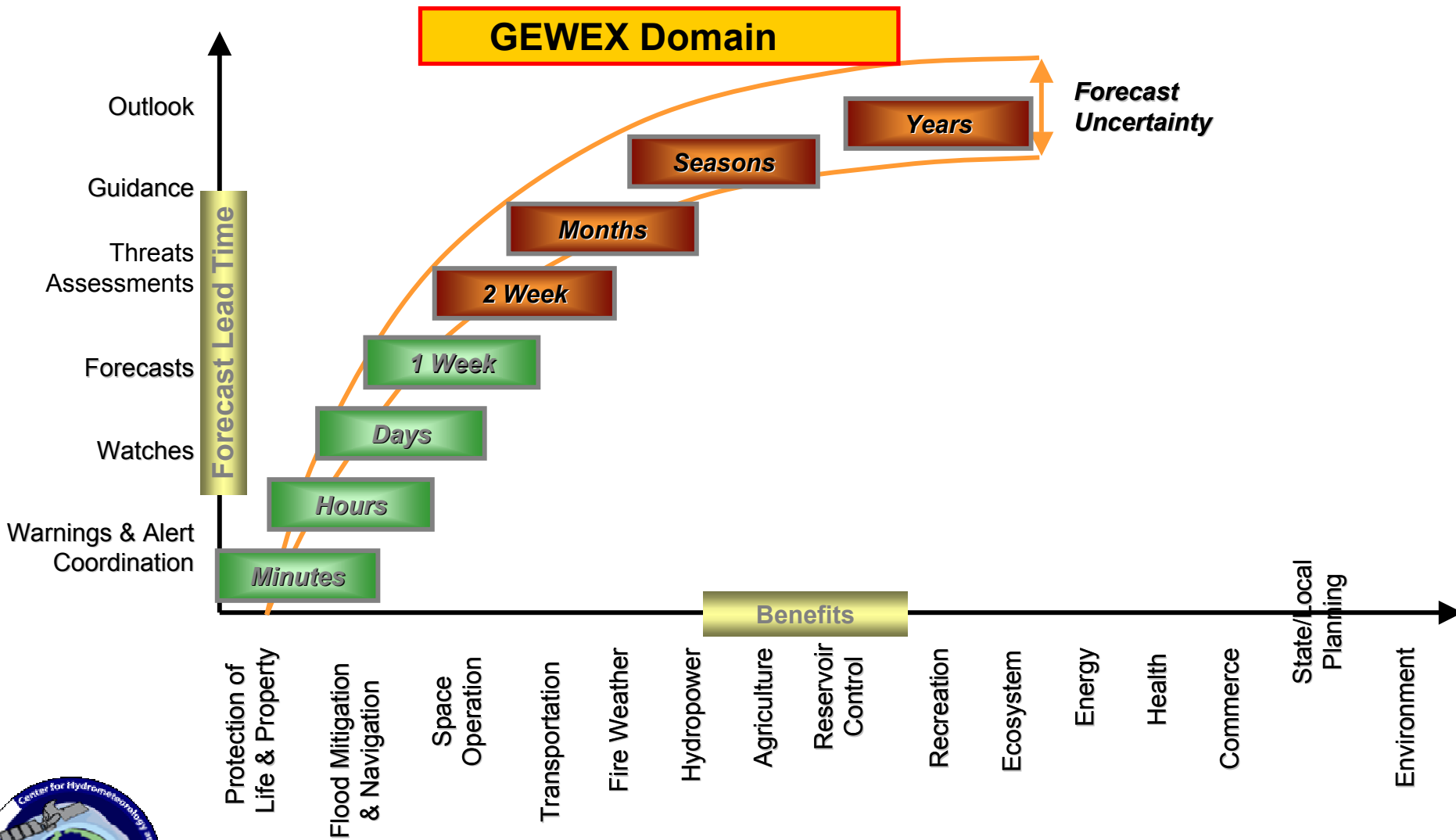
Seamless Suite of Forecasts



Source: HRL-NWS



Seamless Suite of Forecasts



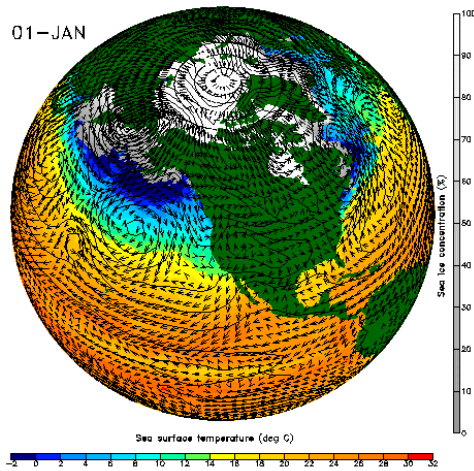
Source: HRL-NWS

Center for Hydrometeorology and Remote Sensing, University of California, Irvine



From Weather *to Hydrology*

NWP



Days to weeks

*Rainfall
Runoff
Models*

*Advanced
Hydrologic
Prediction*



Precipitation Data Requirements

Spatial: 25x25 km → 4x4 km

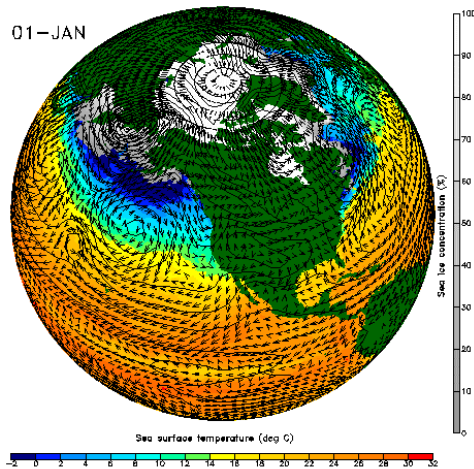
Temporal: Daily → 6 hr. → 30 min.

Source: S. Sorooshian GEWEX-SSG

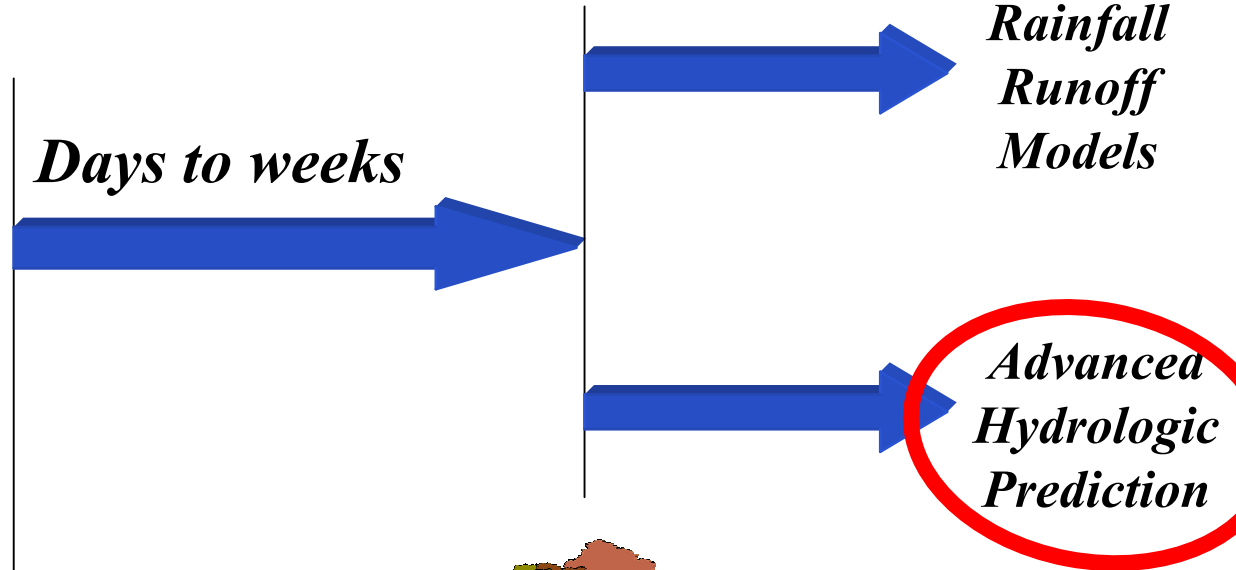


From Weather to Hydrology

NWP



Days to weeks



Precipitation Data Requirements

Spatial: 25x25 km → 4x4 km
Temporal: Daily → 6 hr. → 30 min.

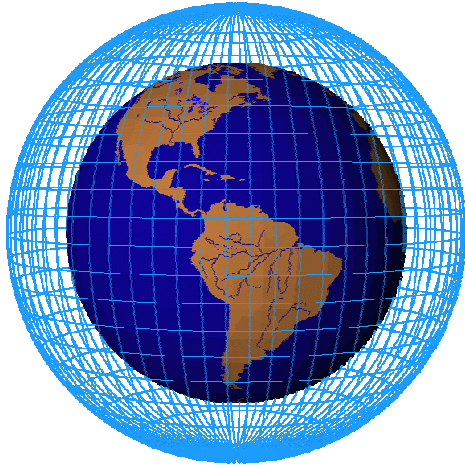


Source: S. Sorooshian GEWEX-SSG



From Climate to Hydrology

GCM



Seasonal to Interannual



*Advanced
Hydrologic
Prediction*



*Statistical
Estimates*



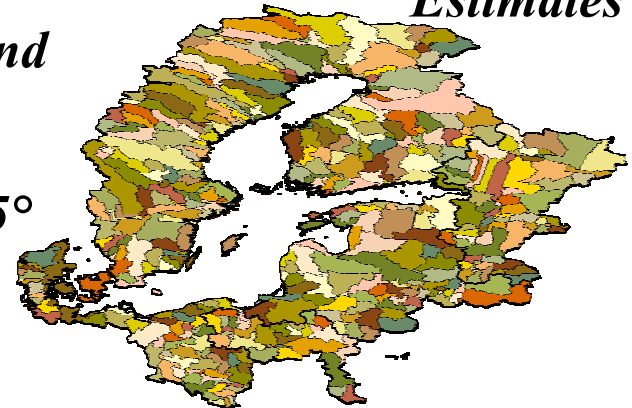
Decadal and Beyond

*Statistical
Estimates*

Precipitation Data Requirements

Spatial: $2.5^\circ \times 2.5^\circ \rightarrow 1^\circ \times 1^\circ \rightarrow 0.25^\circ \times 0.25^\circ$

Temporal: Monthly \rightarrow Pentad

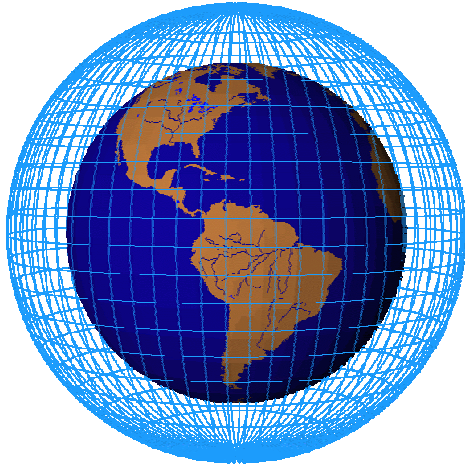


Source: S. Sorooshian GEWEX-SSG



From Climate to Hydrology

GCM



Seasonal to Interannual



**Advanced
Hydrologic
Prediction**

**Statistical
Estimates**



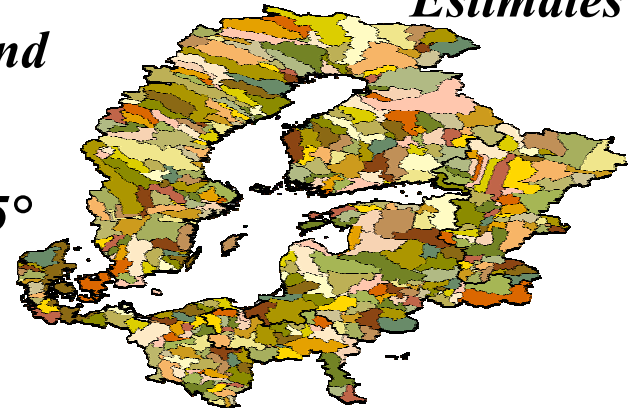
Decadal and Beyond

**Statistical
Estimates**

Precipitation Data Requirements

Spatial: $2.5^{\circ} \times 2.5^{\circ} \rightarrow 1^{\circ} \times 1^{\circ} \rightarrow 0.25^{\circ} \times 0.25^{\circ}$

Temporal: Monthly \rightarrow Pentad



Source: S. Sorooshian GEWEX-SSG



HEPEX Contribution: Expectations?

- Will HEPEX contribute equally to **HY**drologic **PRE**dictions (short- to long-time scales)?
 - If yes, is it realistic and can we ensure the required resources?
 - If not, then where should one start first?
- What will bring the biggest improvements to **HY-PRE**?
 - models, improved precip. forecasts (QPF), ??????



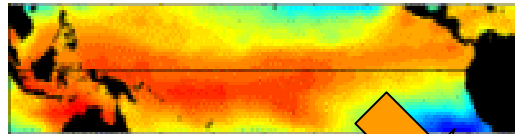
GEWEX: A future Scenario

One Possible Scenario of the future from the Hydrologic and Water Resources perspective

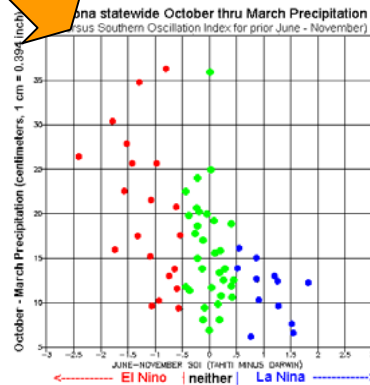


Example of SI "End-to-End" Prediction

From climate prediction

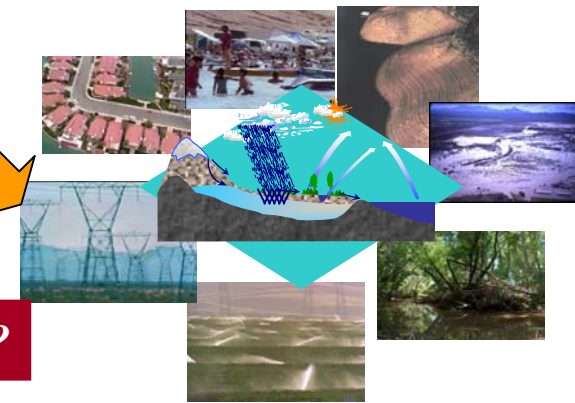
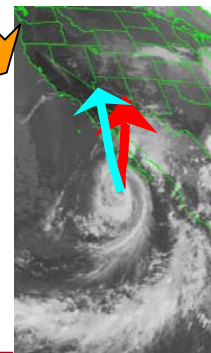


To Weather predic:
the actual event



Decisions

To impact on water resources



El Nino Prediction

Possibility of Wetter or Drier?

Early Releases

Water Saved



Source: S. Sorooshian GEWEX-SSG

Center for Hydrometeorology and Remote Sensing, University of California, Irvine

A vision of the future for hydrologic predictions

Winter Scenario

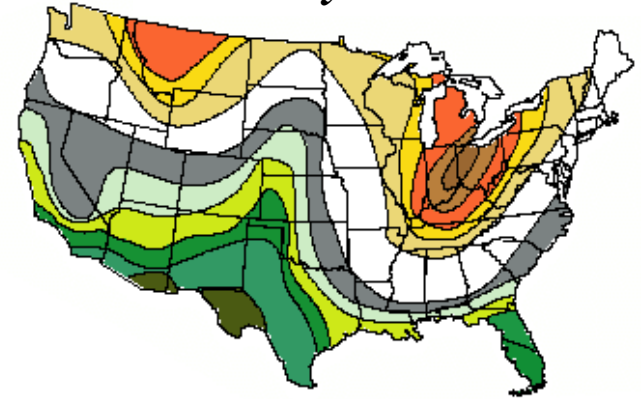
Now:

-It's El Niño, maybe it'll be wet

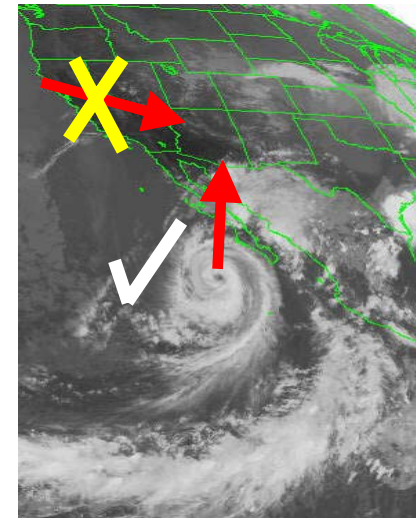
Future:

- Increased chance of fall tropical storms*
- Extra winter snow at high elevations*
- Warm spring events – rain on snow*
- Floods likely in early May*

Generally wet in winter



Tropical vs Frontal

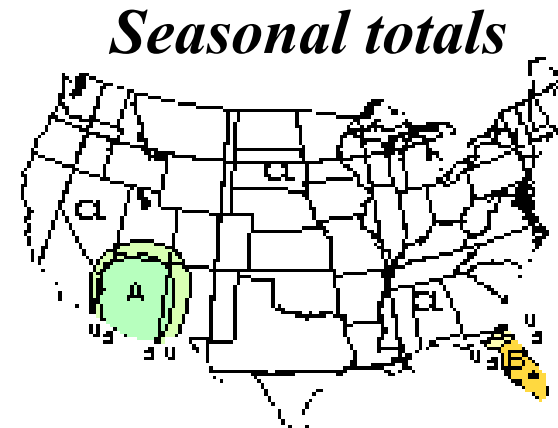


A vision of the future for hydrologic predictions

Summer Monsoon

Now:

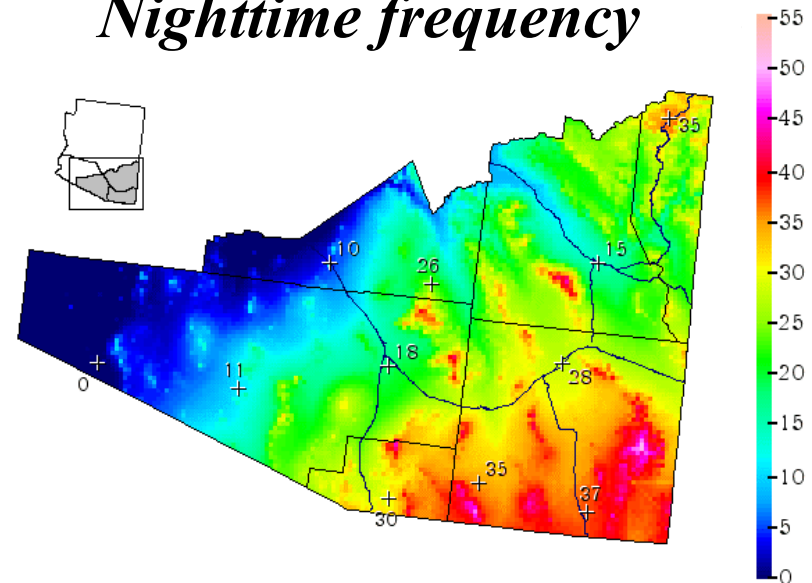
- It's La Niña, maybe it will be wet



Future:

- Monsoon starts 2 weeks late*
- Infrequent but intense rain*
- Mostly nighttime rainfall*

Nighttime frequency



HEPEX Contributions to this vision

-Given the previous “wish list” of some water resources/emergency managers, will HEPEX be able to contribute towards meeting them?

-How do we measure progress?
-Forecast Evaluation Tools



Progress on forecast Evaluation

- *Climate Forecast Evaluation*
- *Hydrologic Forecast Evaluation*



Progress on forecast Evaluation

- *Climate Forecast Evaluation*
- *Hydrologic Forecast Evaluation (Franz Presentation later)*



Forecast Performance Evaluation

Sub-setting: Seasons, Leadtimes, Regions

Scores: Simple/Intuitive to Complex/Informative

Transparency: Data behind analysis

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Home Netscape Search Shop Bookmarks Net2Phone

Climate Forecast Performance: Evaluation Results

The following maps show how well the CPC climate forecasts have worked for the seasons and lead times you selected: You chose Temperature forecasts issued August - November covering seasons December - April.

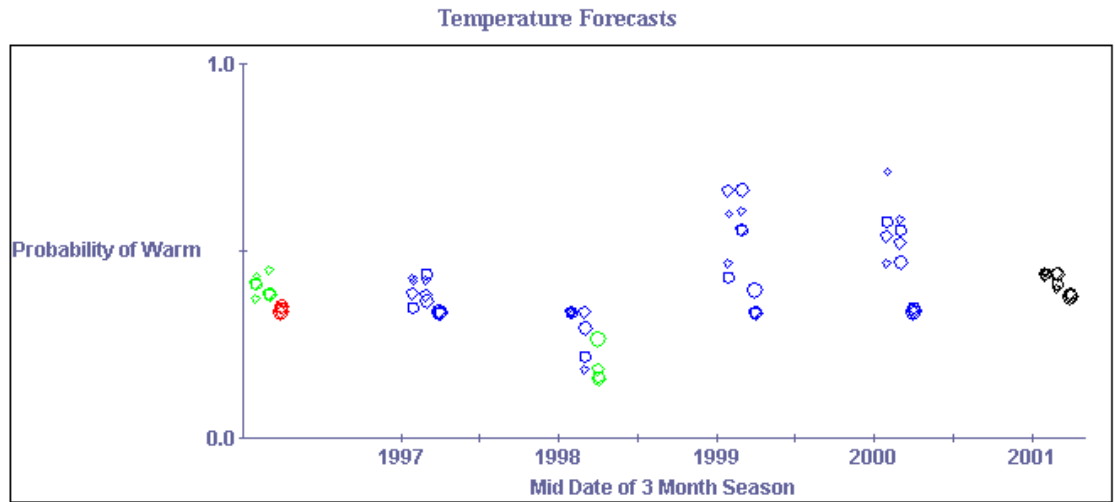
To see the data that were used in the evaluation, go to the map that you are interested in and click on the region you want to see.

Ranked Probability Skill Score Results

This map shows the Ranked Probability Skill Score (RPS) for each county. The RPS is a measure of the strength of the probability given to each of the outcomes. The RPS is calculated as the difference between the probability of the event actually occurring and the probability of the event occurring based on a forecast. For example, for forecasts made heavily if conditions turn out to be a distant (but forecasts with low probability aren't expected forecasts where conditions turn out to fall in the normal instead of cold), are penalized as if they were wrong.

The legend shows the Ranked Probability Skill Score over using chance or climatology as a forecast would be given a 33% chance of occurring.

0.0 0.733 1.0
Show Data Behind the Map



LeadTime: 2months	ProbabilityBelow: 0.218	ProbabilityNormal: 0.317	ProbabilityAbove: 0.465	TargetMonth: DJF
LeadTime: 4months	ProbabilityBelow: 0.166	ProbabilityNormal: 0.299	ProbabilityAbove: 0.535	TargetMonth: DJF
LeadTime: 3months	ProbabilityBelow: 0.146	ProbabilityNormal: 0.279	ProbabilityAbove: 0.575	TargetMonth: DJF
LeadTime: 1months	ProbabilityBelow: 0.077	ProbabilityNormal: 0.211	ProbabilityAbove: 0.712	TargetMonth: DJF

Forecast Evaluation

Sub-setting: Seasons, Leadtimes, Regions

Scores: Simple/Intuitive to Complex/Informative

Transparency: Data behind analysis

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http://hydis2.hwr.arizona.edu/cgi-
Home My Netscape Search Shop Bookmarks Net2Phone

Climate Forecast Performance: Evaluation Results

The following maps show how well the CPC climate forecasts have worked for the seasons and lead times you selected: You chose Temperature for the forecast issued August - November covering seasons December - April .

To see the data that were used in the evaluation, go to the map that you are interested in and click on the region you want to see.

Non Climatology Score Results

0.0 0.733 1.0

Show Data Behind the Map

Ranked Probability Skill Score Results

This map shows the Ranked Probability Skill Score (RPS) for each region. The RPS is a measure of the strength of the probability given to each of the worse scores for assigning higher probability to what actually occurs. For example, forecasts made heavily if conditions turn out to be a distant (But forecasts with low probability aren't expected forecasts where conditions turn out to fall in the normal instead of cold), are penalized as in the legend.

The legend shows the Ranked Probability Skill Score over using chance or climatology as a forecast would be given a 33% chance of occurring.

-0.1 0.258 0.5

Show Data Behind the Map

Forecast Evaluation Results: Maps Behind the Data

The following maps correspond to the specific forecast you selected from the bubble plot.

You chose the forecast issued in October 1996 covering December-January-February 1997
The CPC forecast

Forecast issued in October 1996 covering December-January-February 1997

Corresponding Observations. The color corresponds to the condition that actually occurred, according to area averages computed by the Climate Protection Center using data from the National Weather Service National Climate Data Center

Temperature

Probability of Warm

1.0

0.0

1997

Climate Outlook Temperature

JF D

Mid Date of 3 Month Season

LeadTime: 2months	ProbabilityBelow: 0.218	ProbabilityNormal: 0.317	ProbabilityAbove: 0.465	TargetMonth: DJF
LeadTime: 4months	ProbabilityBelow: 0.166	ProbabilityNormal: 0.299	ProbabilityAbove: 0.535	TargetMonth: DJF
LeadTime: 3months	ProbabilityBelow: 0.146	ProbabilityNormal: 0.279	ProbabilityAbove: 0.575	TargetMonth: DJF
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Forecast in Historical Context

Which climate variable are you interested in?

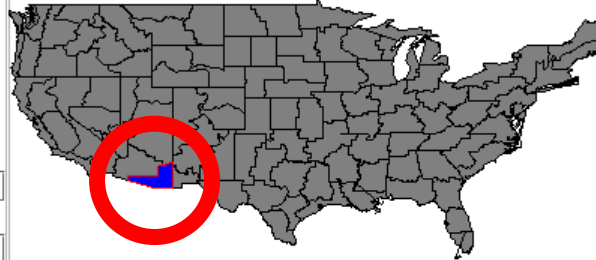
- Monthly precipitation
- 3-month seasonal precipitation
- Monthly temperature
- 3-month seasonal temperature

How much of the recent past do you want to see?

23 months

How far into the "future" do you want to see?

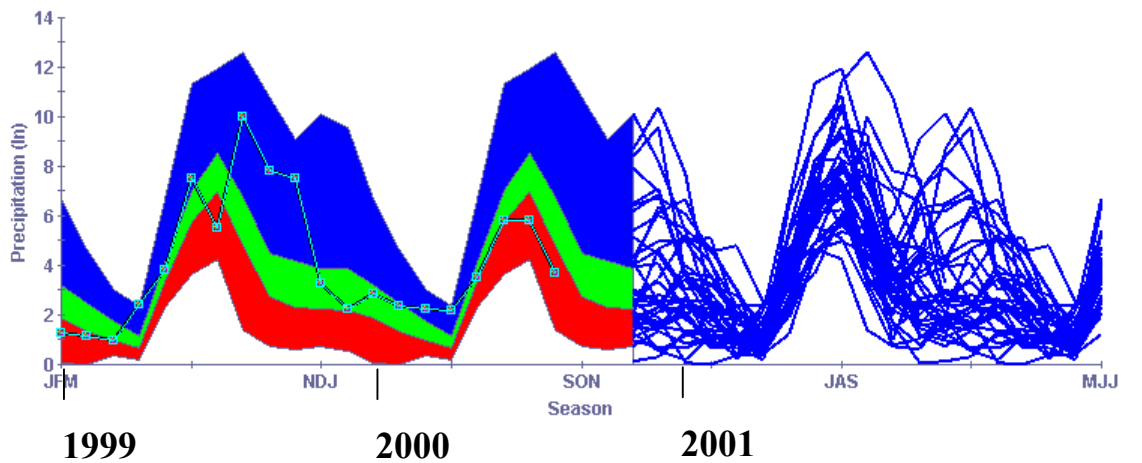
19 months



*Requested by
Fire managers...
Applicable to any
climate variable*

This plot shows seasonal 3-month precipitation for the last 23 months (black line on the left subplot), compared to the historic tercile categories from 1961-1990

Recent History | *Possible Futures*



Forecast in Historical Context

Which climate variable are you interested in?

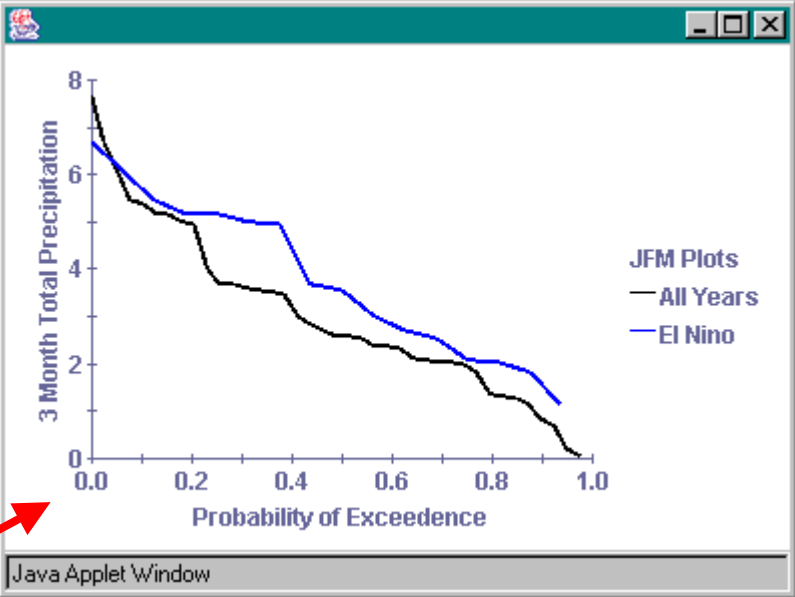
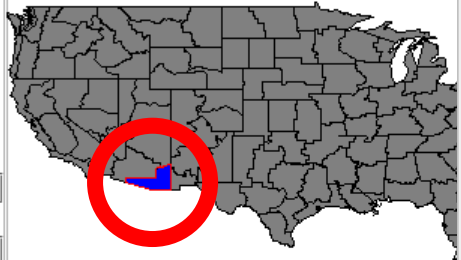
- Monthly precipitation
- 3-month seasonal precipitation
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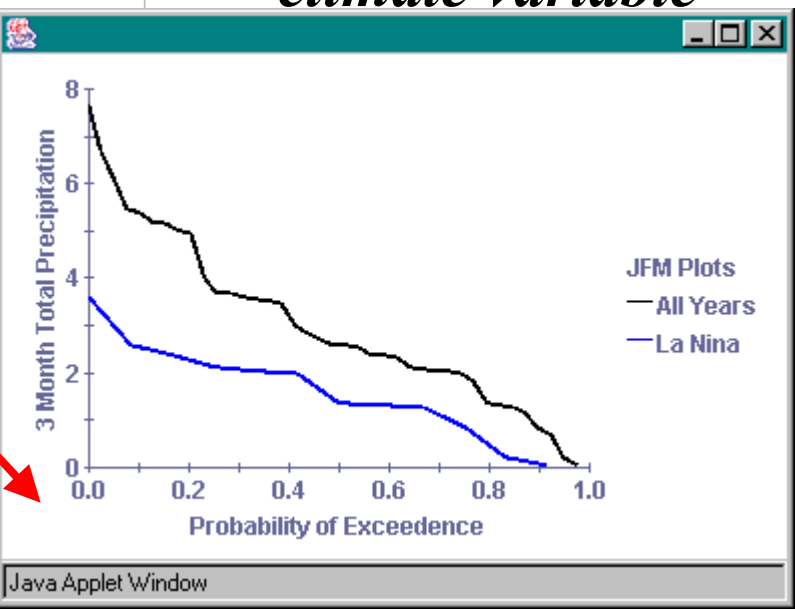
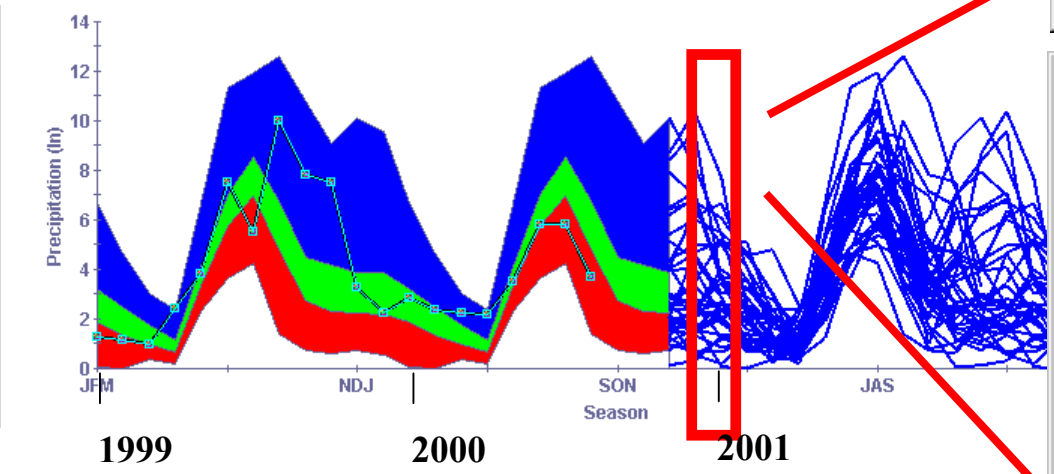
23 months

How far into the "future" do you want to see?

19 months



Recent History | *Possible Future*



*Good Luck with the Meeting and
HEPEX*

