Elqui Case Study: Streamflow forecasts to guide water resources decisions and water rights

TI on Adaptive Management of Water Resources under Climate Change in Vulnerable River Basins
15 October 2012

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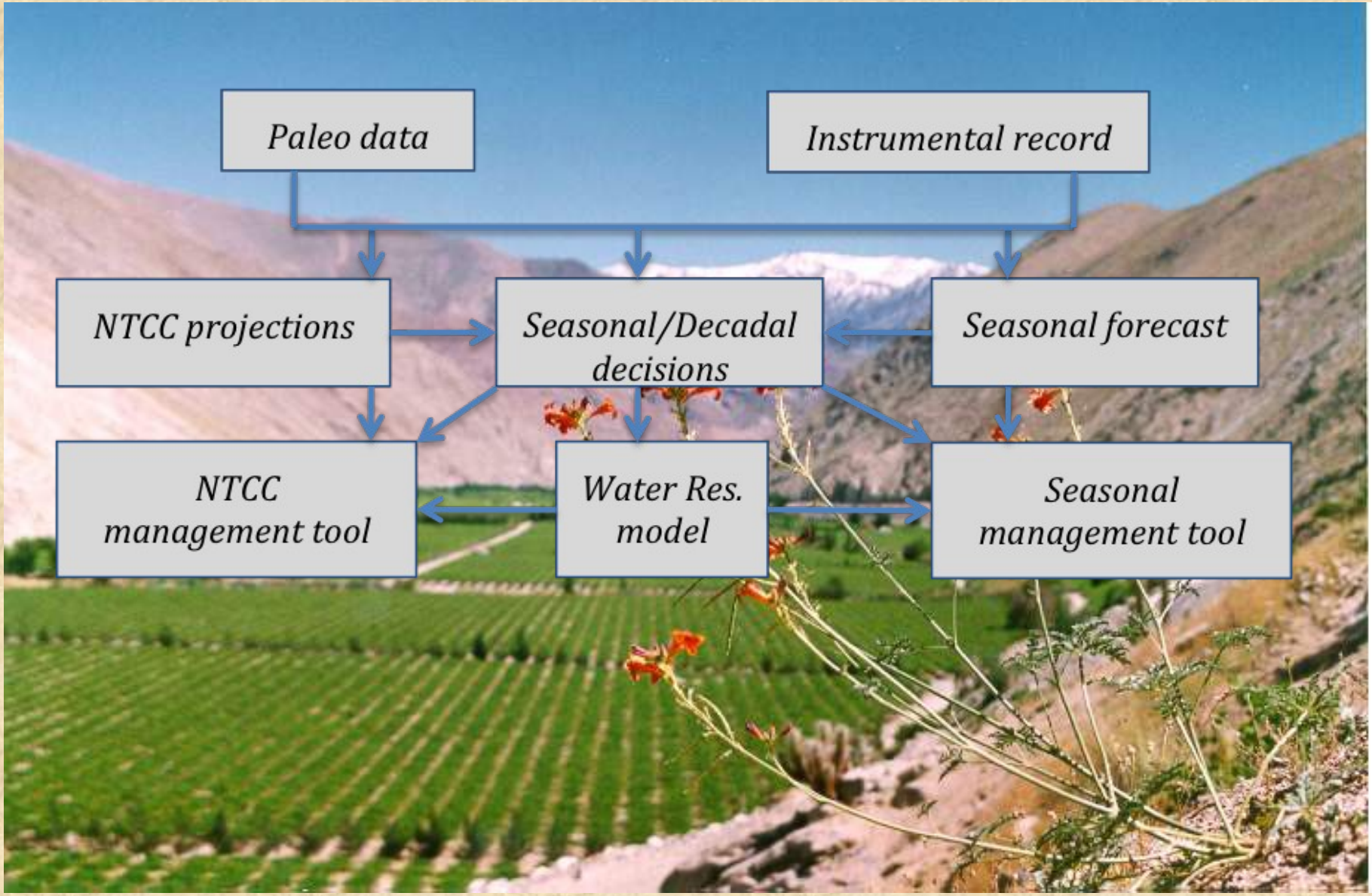
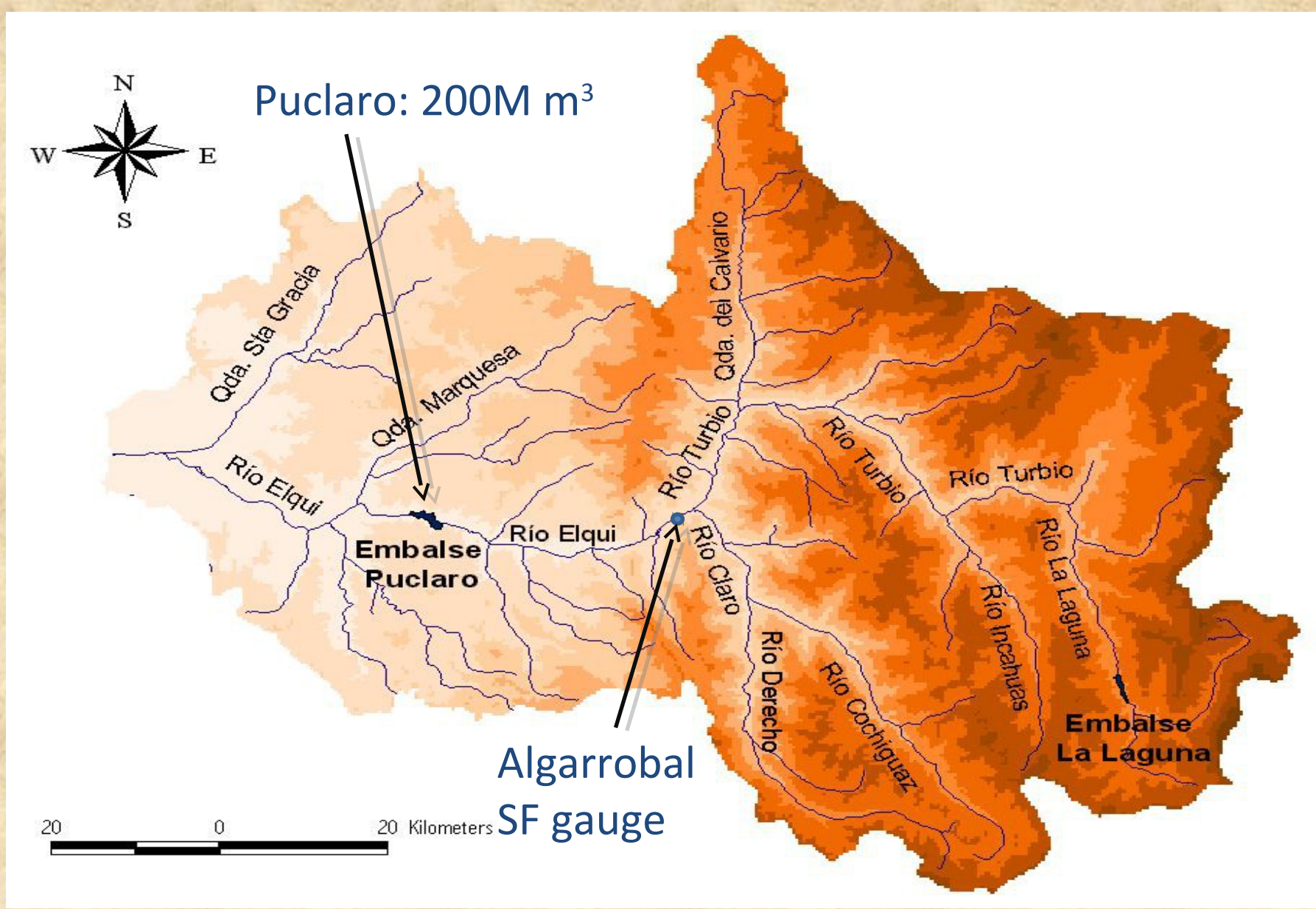
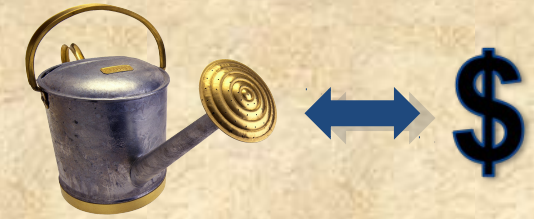
Elqui River Basin, Chile



Basin


Puclaro: 200M m³
N
W
E
S
Qda. Sta Gracia
Qda. Marquesa
Río Elqui
Embalse Puclaro
Río Elqui
Río Turbio
Qda. del Calvario
Río Turbio
Río Turbio
Río Turbio
Río Claro
Río Derecho
Río Cochiguaz
Río Incahuas
Río La Laguna
Embalse La Laguna
Algarrobal SF gauge
20 0 20 Kilometers

Water Rights & Trading



- market-oriented approach: trade, sell
- 25,000 rights in basin; fully allocated
- 1 L/s is legal right (0.5 L/s realistic based on supply)
- piloting volume based approach (can delay use)
- all water rights of equal value
- annual distribution = 400M m^3 (~2x current storage capacity)

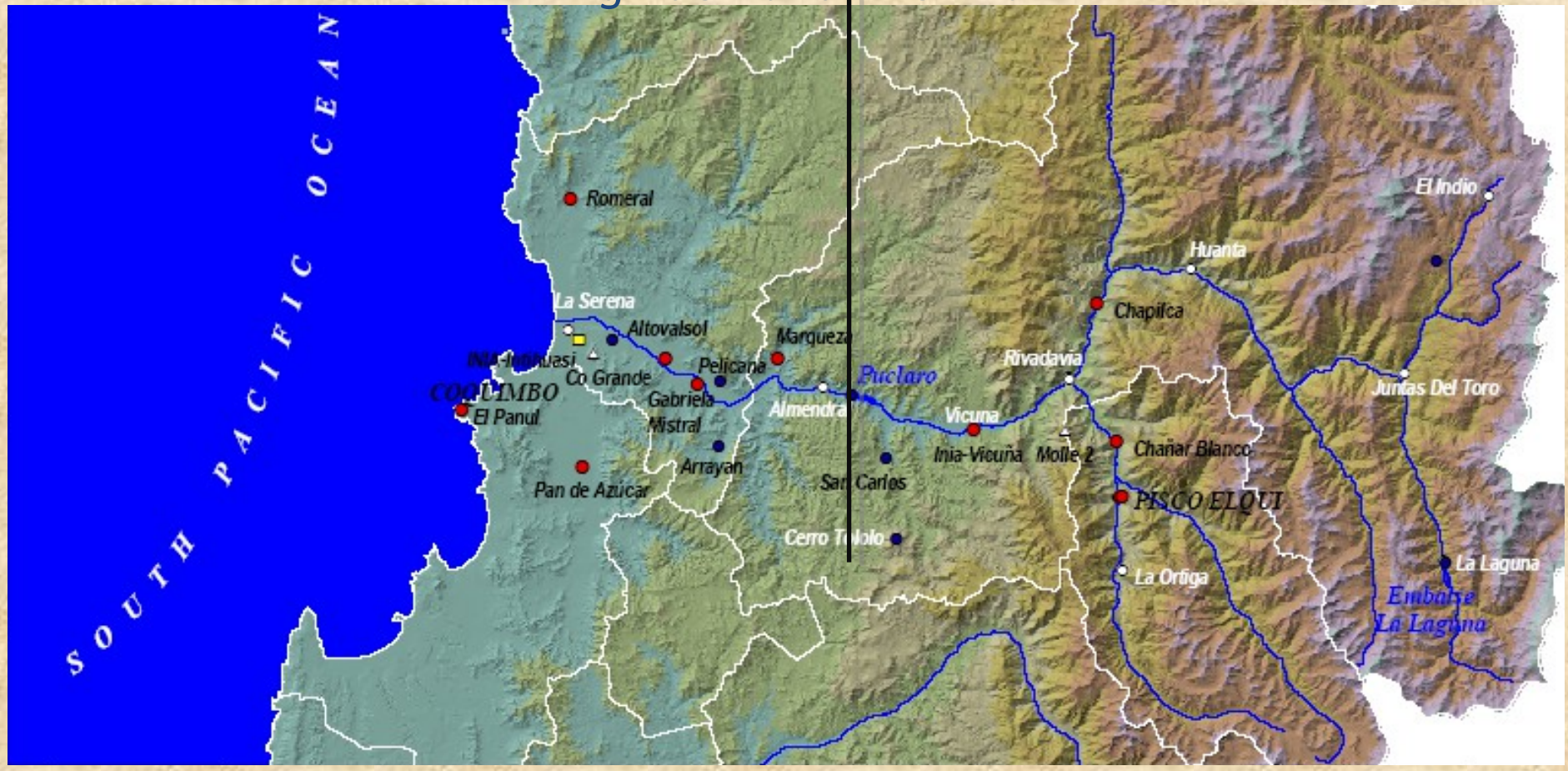
	large farms	small farms
assignment:	44%	48%
users:	4%	78%

- in May and September, water right value announced for ONDJ

Agricultural Users

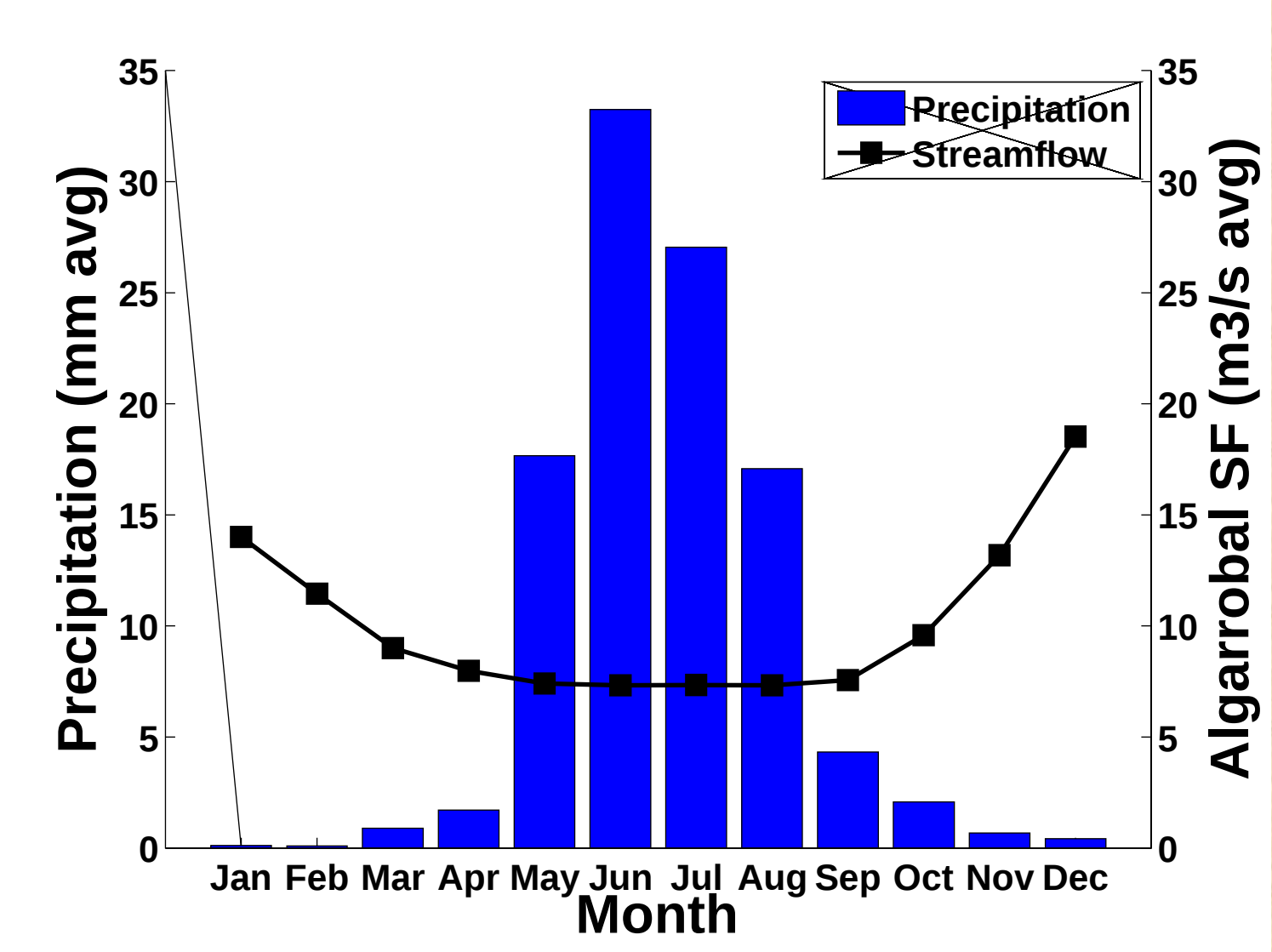
annual crops; flood irrigation | grape growers; drip irrigation

high demand in ONDJ

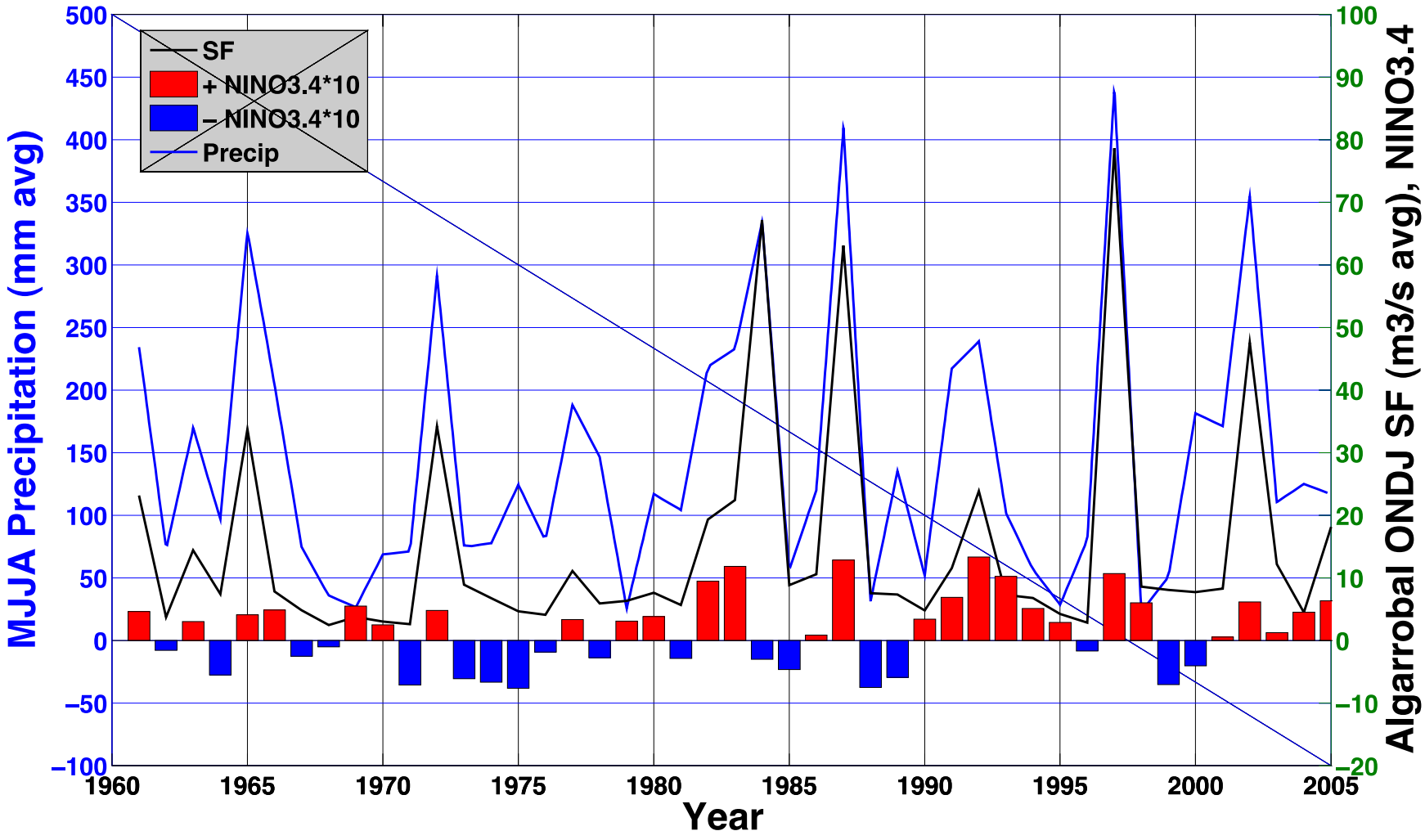


Risks: variable climate/hydrology
maintenance of infrastructure

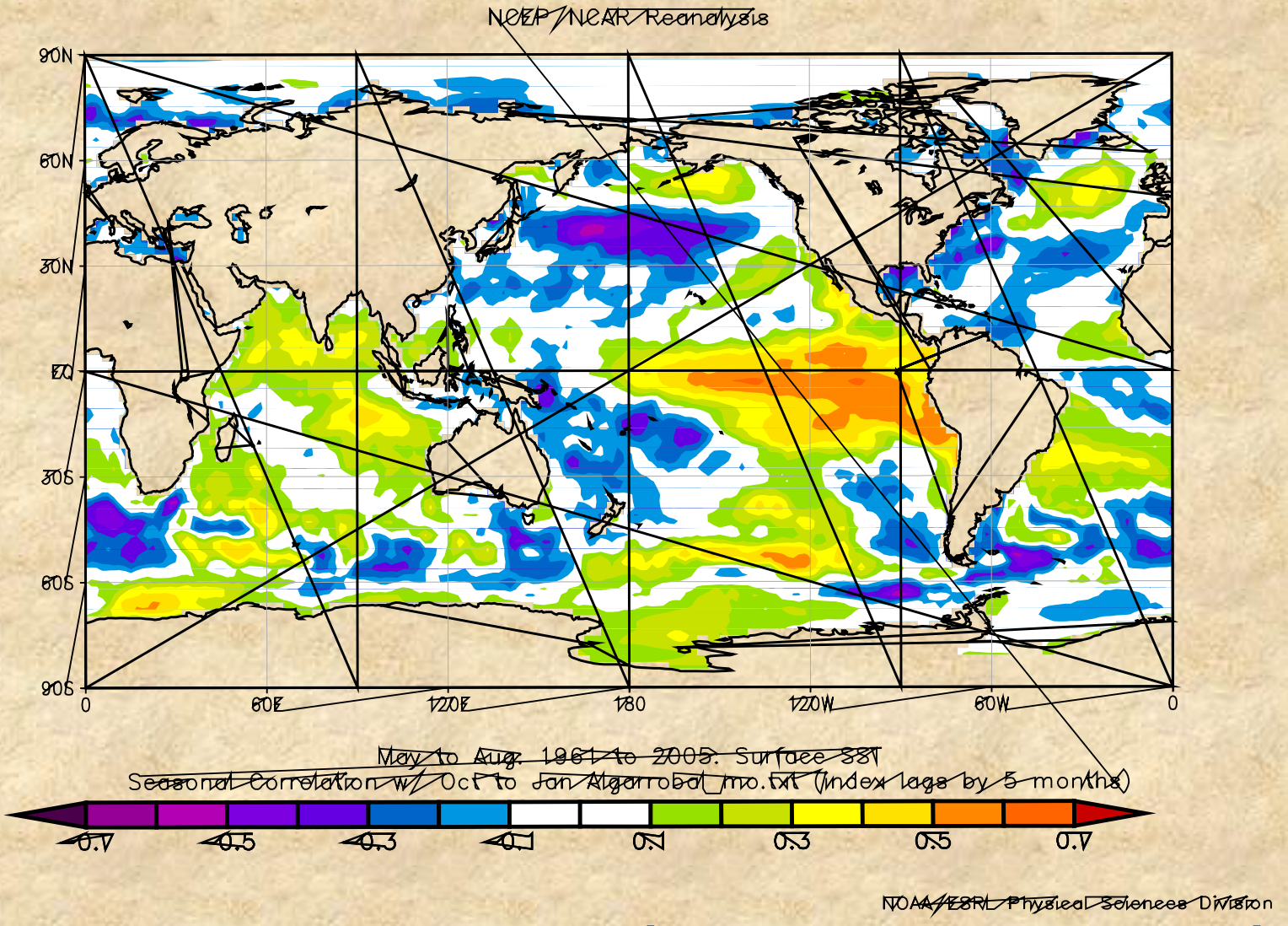
Hydro-Climate



Hydro-Climate



Hydro-Climate



Influences MJJA precipitation → snowpack in mountains → SF

Correlation between SF and ENSO indices ~ 0.5

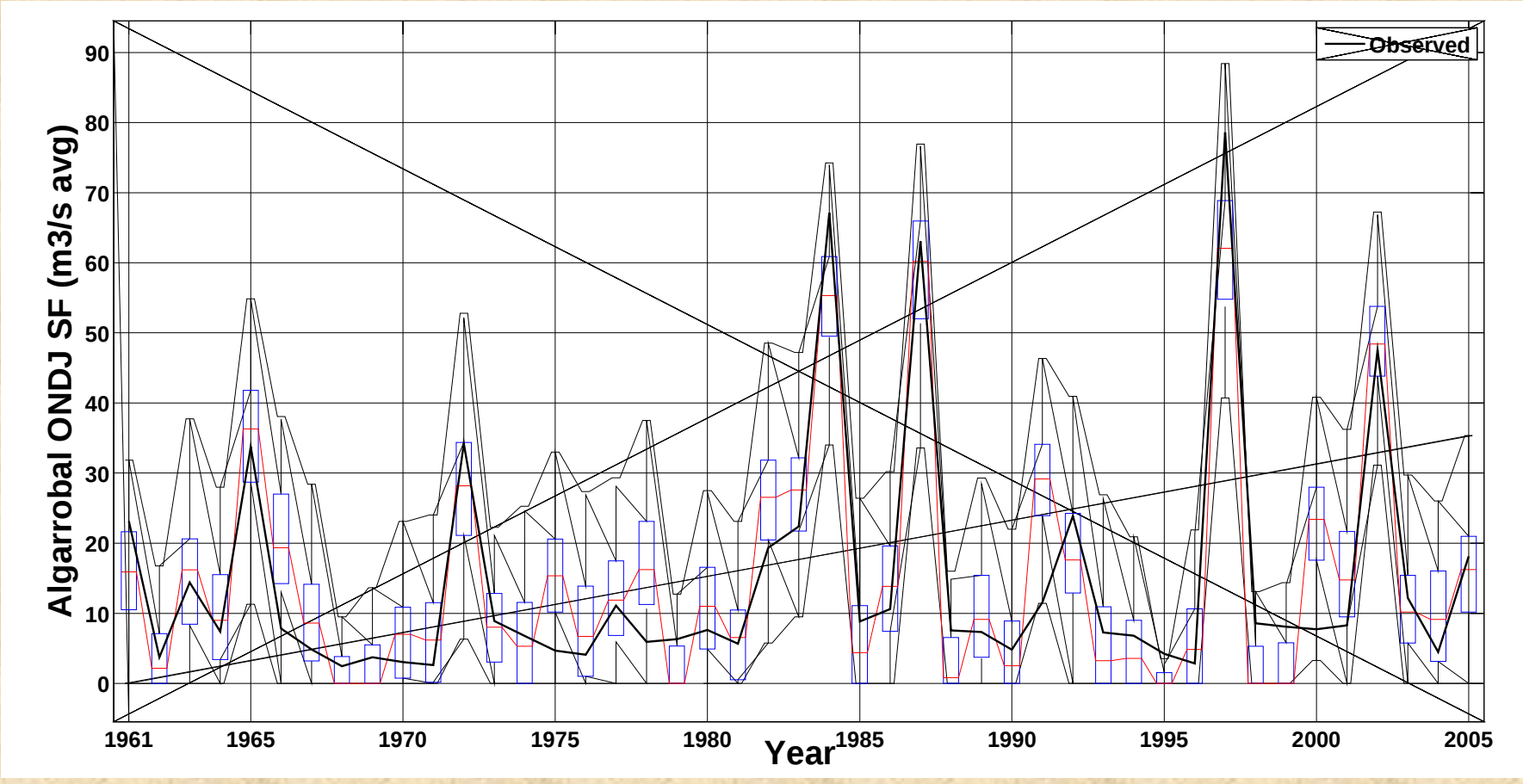
Streamflow Forecast

ONDJ streamflow at Algarrobal (into Puclaro reservoir); snowmelt

September Forecast Issue:

Use MJJA precipitation as predictor – 24 stations

Statistical model: PCA Corr coef = 0.88 RPSS = 0.5



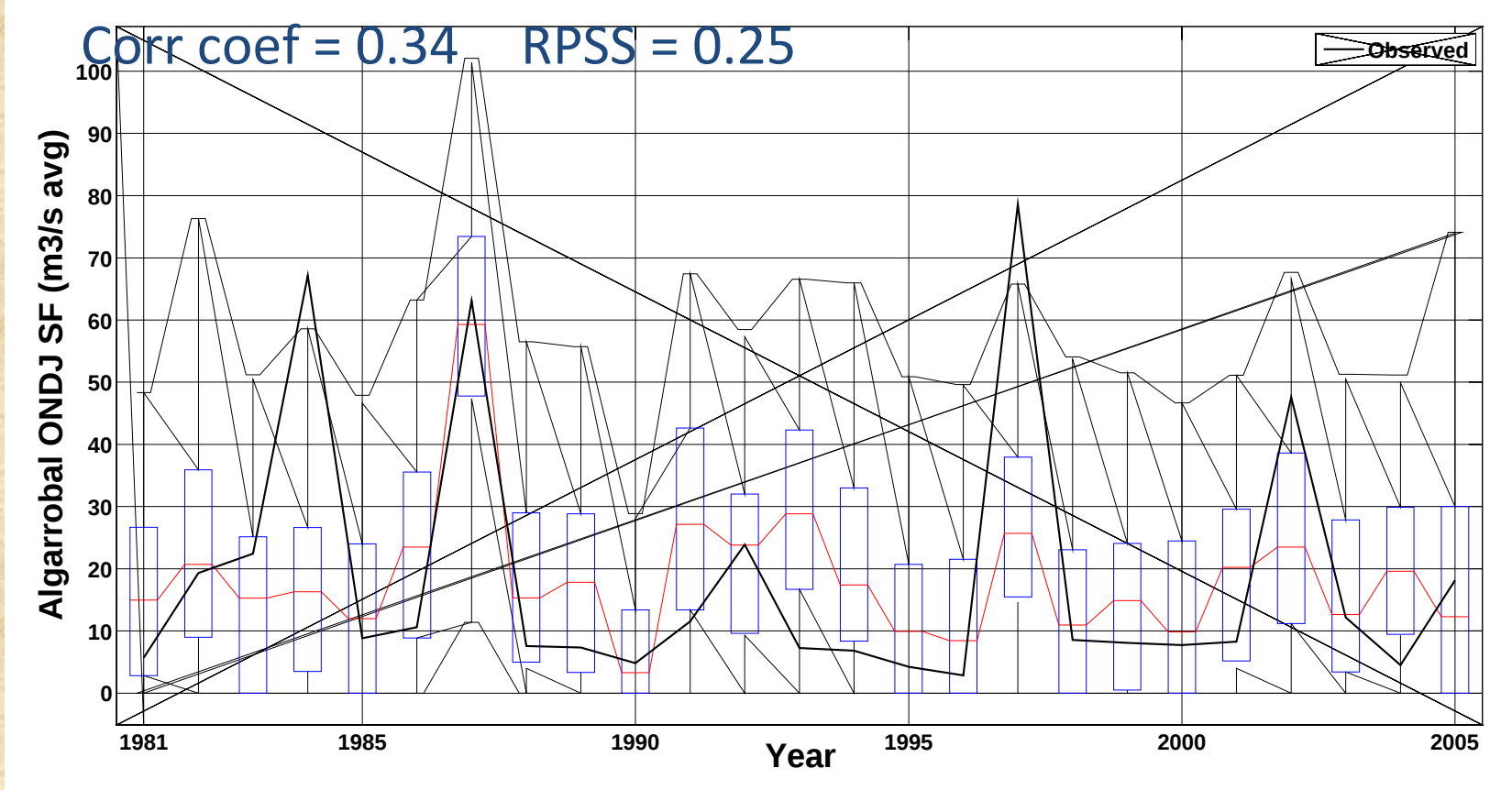
Streamflow Forecast

ONDJ streamflow at Algarrobal (into Puclaro reservoir); snowmelt

May Forecast Issue:

Use NOAA's CFS model to predict MJJA precipitation (*Verbist et al. 2010*)

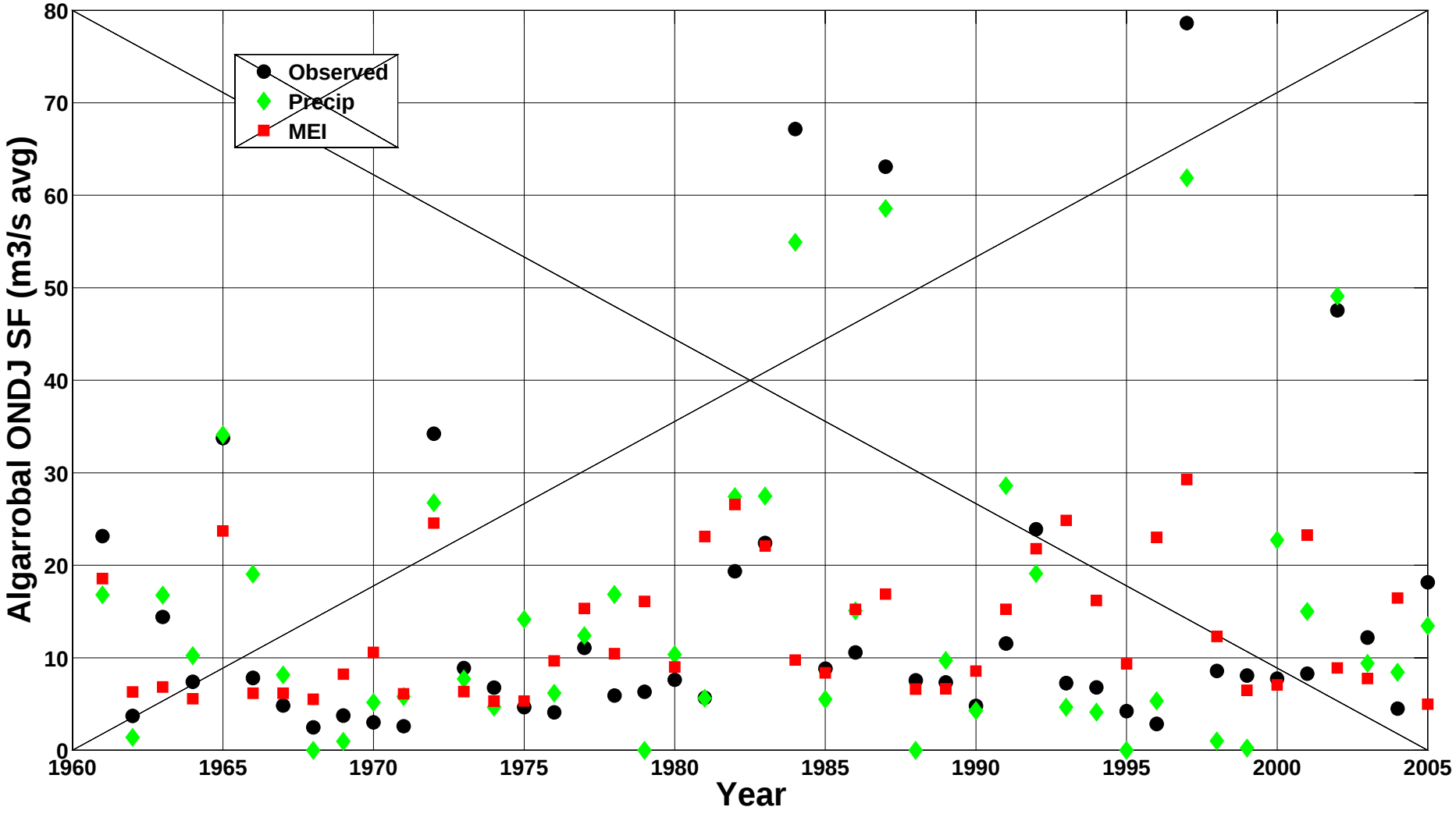
Statistical model: regress to 24 stations, then PCA



Comparison with MEI

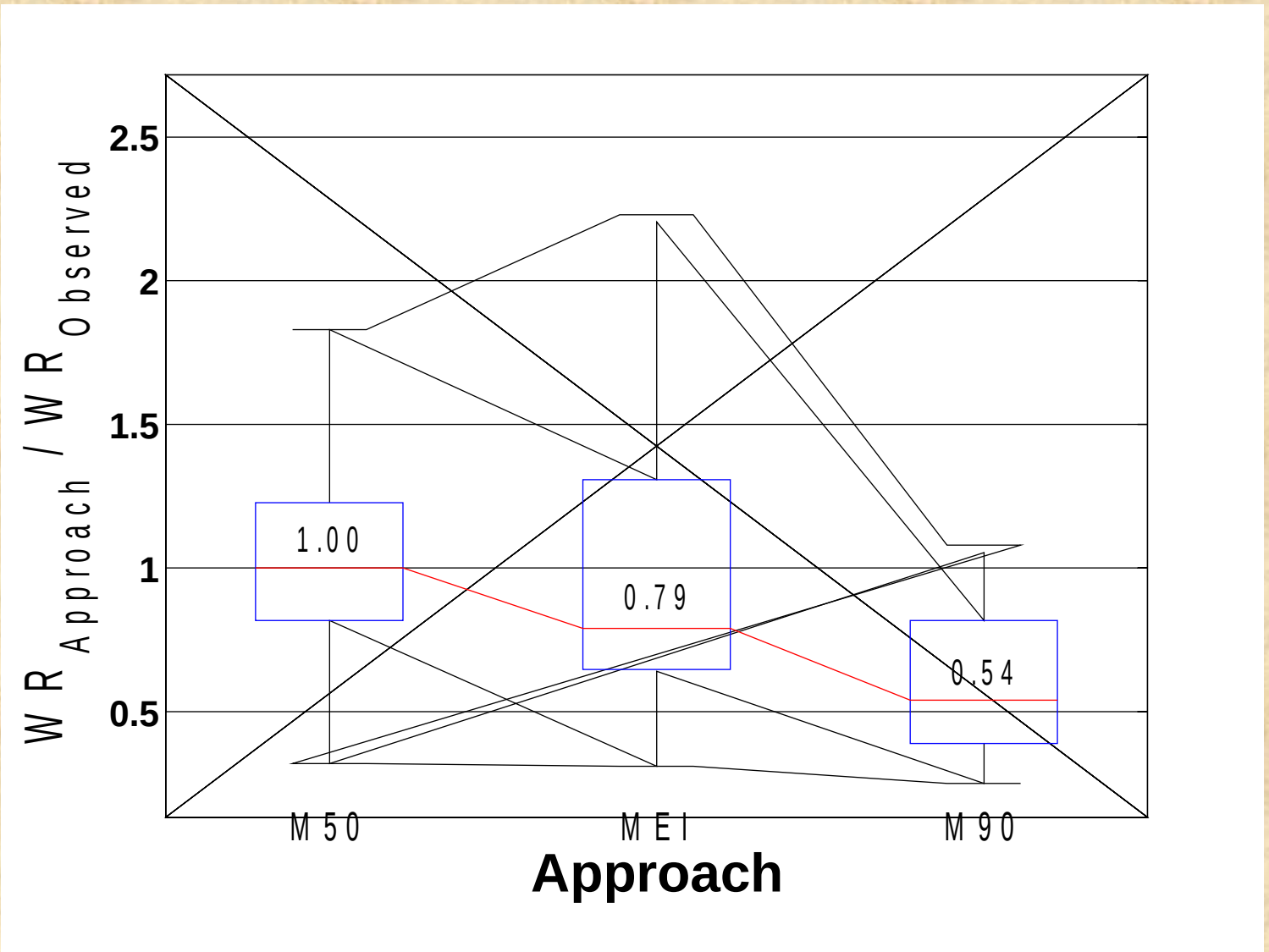
MEI = Existing Approach

Precipitation-based model better skill scores, generally conservative

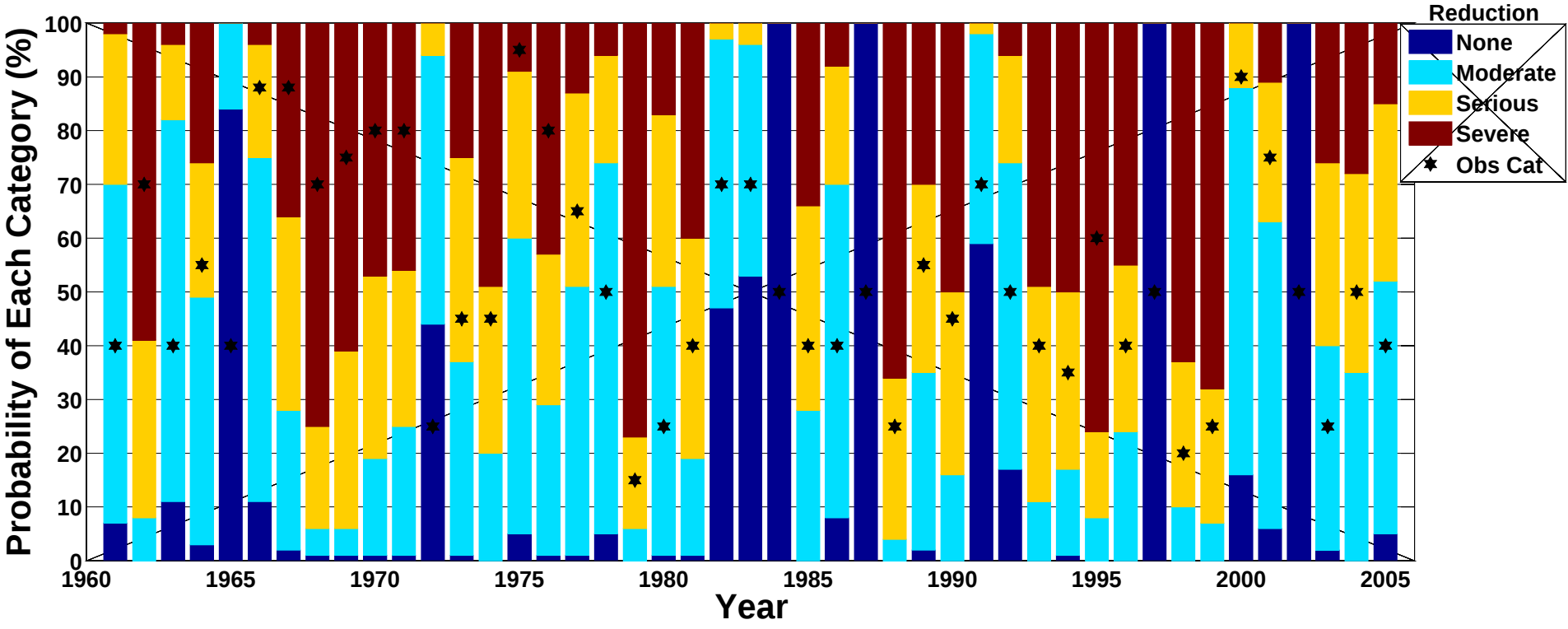


Water Rights Value Forecast

1961-2005



Water Rights Forecast - Categorical



Future

Puclaro reservoir drought plans - dynamic

Publish forecasts online for use by JVRE (and users)

Policy to improve water use efficiency via policy

Hands-On Session

Climate Diagnostics and Attribution

NOAA Physical Science Division, Interactive Plotting

http://www.esrl.noaa.gov/psd/cgi-bin/data/getpage.pl

Composite Map: SLP, 500mb, May-Aug over South America

Correlation SST, surface, May-Aug with ONDJ Algarrobal SF

Lags by 5 months

Use custom file (uploaded):

/Public/incoming/timeseries/Algarrobal_ONDJ.txt

Use SST data for SF prediction

Hands-On Session

Forecast Model

Download Climate Predictability Tool

Google: *IRI CPT* or iri.columbia.edu/climate/tools/cpt

Predictand:

ONDJ Streamflow

http://wiki.iri.columbia.edu/

Predictors:

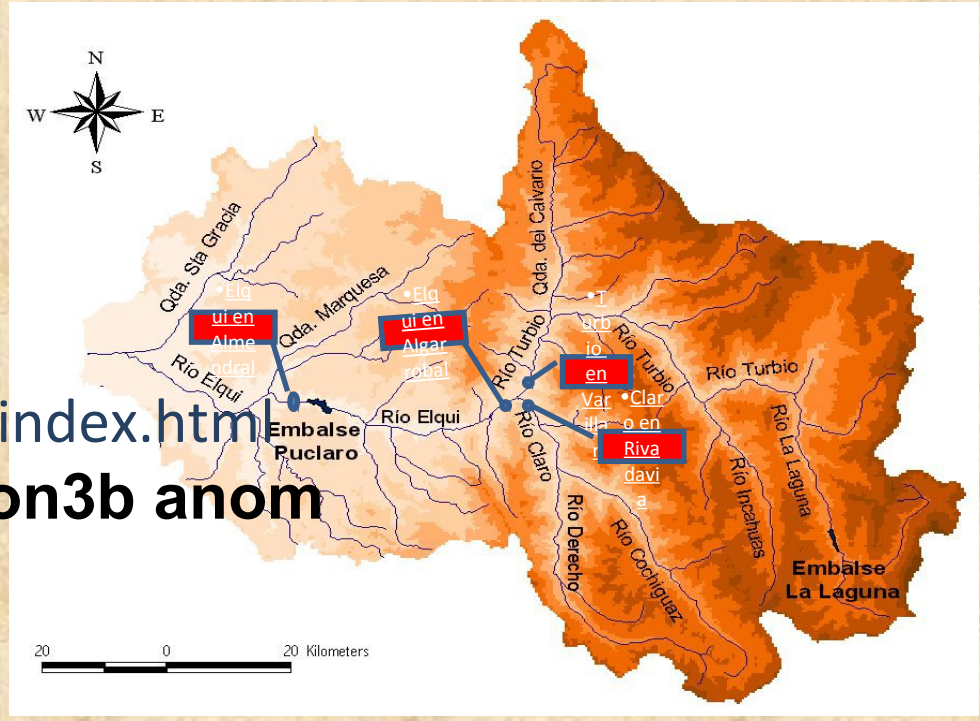
MJJA Precip

SST/Nino index

http://iridl.ldeo.columbia.edu/index.html

NOAA NCDC ERSST version3b anom

160W:90W, 10S:0N



Hands-On Session

SST DATASET

http://iridl.ldeo.columbia.edu/expert/SOURCES/.NOAA/.NCDC/.ERSST/.version3b/.anom/Y/%2810S%29%280N%29RANGEEDGES/X/%2890W%29%28160W%29RANGEEDGES/T/%28May-Aug%20%29seasonalAverage/