



## Aggregated Verification Results for flows using EPPII at 5 ABRFC test basins

## **Hydrologic and Input Uncertainties**

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## Computation

- Verification statistics computed for each individual basins at 3 different scales: annual, seasonal, and monthly
- Aggregated verification statistics computed as the weighted average of individual basin statistics
- Forecast flows generated for lead days 1 to 14 using shortterm RFC-based precipitation and temperature ensembles from Ensemble Pre-Processor EPPII with optimized parameters
- Forecast flows compared to 2 references:
  - observed flow (show all errors hydrologic and input uncertainties)
  - simulated flow (show only errors from input input uncertainty)
- Verification period (dependent validation): 03/06/2003 08/12/2005

## **Verification Results**

• Individual test basins at ABRFC :



- Verification statistics:
  - Briers statistics (slides 4 to 8): annual scale
  - RPS & RPSS (slides 9 to 11): monthly scale Reliability diagrams (slides 12 to 24): annual and seasonal scales
  - ROC plots (slides 25 to 37): annual and seasonal scales

## **Streamflow Thresholds**



## **Briers statistics**

- Annual results with observed and simulated flows
- Briers Skill Score (BSS) computed with 2 references: climatology and persistence

### **Briers Score Statistics**

#### **Reference flow: observed**

#### ABRFC - BS, ENSEMBLE FCST OF 24HR FLOW



#### Reference flow: simulated ABRFC – BS, ENSEMBLE FCST OF 24HR FLOW

THRESHOLD (PERCENTILE)



#### ABRFC - BS, PERSISTENCE FCST OF 24HR FLOW



#### ABRFC - BS, PERSISTENCE FCST OF 24HR FLOW



### **Briers Skill Score Statistics**

#### **Reference flow: observed**

ABRFC - BSS, ENSEMBLE FCST VS. CLIMATOLOGY



#### **Reference flow: simulated**

ABRFC - BSS, ENSEMBLE FCST VS. CLIMATOLOGY



#### **ABRFC – BSS, ENSEMBLE FCST VS. PERSISTENCE**



#### ABRFC - BSS, ENSEMBLE FCST VS. PERSISTENCE

### **Briers Score Statistics**

#### **Reference flow: observed** ABRFC - 24HR FLOW, 10.0TH PER. ABRFC - 24HR FLOW, 25.0TH PER. ABRFC - 24HR FLOW, 50.0TH PER. ABRFC - 24HR FLOW, 75.0TH PER. 0.25 0.30 0.30 0.20 0.20 0.15 BRIER SCORE BRIER SCORE BRIER SCORE BRIER SCORE 0.20 0.20 0.15 0.10 0.10 0.10 0.10 0.05 BRIER SCORE BRIER SCORE BRIER SCORE 0.05 RELIABILITY ELIABILITY RELIABILITY RELIABILIT RESOLUTION RESOLUTION RESOLUTION SOLUTIO 0.00 8 0.00 0.00 UNCERTAINTY UNCERTAINTY UNCERTAINTY UNCERTAINTY G 0 2 6 8 10 12 14 0 2 6 8 10 12 14 0 2 6 8 10 12 14 0 2 6 8 10 12 14 4 4 4 4 LEAD TIME (DAY) LEAD TIME (DAY) LEAD TIME (DAY) LEAD TIME (DAY)

#### **Reference flow: simulated**



BS=Reliability – Resolution + Uncertainty

### **Briers Statistics**





ABRFC - 24HR FLOW, 97.5TH PER.

BRIER SCORE

RELIABILITY

RESOLUTION

JNCERTAINT

8 10 12 14

6



#### **Reference flow: simulated**

BRIER SCORE



BS=Reliability – Resolution + Uncertainty

# **RPS & RPSS statistics**

- Monthly results with observed and simulated flows
- RPSS computed with 2 references:

climatology and persistence

### **RPS Statistics**

#### **Reference flow: observed**

ABRFC - RPS, ENSEMBLE FCST OF 24HR FLOW



#### ABRFC - RPS, PERSISTENCE FCST OF 24HR FLOW



**ABRFC - RPS, PERSISTENCE FCST OF 24HR FLOW** 

#### **Reference flow: simulated** ABRFC – RPS, ENSEMBLE FCST OF 24HR FLOW



### **RPSS Statistics**

#### **Reference flow: observed**

ABRFC - RPSS, ENSEMBLE FCST VS. CLIMATOLOGY



#### **ABRFC - RPSS, ENSEMBLE FCST VS. PERSISTENCE**



#### Reference flow: simulated ABRFC - RPSS, ENSEMBLE FCST VS. CLIMATOLOGY



#### ABRFC - RPSS, ENSEMBLE FCST VS. PERSISTENCE



# **Reliability statistics**

- Annual results with observed and simulated flows
- Threshold values:

10%, 25%, 50%, 75%, 85%, 90%, 95%, 97.5%

• Reliability plot with 5 probability bins

### **Reliability Statistics**



With 5 bins

### **Reliability Statistics**



With 5 bins

### **Reliability Statistics**



With 5 bins

### **Reliability Statistics**



With 5 bins

# **Reliability statistics**

- Seasonal results with simulated flows:
  - Winter: December February
  - Spring: March May
  - Summer: June August
  - Fall: September November
- Threshold values:

10%, 25%, 50%, 75%, 85%, 90%, 95%

• Reliability plot with 5 probability bins

With 5 bins

Deviation from diagonal gives conditional bias





**Reference flow: simulated** 

With 5 bins

Deviation from diagonal gives conditional bias

### **Reliability Statistics**



**Reference flow: simulated** 

1.0

With 5 bins

Deviation from diagonal gives conditional bias

### **Reliability Statistics**



**Reference flow: simulated** 

1.0

With 5 bins

Deviation from diagonal gives conditional bias

### **Reliability Statistics**



**Reference flow: simulated** 

1.0

ROB.

With 5 bins

Deviation from diagonal gives conditional bias

### **Reliability Statistics**







**Reference flow: simulated** 

With 5 bins

OBSERVED FREQUENCY

0.6

0.4

0.2

0.0

Summer

0.0

0.2

0.4

PREDICTED PROBABILITY

Deviation from diagonal gives conditional bias

### **Reliability Statistics**



200 OUENC

00

0.6

PRED

0.8

1.0

DAY 10-14





**Reference flow: simulated** 

With 5 bins

Deviation from diagonal gives conditional bias





0.2

Summer

0.6

PREDICTED PROBABILITY

0.8

0.0

Fall

0.2

0.4

PREDICTED PROBABILITY

0.6

1.0

PRED. P

0.8

ROB

1.0

PRED

- Annual results with observed and simulated flows
- Threshold values:

10%, 25%, 50%, 75%, 85%, 90%, 95%, 97.5%

• ROC diagram with 10 points



**Reference flow: simulated** 



ROC (ability of forecast to discriminate between events & non-events) for a range of threshold percentiles for the 24-hr annual flow



Perfect scores: HR = 1 and FAR = 0

ROC (ability of forecast to discriminate between events & non-events) for a range of threshold percentiles for the 24-hr annual flow



Perfect scores: HR = 1 and FAR = 0

- Seasonal results with simulated flows:
  - Winter: December February
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  - Summer: June August
  - Fall: September November
- Threshold values:

10%, 25%, 50%, 75%, 85%, 90%, 95%

• ROC diagram with 10 points

ROC (ability of forecast to discriminate between events & non-events) HIT RATE for a range of threshold percentiles for the 24-hr seasonal flow



ROC (ability of forecast to discriminate between events & non-events) for a range of threshold percentiles for the 24-hr seasonal flow



Perfect scores: HR = 1 and FAR = 0

ROC (ability of forecast to discriminate between events & non-events) for a range of threshold percentiles for the 24-hr seasonal flow

Perfect scores:



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ROC (ability of forecast to discriminate between events & non-events) for a range of threshold percentiles for the 24-hr seasonal flow



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