State of Hydrologic Forecasting in Manitoba and Issues

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Fisaha Unduche, Ph.D., P. Eng.

Director

Hydrologic Forecasting and Coordination

Manitoba Infrastructure

Manitoba

Sept 14, 2017

History

- Forecasting started in **1950** following the widespread flooding of the Red River

- Graphical procedures had been used until mid 1970's

- A **MANAPI** model (Manitoba Antecedent Precipitation Index) was developed between the period 1970-1977

  ➢ Based on historical observations

  ➢ Only for Spring Runoff Outlook

  ➢ Empirical model - Not physically based

History – Contd'

- The MANAPI model did not accurately predict the outlooks of many of the 1974 to 1979 floods

- In 1981, through Can-MB Flood Damage Reduction Agreement, a study initiated to improve spring flood forecasting procedures

- The 1981 team looked at the performance of the HSPF model (Hydrological Simulation Program—Fortran) on the Pembina River.

- They concluded HSPF no better than MANAPI

History – Contd'

- Therefore, the MANAPI model had been used for spring flood forecasting from mid 1970's until 2014 – for 44 years.

- There were very limited real time operational flood forecasting tools/procedures

- The Art of Flood Forecasting:

  – 70% about knowing the models, the watershed, the data source, past floods, etc (Experience)

  – 30% about getting accurate forecasting models

HFC – New Construction Phase

- Since 2014, HFC is in a "new construction" phase

- New construction advancements in:

  1. Hydrologic modeling
  2. Hydraulic modeling/routing
  3. Data acquisition/analysis etc
  4. Communication/Information exchange
  5. Collaboration with other forecast centers, etc

Forecasting Models

- Models in that are being used for Operational Forecasting
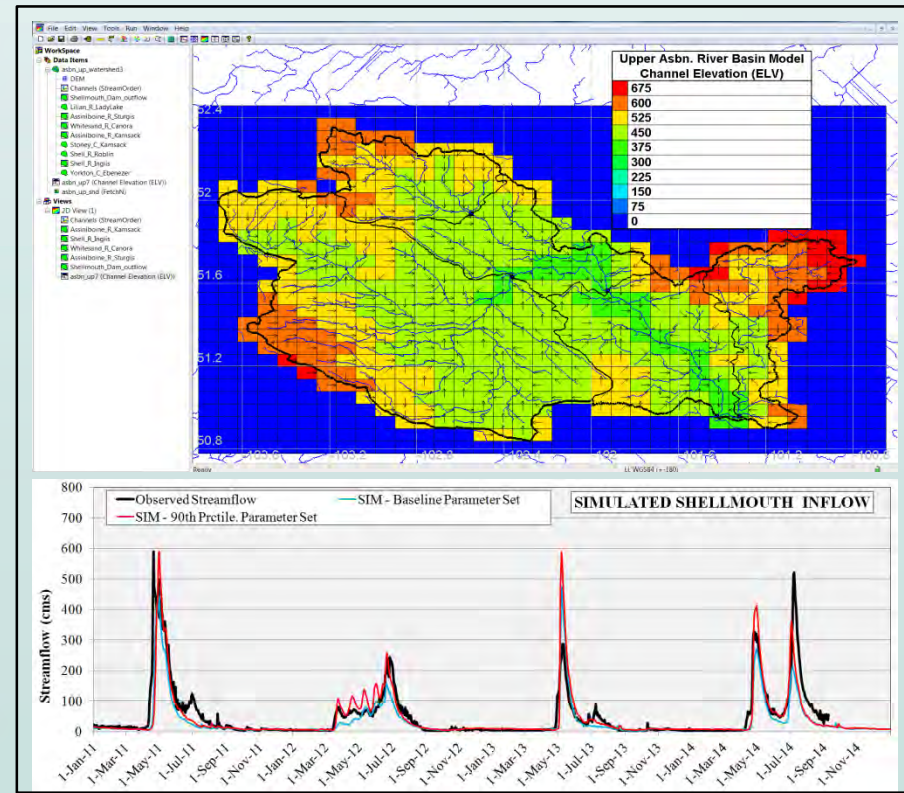 - ➤ **WATFLOOD** – Physically based, Distributed Hydrologic Model
  - ➤ **HBV_96** – Semi Distributed Hydrologic Model
  - ➤ **HBV_EC** – Semi Distributed Hydrologic Model
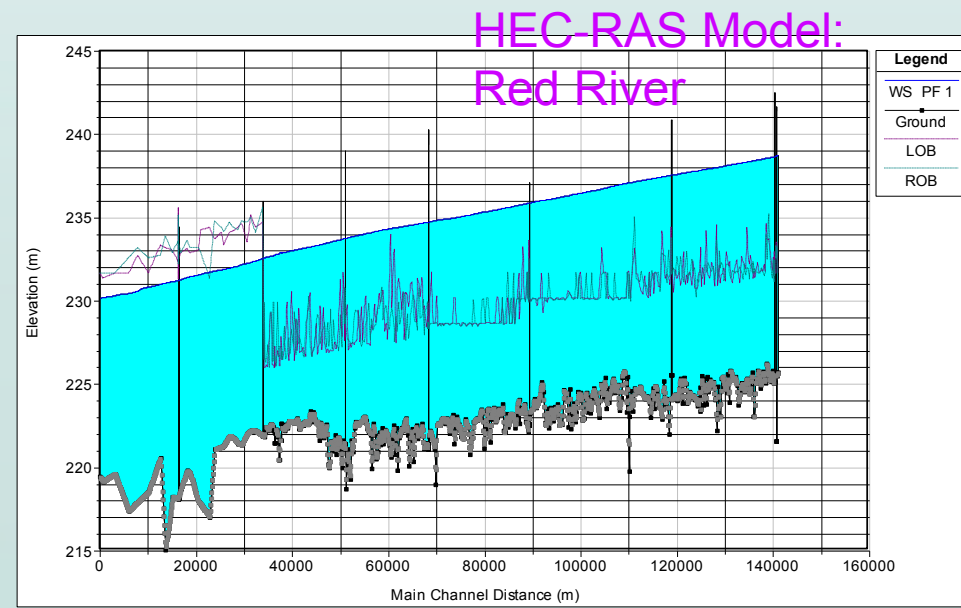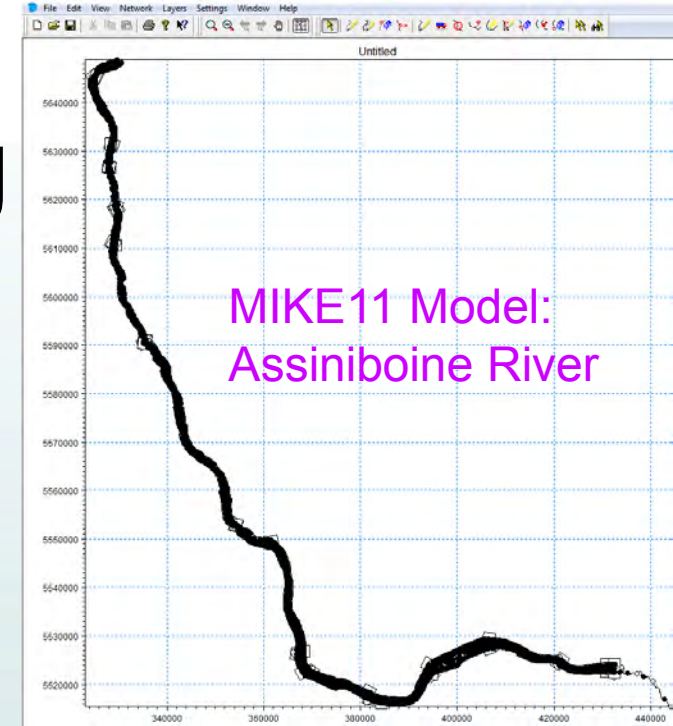 - ➤ **HSPF** – Semi Distributed Hydrologic Model
  - ➤ **HEC-HMS** – Conceptual Lumped Hydrologic Model
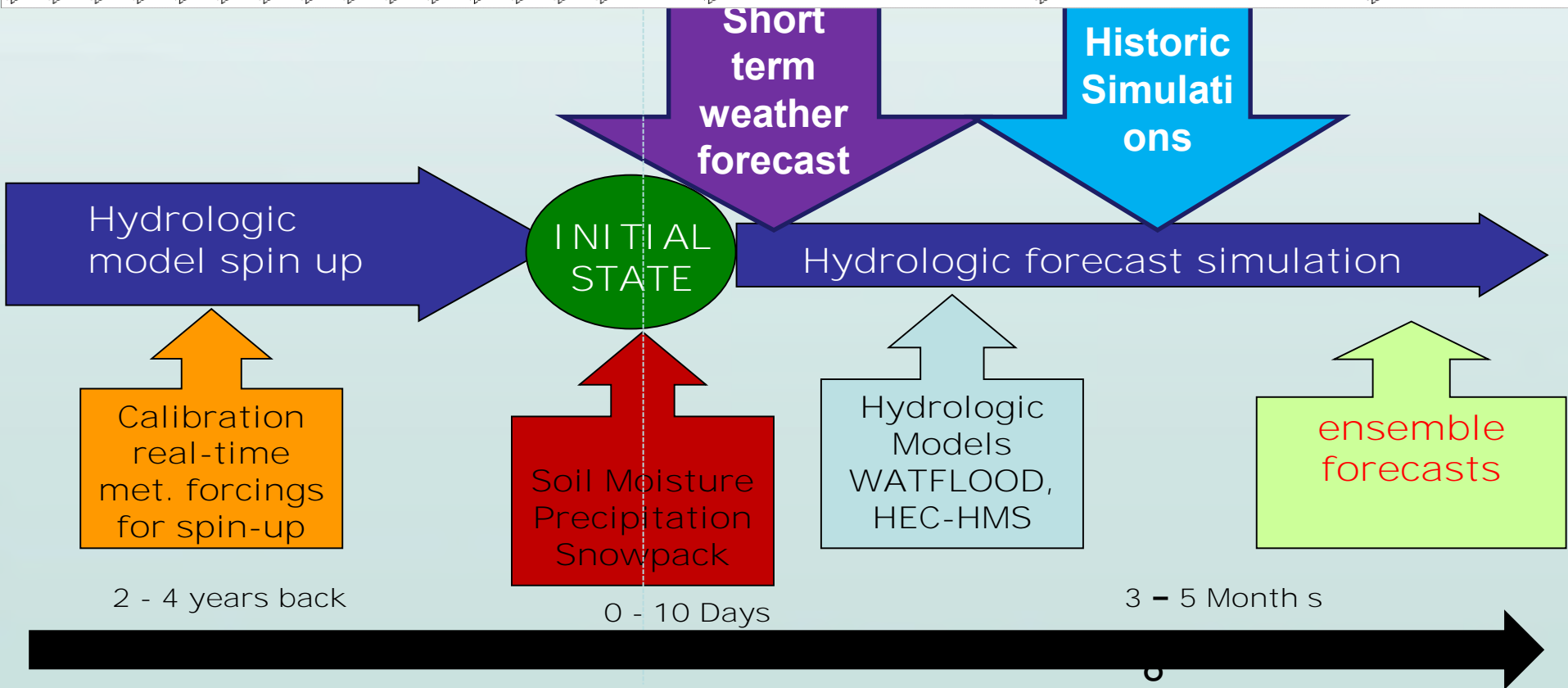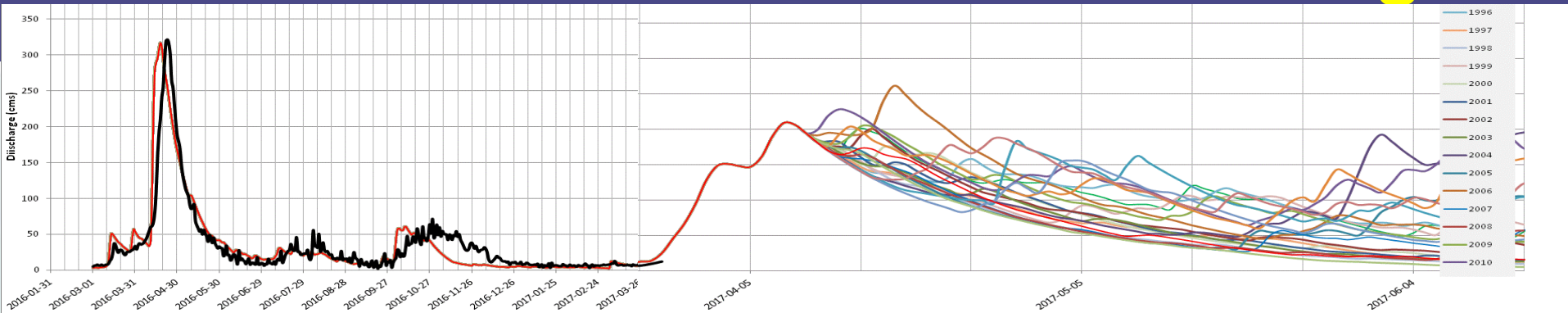 - ➤ **Statistical Tools** – IAO, etc

Hydrodynamic Modeling (Routing)

MIKE11 Model: Assiniboine River

- Developed HEC-RAS and/or MIKE11 models for the
  - Red River
  - Assiniboine River
  - Souris River

HEC-RAS Model: Red River

Runoff Forecasting:
Ensemble Stream Flow Forecasting

Manitoba

Short term weather forecast

Historic Simulations

Hydrologic model spin up

INITIAL STATE

Hydrologic forecast simulation

Calibration real-time met. forcings for spin-up

Soil Moisture Precipitation Snowpack

Hydrologic Models WATFLOOD, HEC-HMS

ensemble forecasts

2 - 4 years back

0 - 10 Days

3 – 5 Month s

Flood Forecasting – Challenges

- Flow Metering Discrepancies (Ice effects, etc)
- Extreme event calibrations
- Ice Jam Related Flooding
- Frozen Ground Effects
- Rainfall on snow melt
- Data Acquisition
  - Quality control issues
  - Different data use across jurisdictions
- Staff retention

HFC Staff

- Comprised of 10 full time staff
  - ➢ A Director
  - ➢ 6 Hydrologic Engineers
  - ➢ 2 Hydraulic Engineers
  - ➢ 1 Data Analyst
- Staff qualifications:
  - ➢ 4 Ph.D.'s,
  - ➢ 2 M.Sc.'s,
  - ➢ 3 B.Sc.'s
  - ➢ 1 Vacant

Thank You !