Forecasting Floods
Practices and Challenges for Coastal Rivers

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NOAA National Weather Service
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• Intro to the National Weather Service
• River forecasting services
• Forecast process
• Forecasts for various needs
• Using our services
The National Weather Service (NWS) provides weather, water, and climate data, forecasts and warnings for the protection of life and property and enhancement of the national economy.
NWRFC Forecast Domain
WFO Forecast Domain
River Forecast Point

Nehalem R near Vernonia
Nehalem R near Foss
Wilson R near Tillamook
Trask R near Tillamook
Nestucca R near Beaver

Siletz R at Siletz
Alsea R near Tidewater
Siuslaw R near Mapleton
River Forecasting Services

- Hydrograph with observed & forecast stage/discharge
- Multiple flood thresholds
  - Action/bankfull (near flood)
  - Flood Stage – Minor
  - Moderate Flood
  - Major Flood
- Forecasts updated once daily, more often during high flows
- Update time shown for image and forecast issuance

- Impacts based on past floods
- Inconsistent level of detail for coast rivers
- Coordinated with local partners

27 Above 27 ft, flooding is comparable to that of the flood of February 1996, especially during the high tide.
24 Above 24 ft, expect major flooding in the town of Nehalem and surrounding areas, with the worst flooding during high tide. Wide spread flooding of numerous roads and buildings occurs at this stage.
20 Above 20 ft, flooding of some buildings in the town of Nehalem begins, with the situation worsening during the high tide. Also expect widespread low land flooding and numerous flooded rural roads from the Foss gauging station downstream to Nehalem.
18 Above 18 ft, expect widespread flooding of low lying farm land and structures downstream of the Foss gauging station to Nehalem. Street flooding in the town of Nehalem begins at this point, usually during the high tide.
15 Above 15 ft, expect minor flooding of low lying farm land and structures.
River Forecasting Services

NEHALEM-FOSS (FSS03)

State: Oregon  County: TILLAMOOK
Latitude: 45.42' N  Longitude: 123.45' W
Elevation: 33 feet
Supporting WFO: Portland  NWS Official River Forecasts Click Here
Action Stage: 15'  Flood Stage: 15'  Moderate Flood Stage: 20'
Major Flood Stage: 24'
Record Stage: 29.56'  Record Flow: 70300 cfs
Date of Record: February 8, 1996

Daily Historical Flow Statistics for February 23
Mean Stage: 8.38 ft  Mean Flow: 5320 cfs
Max Stage: 18.70 ft  Max Flow: 34300 cfs (1949)
Min Stage: 4.15 ft  Min Flow: 782 cfs (2005)
Statistics based on water years: 1940-2016

The 4-10 Day Trend Forecast is based on model guidance only. Daily variation and uncertainty of forecasts during this period is high.

NEHALEM-FOSS (FSS03)

- Hydrograph with observed forecast stage/discharge also at www.nwrfc.noaa.gov
- It’s the same data. HOWEVER, RFC web page shows forecast and trend out to 10 days.
- Doesn’t include flood impact information
River Forecast Process

Models are physically- and empirically-based, but simplified

- Lumped (rather than distributed)
- Primary inputs are precipitation and temperature
- Calibrated based on long record (typically 40 to 70 years) of daily observed precipitation, temperature, and streamflow
Wilson River near Tillamook – October 22 – 24, 2017
Observed hydrograph and sequence of forecast updates
Atmospheric River Research

Depiction of the results of discussions between experts on atmospheric rivers, warm conveyor belts (WCB) and tropical moisture exports during a workshop in June 2015. Summary available in an EOS Meeting Report by Dettinger, Ralph and Lavers 2016.

Color fill is vertically integrated water vapor (mm). Background image from NOAA/ESRL/PSD

NCEP GFS IVT Probability > 250 kg/m/s

Initialized: 00Z Thu 09/22/16 Verifies: 00Z Mon 09/26/16

F=96

NWS Portland
weather.gov www.nwrfc.noaa.gov mobile.weather.gov

A. Martin 05/2017
Beyond Floods: Tools for various thresholds and time periods

SILETZ RIVER AT SILETZ

Universal Time (UTC)

Latest observed value: 6.35 ft at 030 AM PST 26-Feb-2016. Flood Stage is 16 ft

WILLAMETTE RIVER AT PORTLAND

Universal Time (UTC)

Latest observed value: 6.54 ft at 200 PM PDT 9-Sep-2016. Flood Stage is 18 ft
Beyond Floods:
Tools for various thresholds and time periods
Beyond Floods:
Tools for various thresholds and time periods

Siuslaw River near Mapleton

Willamette River at Salem

For coastal basins, most of the runoff for a given period is generated by rainfall runoff during or just before the time period of interest. For basins with seasonal snowpack in part or all of the basin, there is more lead time in projecting the runoff during the period of interest.
Beyond Floods:
Tools for various thresholds and time periods

Weekly Chance of Exceeding River Stage at MPLO3 - Siuslaw River Mapleton
Forecast for the period 02/25/2018 - 05/26/2018
This is a conditional simulation based on the current conditions as of 02/25/2018

Beyond Floods:
Tools for various thresholds and time periods

NOV-JAN Oceanic Nino Index vs APR-SEP Historical Natural Runoff
(FSS03 NEHALM - FOSS (1951-2017))
NWS Hydro Services: New Directions

Actionable Water Intelligence

- Flooding
- Water Quality
- Water Availability
- Drought
- Climate Change

Need integrated understanding of near- and long-term outlook and risks

Transform information into intelligence by linking hydrologic, infrastructural, economic, demographic, environmental, and political data

National Water Model

water.noaa.gov/map

Hydrologic Ensemble Forecast System

For official forecast, go to http://water.weather.gov/ahps

Flood Inundation Mapping

Inundation Flows

- 34,000 cfs*
- 29,000 cfs*
- 23,900 cfs*
- 20,000 cfs*
- 16,600 cfs*
- 15,000 cfs*

Legend
- Streamflow (cfs)
  - 0 - 119
  - 119 - 1,720
  - 1,720 - 17,500
  - 17,500 - 151,000
  - 151,000 - 1,200,000
  - 1,200,000 or greater

*Estimated values
Weather & River Info

- `weather.gov` & `mobile.weather.gov`

- `www.nwrfc.noaa.gov`
  - River forecasts
  - Seasonal runoff forecasts
  - Precipitation, temperatures, and snowpack data

- `water.weather.gov`
  - Redundant source for river forecasts
  - Includes flood impact information

- `water.noaa.gov`