

The Probabilistic Winter Storm Severity Index (PWSSI) Users Guide

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What The Probabilistic Winter Storm Severity/Impact Index Is

- **A tool** to assist NWS operational forecasters in maintaining situational awareness of the possible significance of weather related impacts based upon the current official forecast.
- **A tool** to help communicate a general level of potential societal impacts and their spatial distribution.

What The Probabilistic Winter Storm Severity/Impact Index Is NOT

- It is **NOT** a specific forecast for specific impacts.
 - For example, a depiction of “moderate” severity does not mean schools will or have to close.
- It is **NOT** meant to be the sole source of information about a Winter Storm. It should always be used in context with other NWS forecast and warning information.
- The PWSSI does **NOT** account for conditions that have occurred prior to the creation time. It only uses forecast information. Therefore during an ongoing winter weather situation, the PWSSI will not be representative of the entire event.

Motivation – To Better Depict Aspects of Winter Storms

- Current NWS Procedures:
 - Winter weather Watches/Warnings/Advisories are raised based primarily on “yes/no” thresholds of accumulation and generally at the level of individual counties.
- Reality of Winter Weather:
 - Severity/impacts from winter weather are due to more than just amounts (one 5” snowstorm is not like the next 5” snowstorm) Great variation in weather conditions frequently occur with individual counties.

PWSSI Impact Scale

Potential Winter Storm Impacts	
	Limited Impacts Rarely a direct threat to life and property. Typically results in little inconveniences.
	Minor Impacts Rarely a direct threat to life and property. Typically results in an inconvenience to daily life.
	Moderate Impacts Often threatening to life and property, some damage unavoidable. Typically results in disruptions to daily life.
	Major Impacts Extensive property damage likely, life saving actions needed. Will likely result in major disruptions to daily life.
	Extreme Impacts Extensive and widespread severe property damage, life saving actions will be needed. Results in extreme disruptions to daily life.

PWSSI Components

Overall Winter Storm Impacts

PURPOSE: This component is designed to highlight the maximum impact from any of the PWSSI components. It's meant to quickly convey where, and how intense, the greatest threat from the storm is.

Snow Rate Index

PURPOSE: This component is designed to highlight areas in which impacts, especially transportation, could become overwhelmed due to the rate snow is accumulating.

Snow Amount Index

PURPOSE: This component is designed to highlight areas in which impacts, could become overwhelmed due to the total amount of snow.

Prior to making calculations based upon the amount of snow, climatology based factors are determined. Climatology is an important aspect to the level of impacts a winter storm brings. Those areas of the country less accustomed to snowfall will be less prepared to deal with snow, resulting in higher level of impacts compared to the same amount of snow in a snowier part of the country. For example 6 inches over snow would result in moderate impacts across Kansas City, MO but would result in Major impacts for Atlanta, GA.

PWSSI Components

Blowing Snow Index

PURPOSE: This component highlights areas where blowing/drifting snow is expected to occur and result in transportation related problems. In general, the blowing snow significance increases as the SLR and winds both increase. Prior blowing snow research indicates that in general it takes just under 20 mph of wind to start to move snow around.

Ice Accumulation Index

PURPOSE: This component was developed to account for the combined effects of ice accumulation and wind which can produce widespread tree damage, transportation shutdowns and utility problems.

Snow Load Index

PURPOSE: This component is to highlight areas where the weight of the snow could result in damage to trees and powerlines. In general, the lower the snow-liquid ratio (SLR) is and the greater the total snow accumulation, the higher the index.

NWS has implemented the WSSI to provide the public with a tool that attempts to convey the complexities and hazards associated with winter storms as they relate to potential societal impacts. NWS acknowledges contributions to the field of ice impact forecast graphics made by Sidney Sperry (Oklahoma Association of Electric Cooperatives) and Steven Piltz (NWS) in the development of the “Sperry-Piltz Ice Accumulation Index” or SPIA® Index.

Using Non-Meteorological with Meteorological Data

The WSSI uses non-meteorological data along with meteorological data to help forecast impacts

The non-meteorological data, or factors used are:

- Urban areas
 - Used in the Ice Accumulation Index and Snow Amount Index
 - They give a 25% increase to impact
 - Defined from US Census Bureau
- Land Use / Coverage
 - Decreases impacts for areas of reduced wind (e.g. forests, high density commercial/residential areas) compared to areas without reductions (e.g. cropland, grassland)
 - Used in the Blowing Snow Index
- Forest Classification
 - Delineates forestland described as conifer vs deciduous
 - Conifer trees can handle more snow than deciduous trees
 - Used in the Snow Load Index

WSSI Element Generation

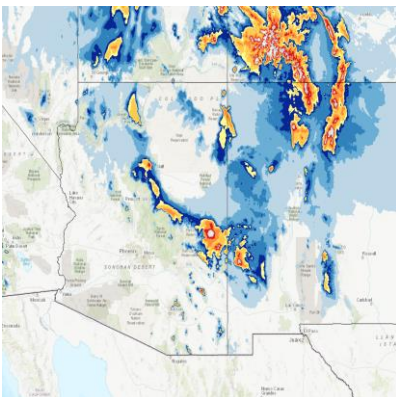
The WSSI uses meteorological data along with non-meteorological data to calculate forecast impacts

Model Data → WSSI Algorithms → WSSI Output

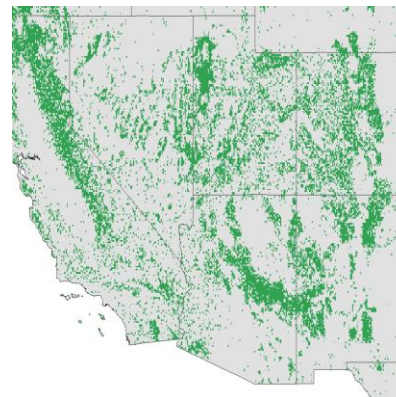
6h QPF/Snow/Ice
6h Wind Gust
6h Temperature

Forest Classification for snow load
(Evergreen or deciduous)
Land use mask for blowing snow and blizzard
Urban mask for snow/ice amount impact

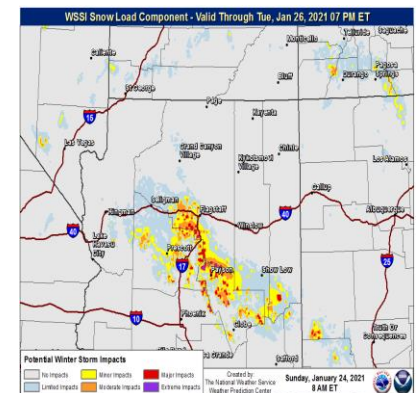
Model Snow and QPF Forecast



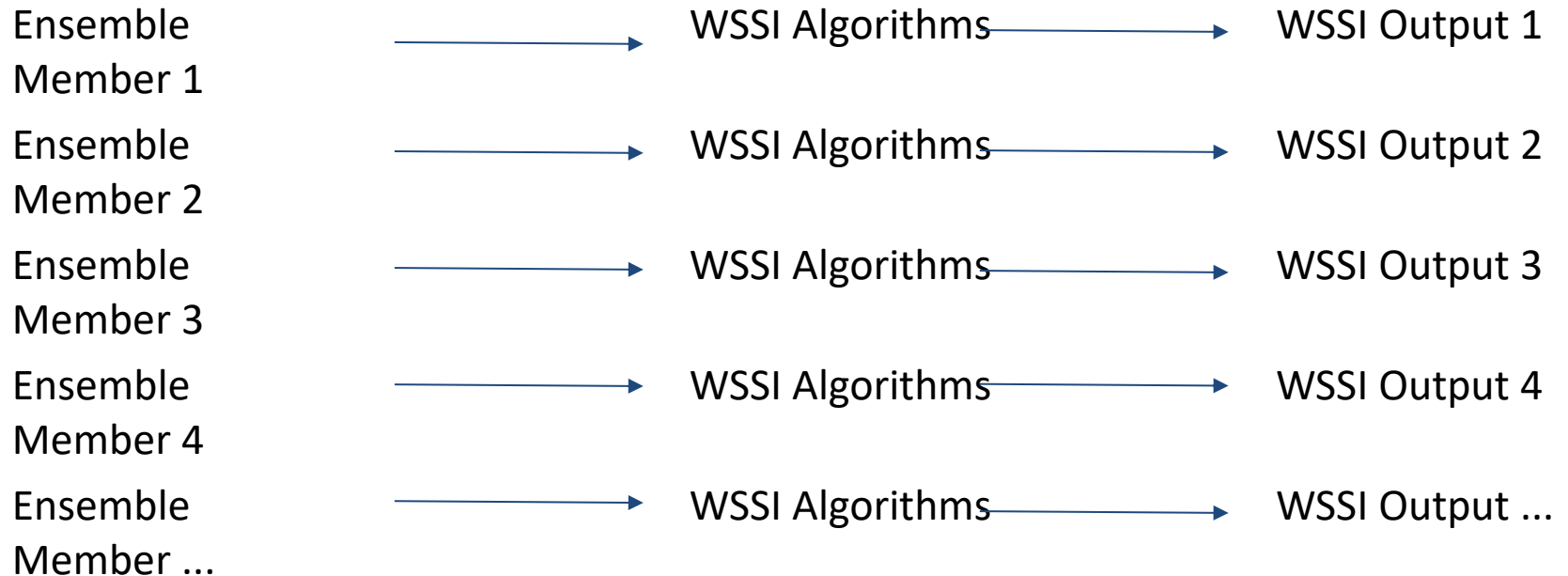
WSSI Evergreen Mask



WSSI Snow Load



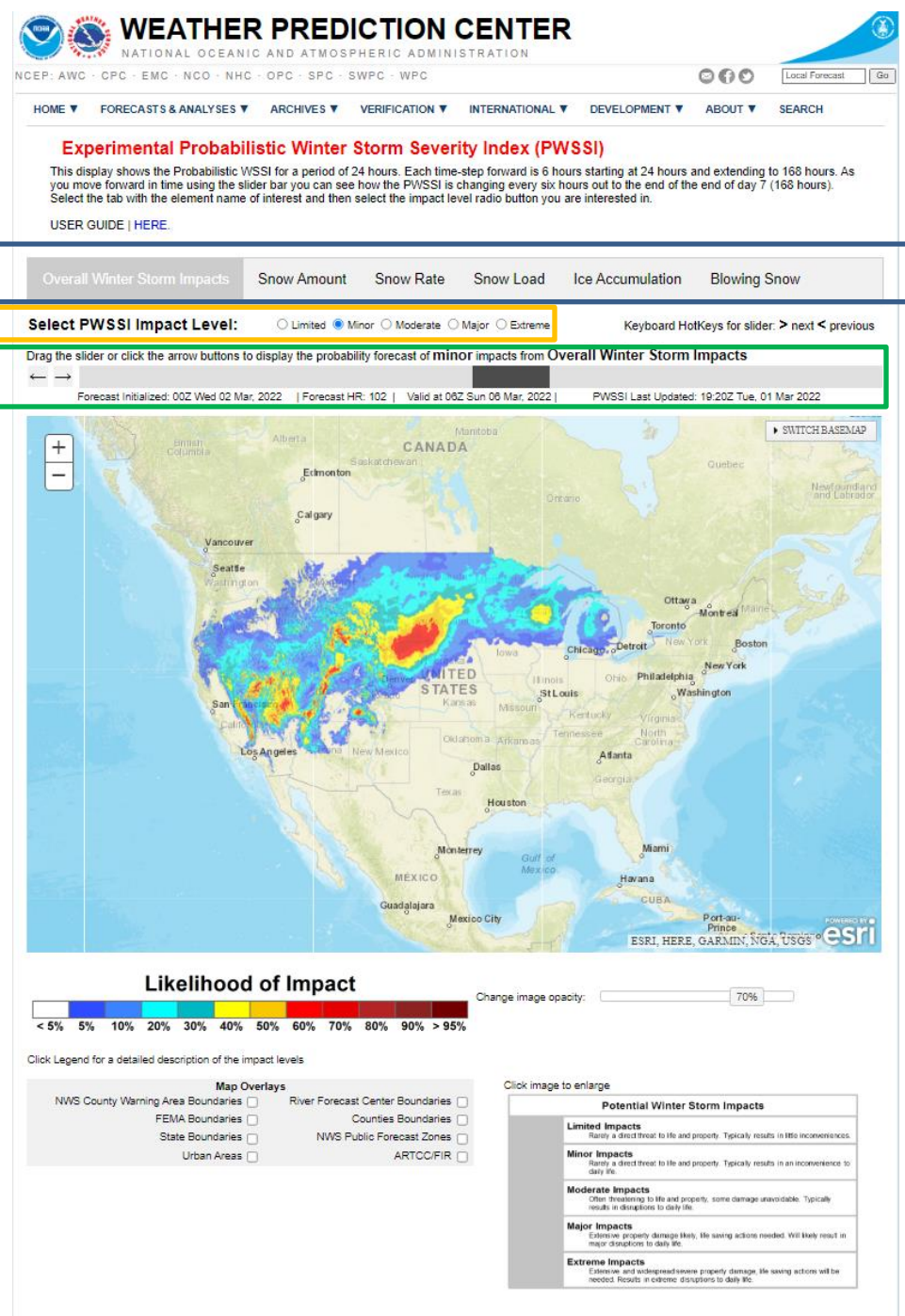
Experimental Probabilistic WSSI Generation



- **Run centrally at WPC. 60 meteorologically consistent scenarios run through the WSSI algorithms, which provide a distribution of PWSSI values.**
 - **The 60 members are the same as the model membership of the WPC super Ensemble (WSE) used in WPC Probabilistic Winter Precipitation Guidance**
- **Resultant PWSSI probabilities reflect # of scenarios forecasting given impact out of total membership. They are processed and displayed.**

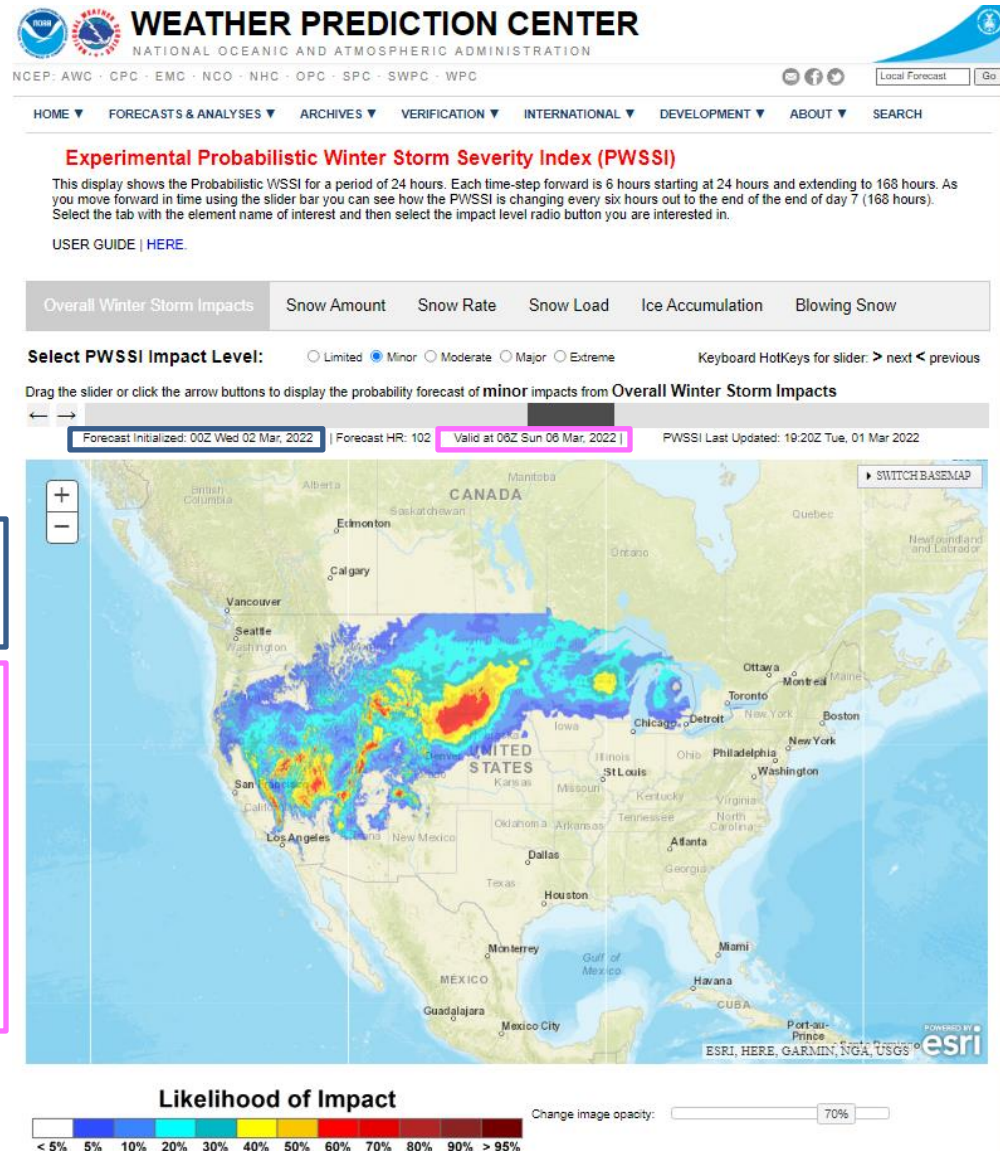
PWSSI – How to Interpret

- The PWSSI web page has several interactive mechanisms that work together to produce the image overlay on the web map.
- Each image depicts a likelihood of impact, ranging from 5% to >95%, for a component and impact level.
 - The default option shown when the page loads is the likelihood of for **Moderate impacts** from the **Overall Winter Storm Impacts**
 - How that likelihood is calculated will be covered later
- Click a component's tab to view the impact forecast for each component or the Overall Winter Storm Impacts to view the combined greatest threat**
 - Component options are: Overall Winter Storm Impacts, Snow Amount, Snow Rate, Snow Load, Ice Accumulation Blowing Snow
- Select a PWSSI Impact Level radio button for the level of impact**
 - Impact types: Limited, Minor, Moderate, Major, Extreme
- The slider bar controls the forecast time.
 - To advance or retreat the slider you can: drag the dark gray slider click the arrow buttons, or use the > to go forward in time or the < key to go back in time.



PWSSI – How to Interpret

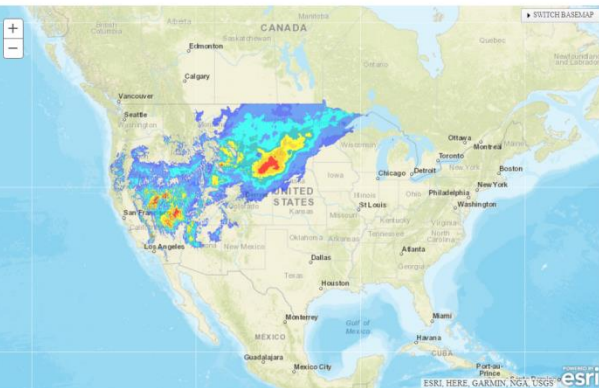
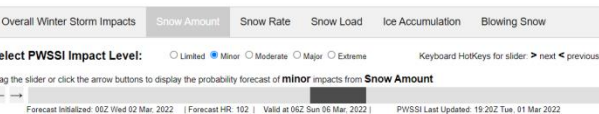
- The PWSSI forecasts are for 24 hr periods with a six hour cadence. This means every time step represents a 24 hr period moving forward six hours at a time. All time is in UTC (labeled Z). Please visit either time.gov or timeanddate.com for information on how to convert UTC to your local time zone
- The “Forecast Initialized” time indicates what the initial time period is for this forecast. In this example 00Z Fri 18 Dec 2021
- The “Valid at” time indicates when the end of that forecast period is
 - For example, the image to the right depicts a 48 hr forecast valid at 00Z Mon 20 Dec, 2021
 - This is covering the period from 00Z Saturday 18 Dec, 2021 through 00Z Monday 20 Dec, 2021
 - The next time step, Forecast HR: 54, would cover 06Z Saturday 20 Dec, 2021 through 06Z Monday 20 Dec, 2021, with a valid time of 06Z Monday 20 Dec, 2021
 - The “Last Update” time show when the images were last uploaded to the web site.



PWSSI – How to Interpret

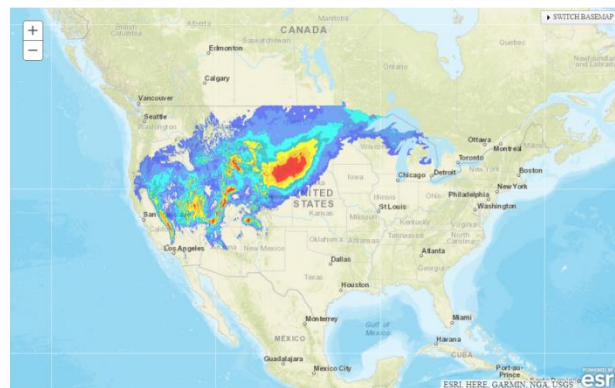


Snow Amount

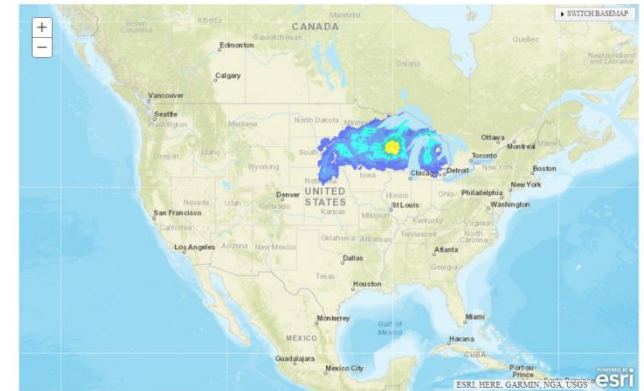
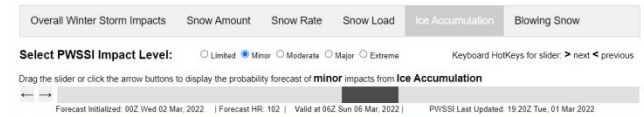


To the left is the Overall Winter Storm Impacts. Below we can see how the Snow Amount, Snow Rate, Ice Accumulation and Snow Load components combine to create the overall impacts.

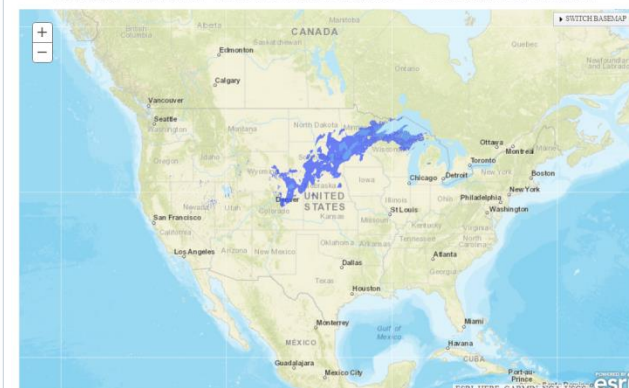
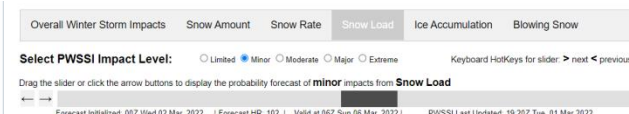
Snow Rate



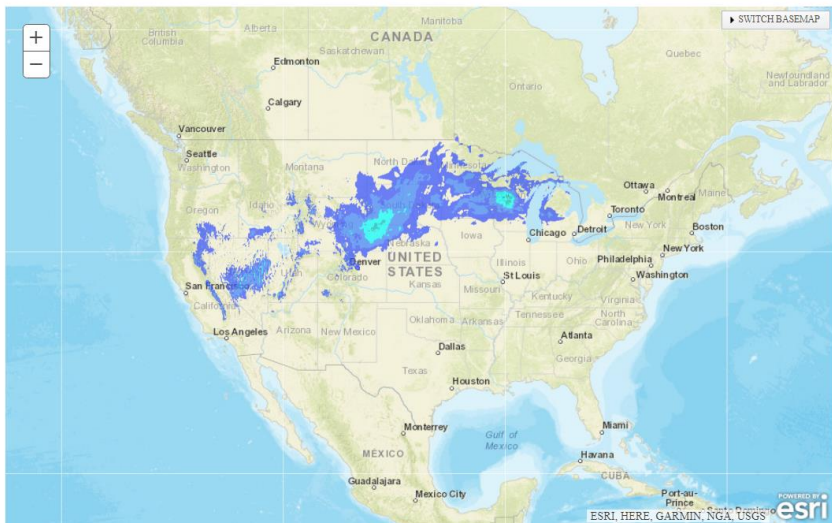
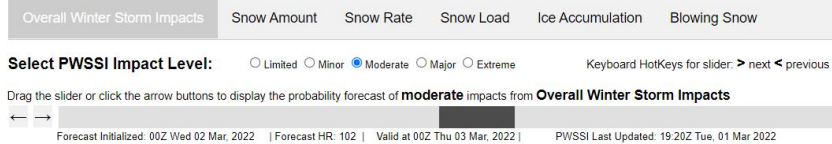
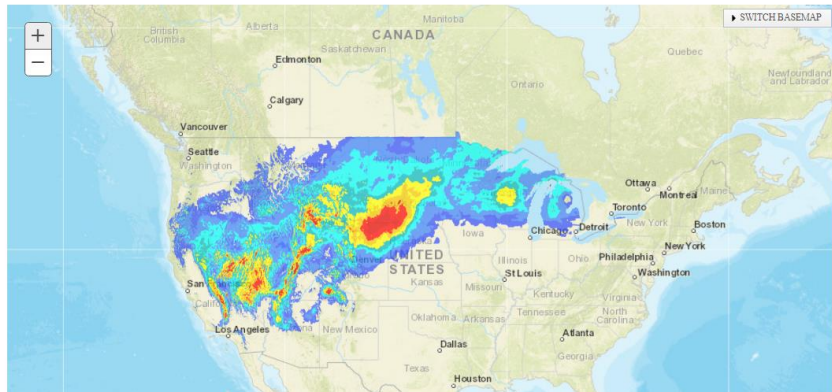
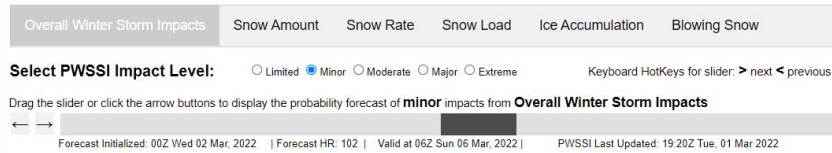
Ice Accumulation



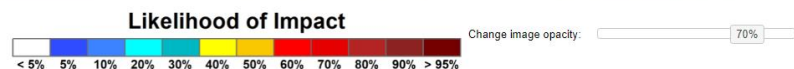
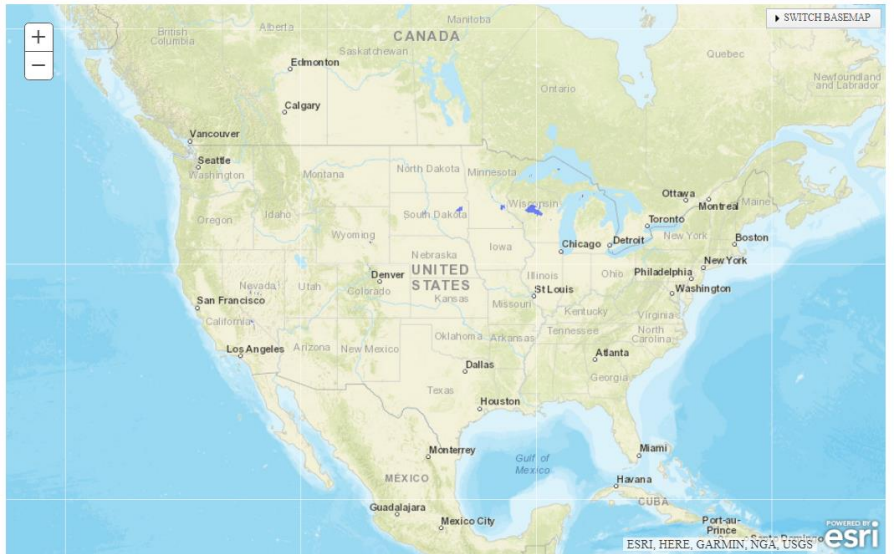
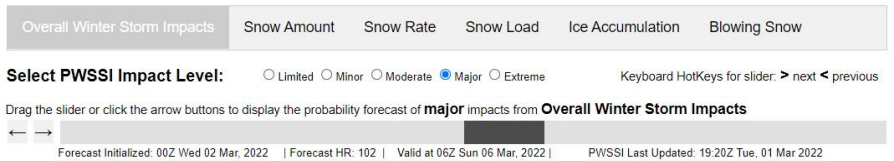
Snow Load



PWSSI – How to Interpret



Here we see the likelihood of Overall Winter Storm Impacts for Minor, Moderate and Major Impacts. In this case we see high likelihoods for Minor with decreasing likelihoods for Moderate and Major



Summary

- The PWSSI tool is designed to help maintain situational awareness and to help communicate a general level of potential societal impacts and their spatial distribution for winter weather.
- This tool uses both meteorological and non-meteorological data to forecast impacts for Snow Amount, Snow Load, Ice Accumulation, Blowing Snow, and a Summary graphic, which is a composite of the maximum impact from any of the other components.
- Probabilities are generated from the WPC Super Ensemble.
 - All 60 member forecast WSSI impacts
 - Components and Summary
 - Probabilities are an unweighted result of number of members forecasting a given scenario

Contact Information

- Questions or Comments? Please Reach out to:
- NWS WSSI Project Lead:
 - Jim Nelson (james.a.nelson@noaa.gov)
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