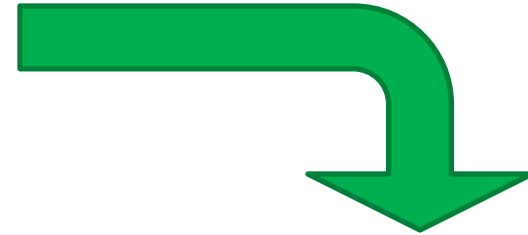


# Ag-Weather Partnership Recap

Product trials & feedback over the last 12  
months



# Where we started...



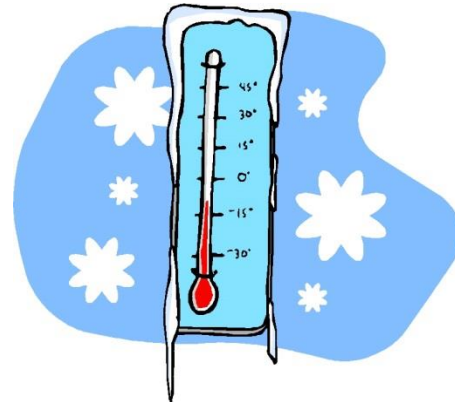
- Roughly 30 attendees including farmers, ranchers, and various gov't agencies
- Discussed history of the NWS in agriculture and addressed concerns
- Frost/freeze is one of the biggest concerns in addition to hail
- There was expressed interest in the VIP program
- NWS had not been hitting the mark with regard to temperatures, especially lows
- We were invited to provide similar workshops in other counties



Farm & Ranch  
Weather and Climate Workshop  
June 12, 2014

# Initial Takeaways

- Attack temperature problem by incorporating AZMET data into the bias-corrected models
  - The more observations we acquire from areas where currently none exist, the better the forecast will be
- Improve frost/freeze forecasting
- Host another workshop to reinforce open communication, and to gather more information with regard to the needs of the ag community



# Frost/Freeze Workshop



## • Nov 5, 2014 in Willcox

- Wind speed/direction/duration important for overnight lows – local effects.
  - 9 growers & crop consultants
  - Also affects insects/pollen/pollination
- Precip forecast is important for pesticide/herbicide application and irrigation use.
  - Discuss impacts of cold weather season on crops, including early/late freezes
- Not just interested in what the low will be, also want to know if freezing temps occur, how long and where
  - Get more information on any other weather/climate concerns
- Discrepancy in low temps as much as 10-15 degrees attributed to microclimates/local topography which is not picked up even by hi-res models.
- Using forecast overnight low at Mt. Lemmon as a gauge (or a personal bias-correction).
- Most damaging frost (if one occurs) is often close to May 1.
- Potential for a freeze event is significant at 7-10 days out, even if confidence is less than 50%.

# Next Steps



- Give advanced notice of early/late freezing conditions
  - Convey information in such a way that it can be used effectively to make mitigation decisions
- Create a “Point Forecast Matrix” (PFM) for Bowie, San Simon, and Bonita
  - Make this readily available to users
- Host a workshop for those interested in installing their own weather stations
  - Address siting for both new and existing stations, as well as uploading data to the web
- Employ a way to stay in touch with members of the ag community
  - Create a network allowing fluid communication with us, and with others who have similar interests and concerns

# Point Forecast Matrix

- Bowie, San Simon, Bonita
- NWS Tucson system upgrade = broken Ag PFM ☹️
- We are working on a fix and will let the listserv know where to find them
- Temporary workaround = User Created PFM

# User Created PFM (Weather Table)

[www.weather.gov/tucson](http://www.weather.gov/tucson)

Step 1 →

Click on “Weather Table” on left hand blue bar menu

Click here

## Current Hazards

- Watches / Warnings
- Outlooks
- Submit Report
- Weather Briefing

## Current Conditions

- Observations
- Radar
- Satellite
- Precipitation
- Quick Weather
- Surface plot map

## Forecasts

- Forecast Discussion
- Local Area
- Activity Planner
- Aviation Weather
- Fire Weather
- Severe Weather
- Hurricane Center
- User Defined Area

## Weather Tables

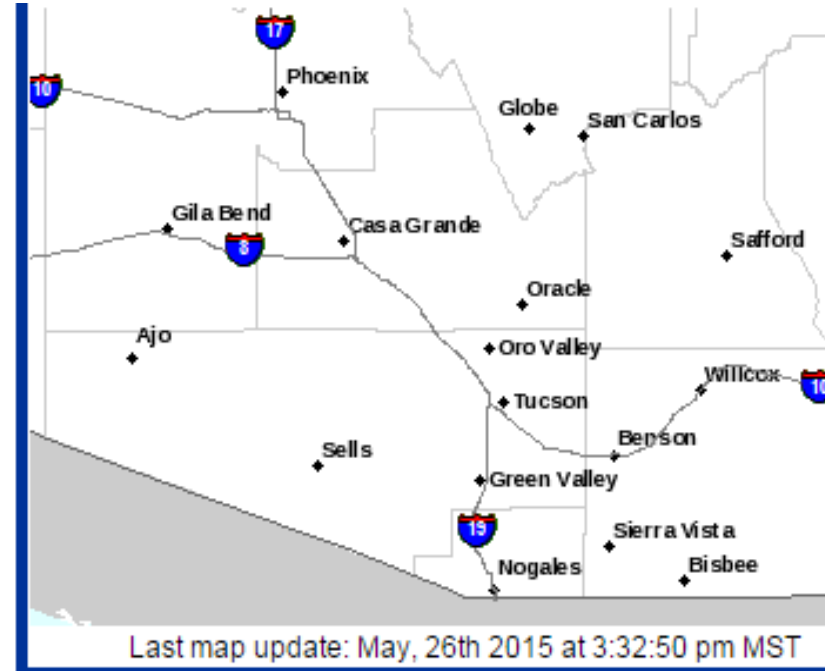
- Numerical Models

## Hydrology

- Rivers and Lakes
- Local Hydrology

## Climate

- Local



## Latest Conditions at Tucson, AZ

May 26  
**2:53 pm MST**

(40 minutes old)



Fair

**92 °F**

(33 °C)

Wind: SE 7 MPH

RH: 9%

DewPt: 26 °F



# User Created PFM (Weather Table)

The screenshot shows the 'Forecast Weather Table Interface' with a navigation menu at the top: Home, Current Hazards, Current Conditions, Forecasts, Hydrology, Climate, Weather Safety, Additional Info, and Contact Us. Below the menu are radio buttons for 'Custom Weather Table', 'XML', and 'Point Forecast Page'. The 'Point Forecast Page' is selected, and a box highlights the 'Select Weather Format' section with options: 'Point Forecast Matrix' (selected), 'Hourly Tabular Forecast', and 'Hourly Weather Graph'. Below this are radio buttons for 'Interval in Hours' (1, 3, 6) and 'Duration in Days' (1, 2, 3, 4, 5, 6, 7). A 'Reload Table' button and a search bar are also present. The search bar contains the text 'Search By Address: Enter Search term in the small box with the magnifying glass inside of the map.' A 'Print Version' button is on the right. The map below shows Arizona and Sonora with various locations and national forests. A blue arrow points from the search bar to a location in the map. Another blue arrow points from the 'Point Forecast Matrix' radio button to the map. A legend at the bottom indicates a crosshair for 'Requested Location' and a red square for 'Forecast Area'.

Step 2 →  
Click on the “Point  
Forecast Matrix”  
radio button

Step 3 → Click on  
a point on the map

OR

Enter in a location  
name in the map  
search bar.



Forecast prepared by WFO TWC  
 0400 PM MDT Tue May 26 2015  
 32.592N 109.968W 4587FT

# User Created PFM (Weather Table)

DATE	TUE 05/26/15	WED 05/27/15	THU 05/28/15
UTC 3HRLY	12 15 18 21 00 03 06 09	12 15 18 21 00 03 06 09	12 15 18 21 00 03
MDT 3HRLY	06 09 12 15 18 21 00 03 06 09	12 15 18 21 00 03 06 09	12 15 18 21 00 03
Max/Min Temp	-- 85	53 86	53 88
Temp	- 88 77 84 83 70 81 58 53 70 79 85 84 71 82 57 53 70 79 85 84 72		
Dewpt	- 34 32 28 25 28 30 31 29 29 22 18 18 19 21 24 26 27 24 23 23 23		
Max/Min RH	0 12	40 8	34 10
RH	- 28 19 13 12 21 31 38 40 21 12 8 8 14 21 28 34 20 13 10 10 16		
Wind Dir	W W SWSE S S SW W W W W WSWSW W W W W W W W		
Wind Spd	- 2 4 6 7 6 5 3 2 4 6 8 9 7 6 4 3 2 3 6 10 8		
Wind Gust(MPH)	- 4 6 9 12 9 7 5 4 6 10 13 14 12 9 6 5 4 5 10 15 13		
Clouds	- FWF FWF FWF FWF WSCS CSCS CF FWF FWF CL CL CL CL CL CL		
Clouds(%)	- 17 19 19 20 20 28 28 41 41 42 42 29 29 15 15 7 7 4 4 5 5		
POP 12HR	-- 0	0 0	0 0
QPF	-- 0.00	0.00 0.00	0.00 0.00

DATE	FRI 05/29/15	SAT 05/30/15	SUN 05/31/15	MON 06/01/15
UTC 6HRLY	09 15 21 03 09 15 21 03 09 15 21 03 09 15 21 23			
MDT 6HRLY	03 09 15 21 03 09 15 21 03 09 15 21 03 09 15 17			
Min/Max Temp	54 88	57 91	61 92	61 91
Temp	57 71 87 74 60 74 90 78 64 77 91 79 65 78 90 77			
Dewpt	24 23 22 22 24 25 24 25 33 42 37 34 39 39 35 34			
RH	28 18 9 14 25 16 9 14 32 28 15 19 38 28 14 21			
Wind Dir	W W W W NWNW E SE W SE SE S W W S W			
Wind Speed	<15<15<15<15<15<15<15<15<15<15<15<15<15<15<15<15			
Avg Cloud Cover	CL FW CL CL CL CL CL CL FW FW FW FW FW FW FW FW			
POP 12hr	0 0	0 0	0 0	0 0

End result looks like this for the PFM

**Forecast Weather Table Interface**

Select Weather Format

- Custom Weather Table
- Point Forecast Matrix
- XML
- Hourly Tabular Forecast
- Point Forecast Page
- Hourly Weather Graph

Interval in Hours:  1  3  6

Duration in Days:  1  2  3  4  5  6  7

# User Created PFM (Weather Table)

And like this for the  
Custom Weather Table

Forecast For Lat/Lon: 32.5920/-109.9680 (Elev. 4587 ft)  
17 Miles SW Swift Trail Junction AZ  
Forecast Created at: 4pm MDT May 26, 2015

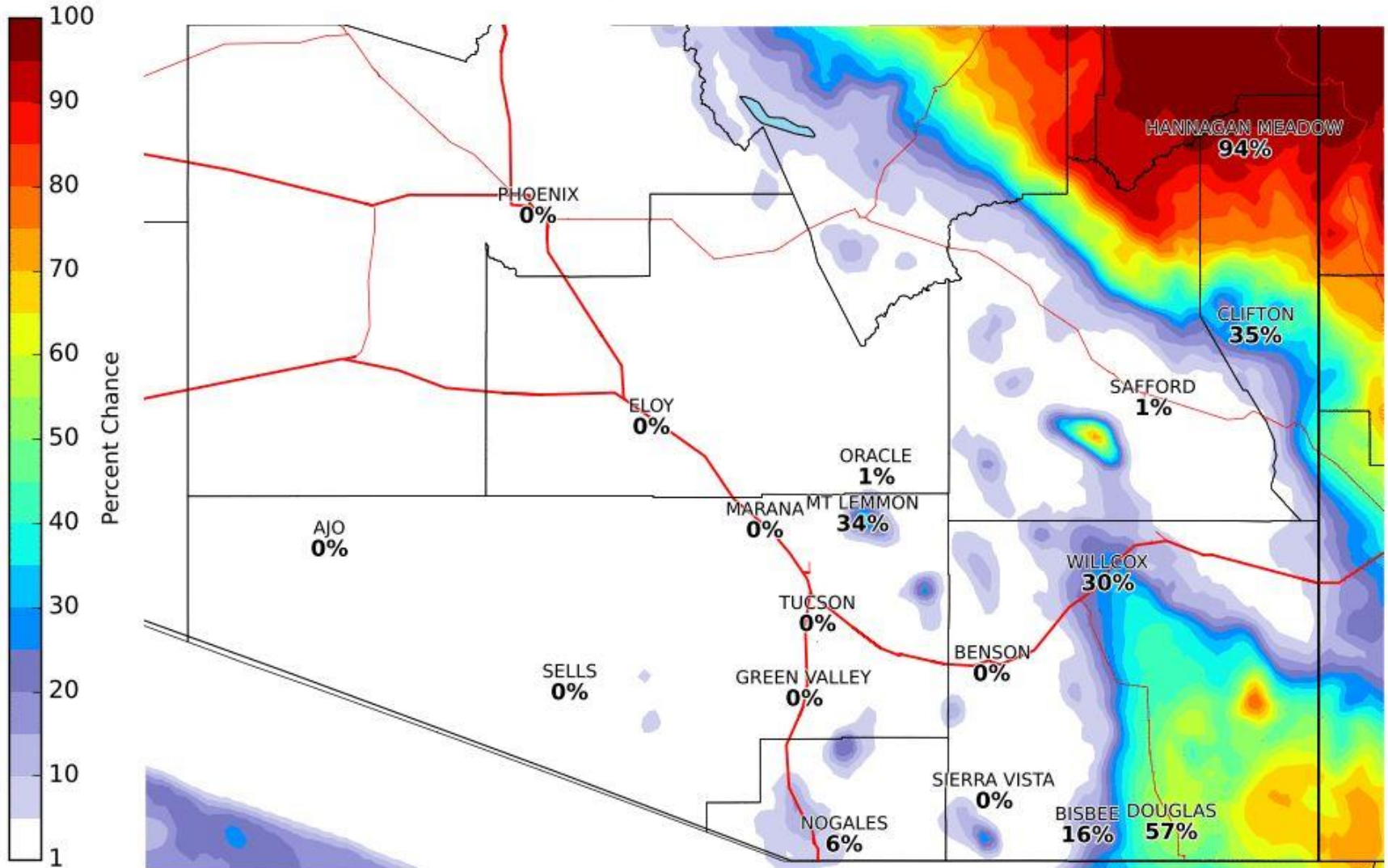
Custom Weather Forecast Table

	Tue May 26				Wed May 27				Thu May 28				Fri May 29				Sat May 30				Sun May 31	
Weather																						
Daily-Temp	High 85 Low --				High 86 Low 53				High 86 Low 53				High 88 Low 54				High 91 Low 57				High 91 Low 57	
Chance of Precip	--	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Precip	0.00"	0.00"	0.00"	0.00"	0.00"	0.00"	0.00"	0.00"	0.00"	0.00"	0.00"	0.00"	0.00"	0.00"	0.00"	0.00"						
12-hr Snow Total	--	0"			0"			0"	0"			0"	0"			0"	0"					
FRET	0.27"				0.29"				0.30"				0.32"				0.30"					
6-Hour Temp	6am	Noon	6pm	Mdnt	6am	Noon	6pm	Mdnt	6am	Noon	6pm	Mdnt	6am	Noon	6pm	Mdnt	6am	Noon	6pm	Mdnt	6am	Noon
Temp		77	83	61	53	79	84	62	53	79	84	62	54	81	86	65	57	84	89	69	61	81
Cloudiness		19%	20%	26%	41%	42%	29%	15%	7%	4%	5%	4%	13%	7%	7%	8%	8%	8%	8%	12%	12%	20%
Dewpoint		32	25	30	29	22	16	21	26	24	23	24	24	22	22	24	24	26	24	28	38	41
Relative Humidity		19%	12%	31%	40%	12%	8%	21%	34%	13%	10%	23%	31%	12%	9%	21%	28%	12%	9%	22%	43%	22%
Wind		S	W	W	SE	S	W	W	W	SW	W	W	W	W	W	W	W	W	NW	NW	E	SE
		6	10	7	3	9	13	8	5	5	14	8	5	7	14	7	5	5	9	5	7	11
Snow Level (ft)		11307	12060	12094	11545	11364	12197	11839	11784	12510	13355	13297	12825	12956	13230	12949	13317	13551	14020	13880	13557	137

# Probabilistic Products

## Chance of Hard Freezing Temperatures (28 Degrees or Lower)

Valid: February 25, 2015



# Feedback

Feb 25, 2015

“Products are very useful the way they are.”

“I am not interested in values less than 10% if they confuse the picture.”

“I would opt for the 32-deg map as the most useful and the data presented is enough.”

“Both graphics remind us to be on point and ready to take action.”

“If the zoom feature is available, we would need to use roads to precisely locate the fields we are concerned about.”

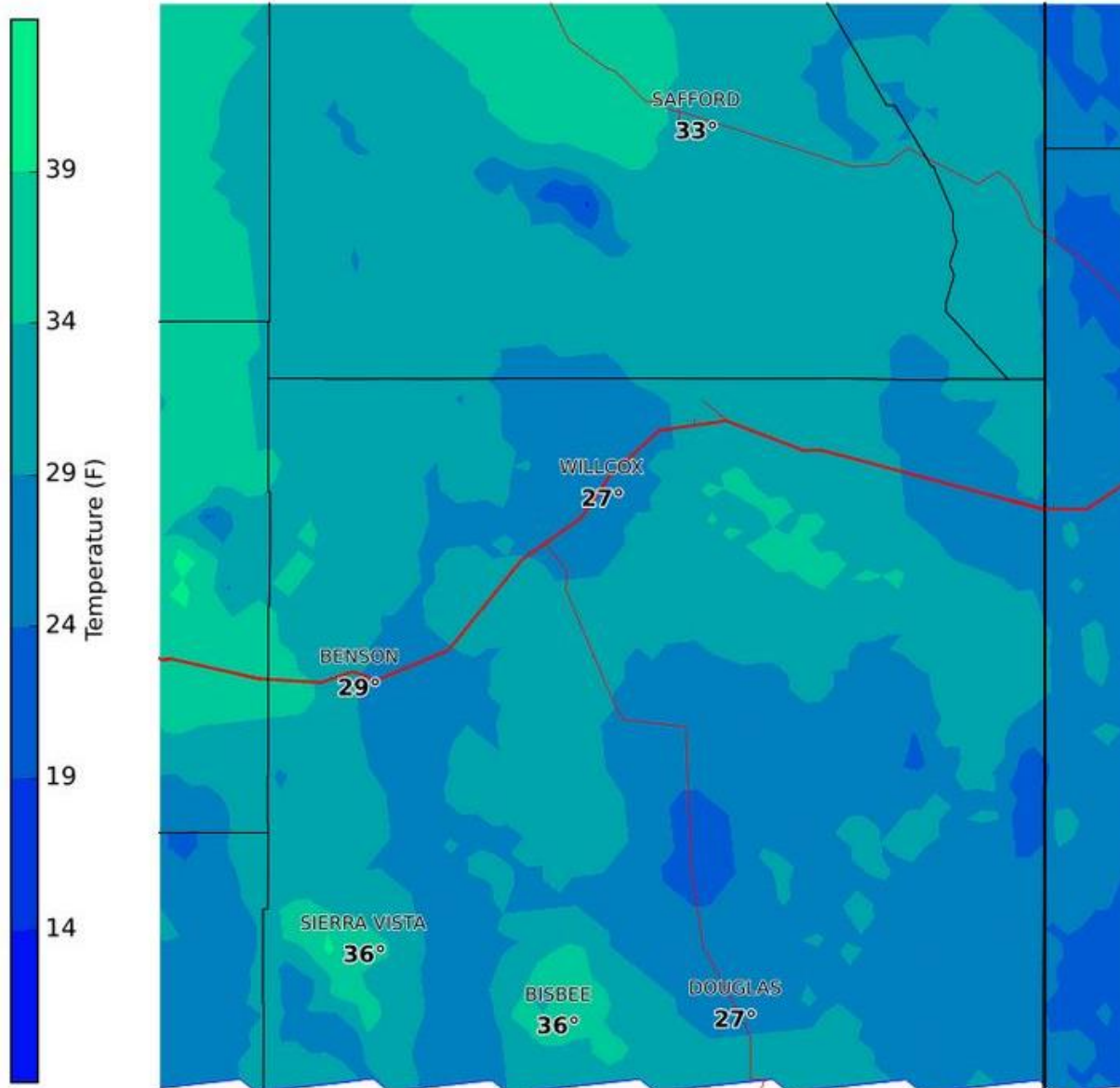
“Excellent! If you focused the map more on our area with these probabilities, it may be more helpful.”

“We are happy to have this tool coming along.”

“A zoomable map is important.”



# Verification – Feb 25, 2015

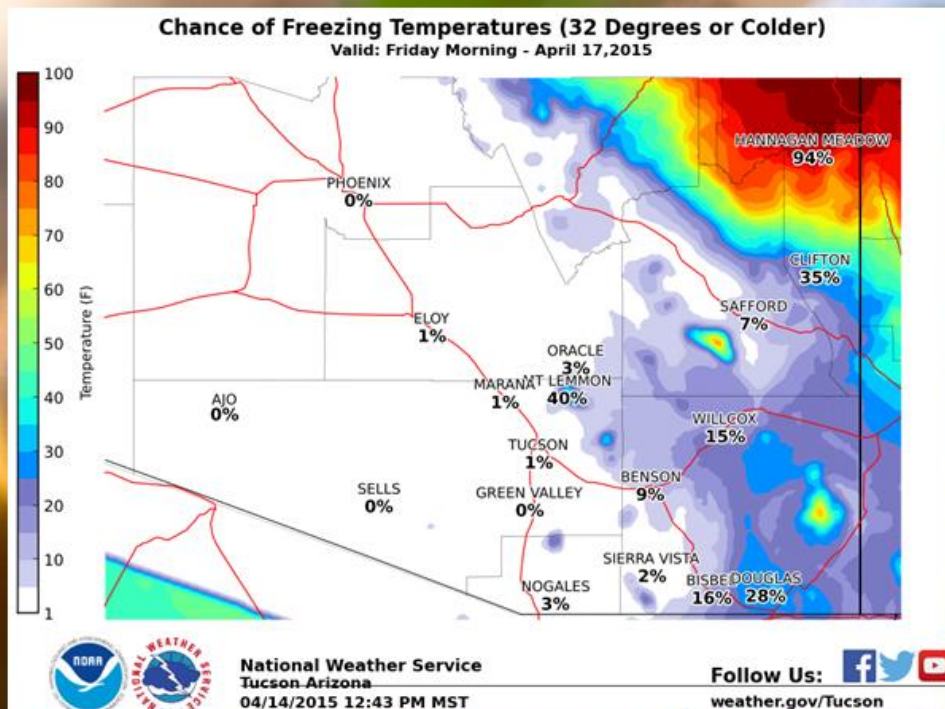


# So...what does this all mean?

- Currently, we can generate probabilistic forecast grids “on-the-fly”
  - When we think conditions are possible
  - The hope is to auto-generate these grids during the vulnerable times of the year
  - They still will need to be sent out to you from the office (not publicly available yet)

# April 17, 2015 Freeze Event

## Chance of Freezing Temperatures Late This Week



Graphic above displays the chance that low temperatures Friday morning will be 32 degrees or below.

- **TIMING** – Pre-dawn hours on Friday, April 17, with the best chances between 4 am and 7 am. Temperatures of 32 or below will likely occur for 2 hours or less.
- **IMPACTS** – Sensitive and unprotected crops and vegetation will be subject to damage.
- **CONFIDENCE** – High for below-normal low temperatures. Low-Moderate for temperatures at or below freezing.



# April 17, 2015 Freeze Event

## NATIONAL WEATHER SERVICE TUCSON



### WEATHER BRIEFING



- April 15  
partners

ent to

Issued: Wednesday, April 15, 2015 9:30 am MST

#### Overview:

A dry cold front will swing through southeast Arizona during the day today. Winds are expected to increase ahead of and along the front. These winds will likely create pockets of blowing dust. This could impact areas along I-10 between Tucson and Casa Grande with reductions in visibility and the potential for hazardous driving conditions. Winds and dust potential will be highest during the afternoon.

Much cooler temperatures will impact the area Thursday and Friday with the potential for areas of freezing temperatures in the high valleys of Graham and Cochise Counties early Friday morning.

#### Hazards:

- GUSTY WINDS of 20 to 30 mph with higher gusts
- BLOWING DUST may produce reduced visibilities.
- FREEZING TEMPERATURES Friday morning

#### Confidence:

**HIGH** for strong gusty winds and pockets of blowing dust

**MODERATE** for pockets of freezing temperatures Friday morning for high valleys of Graham and Cochise counties.



Building a Weather-Ready Nation [weather.gov/Tucson](http://weather.gov/Tucson)



NWSChat

# April 17, 2015 Freeze Event



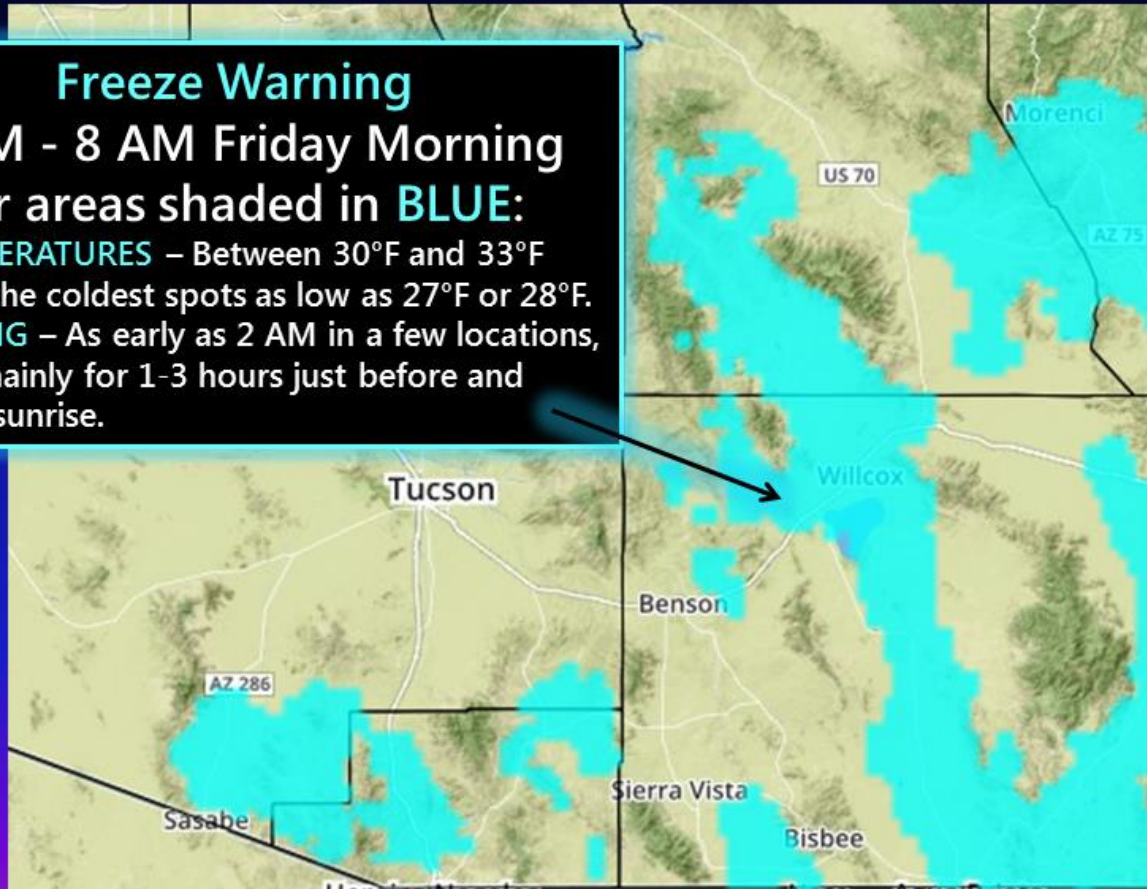
## Late Season Freeze Overnight



### Freeze Warning

1 AM - 8 AM Friday Morning  
for areas shaded in BLUE:

- **TEMPERATURES** – Between 30°F and 33°F with the coldest spots as low as 27°F or 28°F.
- **TIMING** – As early as 2 AM in a few locations, but mainly for 1-3 hours just before and after sunrise.



# April 17, 2015 Freeze Event

## Verification & Feedback

- Early morning of April 17 - freezing temperatures occur

AZMET Site	Hours $\leq 32^{\circ}\text{F}$	Min Temp & Time
Bowie	0	34.2°F @ 5:15 AM
San Simon	3	27.9°F @ 5:45 AM
Bonita	2.5	28.5°F @ 5:00 AM

Station ID	KDUG	ADRA3	CATA3	PDSA3	WILA3
Location	Airport	Elgin	Catalina SP	Paradise	Willcox
Low Temp	30°F	28°F	31°F	27°F	31°F

“Thanks for the information. Hopefully we can continue to receive these products.”

# We've made a lot of headway...

- PFM for Bowie, San Simon, Bonita, Sahuarita\*
- Creation of ag listserv for better communication
- Integration of probabilistic forecasting
- More NWS awareness with regard to damaging frost/freeze events
- Multiple workshops/meetings
  - Weather station 101

# ...but let's not stop there!



- Web page for probabilistic information
  - Likely through Ag Extension??
- Enhancement of probabilistic forecasts using ensemble models
  - Increased accuracy
- Update to the Fire Weather Impact Matrix already available
  - Adding variables like min temps, dewpoints, surface wind, and heat indices?
- Continuation of “heads-up” type emails
  - As long as they are helpful to you
- Expansion of initiative into other counties (Santa Cruz, Graham, Pinal)
- Development of a local crop calendar with phenology information to keep in-house
  - So meteorologists know if/when impacts are possible
- Keep lines of communication open!





**Thank you!**

**Our success this year wouldn't be possible without your much appreciated input and feedback.**