

RECAP

November 2005

For Professionals Who Monitor the Weather. From the Manufacturers of Capricorn™ and Orion™ Weather Stations.

Arizona Emergency Exercise Incorporates Weather Factors

On October 14 the State of Arizona conducted a full-scale exercise to test the Eastern Region's disaster mitigation capabilities. Numerous regional and local agencies participated as First Responders, Incident Command, Police, HazMat, communications, decontamination and mitigation efforts were all tested for their readiness and ability to respond to a mass casualty incident.

The scenario was a large tanker carrying hazardous toxic chemicals being involved in an accident in central Casa Grande. Casa Grande Fire Department was designated as first on-

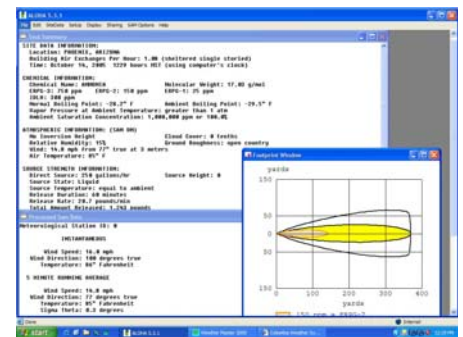
scene and, therefore, assumed Incident Command. The simulated incident area was on a major commercial route through the city, near several small businesses and a large residential area. Chemicals spilled from the tanker and caused multiple casualties at the scene.

CWS's meteorologist John Gerrish assisted Western Fire, Inc. as the designated weather representative to provide real-time weather inputs to the Incident Command and to document weather conditions during the incident. This was done in two ways: 1) from Western Fire's vehicle-mount weather system on their fire truck, and 2) an Orion Nomad portable weather station positioned at the State of Arizona's new communications vehicle.

With a residential neighborhood immediately downwind of the accident, the initial weather concern was the wind carrying the chemical plume. Initial winds were mild, but they picked up soon with gusts up to 32 mph. The higher gusts created dust clouds which would have been contaminated by vaporizing chemicals. Instead of dissipating, the chemical plume, now became a toxic dust cloud and would have contaminated everything it touched, exacerbating the situation.

It was pre-determined that weather would play a major role in this exercise. Live weather data was captured via computer utilizing WeatherMaster™ software. The program viewed live weather data readings, created an incident weather data log, and also interfaced with CAMEO/ALOHA software for toxic chemical plume modeling predictions. Data was then sent via a wireless Internet feed from the communication vehicle to the Pinal County Emergency Operations Center every 15 minutes.

CAMEO/ALOHA models the toxic plume with data input from the weather station.



All in all, Arizona's first statewide exercise was successful in the sense that many people learned some very valuable lessons and gained valuable field experience including working together as an inter-agency team. It also pointed out some areas that need more attention.

As was experienced during the exercise, there are many aspects to weather monitoring that are crucial to the mitigation process and the public's safety.

One recommendation was for Arizona's Incident Commanders to incorporate weather input operating procedures into their Incident Command Action Plan. This might be best addressed and uniformly implemented at the state's incident command academies.

Training is the key to preparedness and preparedness is the key to success.

This article is condensed from the "After Action Report" by John Gerrish, CWS Meteorologist. A copy of the full report including recommendations can be downloaded from our website www.columbiaweather.com.



Western Fire representative sets up the Orion Nomad portable weather station in record time.



INSIDE ReCap

- ▶ ORION MOBILE AND NOMAD PORTABLE STATIONS
- ▶ LEWIS AND CLARK WEATHER BOOK *Enter to Win*
- ▶ A HURRICANE TUTORIAL
- ▶ NEWS AND HOLIDAY CLOSURE SCHEDULE

▼ New Product Highlight: *Orion Mobile and Nomad Portable Ready for the “wear and tear” of tactical operations*

The Orion Mobile and Nomad portable weather stations are the latest applications for the cutting-edge Orion all-in-one sensor technology with its:

- ultrasonic wind direction and speed sensors,
- impact rain gauge,
- capacitive humidity, temperature and pressure readings.

Rugged Single Sensor Module

As one sensor module with no moving parts, the Orion is less susceptible to damage than other wind sensors. This helps the Orion Mobile and Nomad weather stations stand up to the rugged conditions and “wear and tear” of tactical operations.

On the Orion Mobile weather station, the sensor unit can be permanently affixed to the mast. A single cable connects through an external connector plate mounted on the vehicle. Inside, the Orion Interface Module provides power to the sensor transmitter and communication ports for both computer and Weather Display Console.

Snap-On Mounting Adapter

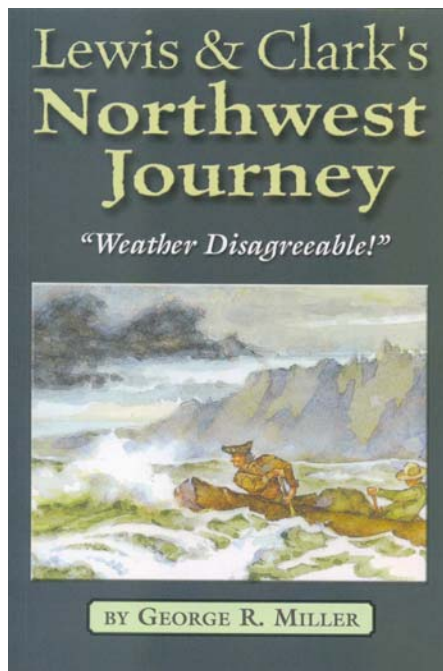
For both the mobile and portable configurations, a permanent “snap-on” mounting adapter allows you to quickly remove and reinstall the sensor head without losing North orientation. (North offset can be entered via the software.)

Orion Nomad portable weather station is much quicker to set up and less cumbersome than other portable weather stations.

Within minutes it can be deployed and communicating to the command center. (At the recent Arizona Emergency Exercise, a novice had it up and running within two minutes.)

Quick Portable Set-up

1. Set up the tripod mast. With the attached compass, orient the leg marked North.
2. Inside the carrying case, connect the battery to the radio transceiver.
3. With a snap and twist, mount the sensor module to the mounting adapter on the mast.
4. Plug the sensor cable into the carrying case outlet.



Enter to win a free copy. Send us an email before December 31 with "Book Drawing" as the subject to info@columbiaweather.com. Be sure to include your name and address.

► *Lewis and Clark's NW Weather Experience*

Two hundred years ago the Corps of Discovery stumbled out of an early northern Idaho snowstorm into the Weippe Prairie. They were tired and hungry, but they had crossed the Divide and it was all “downhill” now to the Pacific Ocean. They were out of the mountains, but they were not out of the weather.

On their trek down the Clearwater River to the Snake River to the Columbia River and finally to the Pacific Ocean and then back to the Rocky Mountains they experienced a variety of weather. But how much different was it than the weather we experience today? Not a whole lot, indicates George Miller in his new book: *Lewis and Clark's Northwest Journey: Weather Disagreeable*, but there were some differences.

Before we are critical of the winter they experienced along the Pacific coast for five months, we need to observe where members of this party originated. They came from West Virginia, Virginia, Ohio, and other states much nearer the east coast of the United States than the west coast. They were not accustomed to

days of steady light rain, common on the Pacific Northwest coast in the winter months.

What most historians overlook regarding their stay along the Pacific Northwest coast was a two week cold spell that lasted from the last week of January through the first week of February 1806. The Corps of Discovery noted two weeks with snow on the ground at Fort Clatsop, a remarkable event, and unprecedented today.

Research for this book took retired meteorologist George Miller to most of the Corps of Discovery campsites from Lolo Pass between Montana and Idaho to the Pacific Ocean. His research into the journals kept by both Meriwether Lewis and William Clark as well as four other members of the party focused on their entries regarding the weather.

The book was published by Amato Publications. Copies are available in bookstores, at the Oregon Historical Society in Portland where Miller volunteers, or through Columbia Weather Systems for \$14.95 plus shipping.

▼ CWS Sponsors Climate Forum

By Jan Dabrowski, Ph.D.

On October 8, nine climate researchers from five universities in the Pacific Northwest presented their work on climate change to the public at Marylhurst University near Portland, Oregon. They covered topics ranging from viticulture to glacier snowmelt, marine life effects to fire potential. They came from Oregon State Univ., Portland State Univ., Washington State Univ., Univ. of Washington and Southern Oregon Univ.

“Northwest researchers predict more wildfires and altered ecosystems An increasingly warmer climate will trigger more wildfires, curtail water supplies and alter Northwest ecosystems in the ocean and on land, warn several of the region’s top climate scientists.” —The Oregonian, 10/9/05

The free conference was attended by 160 people – a mix of general public, university and high school students, and professionals in climate and meteorology fields.

The conference was hosted by Marylhurst University and sponsored in part by Columbia Weather Systems, The Oregon Chapter of the American Meteorological Society, and the Environmental Atmospheric Research Group of Portland State University.

Information about the conference, including abstracts and web sites for the researchers can be found at:

<http://www.marylhurst.edu/scienceseминаr/agenda.html>



Small TN Fire Dept. Draws Media Attention

Sullivan West VFD gets weather system

“The Sullivan West Volunteer Fire Department soon will have a state-of-the-art weather monitoring system from Columbia Weather Systems, thanks to a grant from Home Depot...”
—Kingsport Times-News, 11/10/05

This lead from the local newspaper gratified volunteer firefighter Danny Baines who emailed Columbia Weather with this message:

This is what the local newspaper ran on Thursday. They are going to come out and do a front page news article on the weather system after we get it in. The two local TV news stations are planning to come out and do a news article on the system also.

From my understanding no other fire department in northeast Tennessee has the capabilities to do what we are doing and we are getting ask a lot of questions on this.

I never dreamed that our little project would turn into something big like this. It has got a lot of people very excited down here and they are taking notice of our department.

thanks, Danny Baines

Golf Tournament Benefits UPS Driver with Lou Gehrig’s Disease

by Debbie Taylor, Office Manager

In August Columbia Weather Systems proudly sponsored a team as well as the 7th hole at the First Annual Tom Cooper Golf Tournament. The tournament benefited our UPS driver Tom Cooper who was diagnosed with ALS (commonly known as Lou Gehrig’s disease) earlier this year. It was held at the Meriwether Golf Club in Hillsboro, Oregon.

The tournament raised about \$20,000 to assist Tom and his family with medical bills.

The CWS team represented themselves and the company very well and was honored to be part of such successful event.

Tom is a 20-year employee of UPS and his dedication and reliability made him an important and valuable part of Columbia Weather’s daily operation. We wish Tom and his family the very best and certainly look forward to participating in this annual event.

Donations may be made to the Tom Cooper ALS Fund at any branch of U.S. Bank or Washington Mutual.



Proud to help a friend in need, Columbia Weather’s foursome included (from left) Woody Reames, Geoff Taylor, Mark Taylor, and Kevin Gerrish.

▼ *Weather Watching: Hurricanes 101*

This year has been the most active and devastating hurricane season on record. What is this awesome force of nature?

Simply put, hurricanes are part of the earth's mechanism of global heat transfer. The Earth is perpetually trying to reach a temperature equilibrium. In much the same manner as Arctic Outbreaks bring cold frigid and freezing temperatures to the subtropics in the winter, hurricanes transfer an enormous amount of heat to the northern latitudes in the summer and fall.

Latent Heat of Condensation

Hurricanes are known in different parts of the world as Typhoons, Tropical Cyclones, Willy-Willys, and Medicanes (Mediterranean Hurricanes). No matter what their name, the mechanism that creates these massive storms is known as the "Latent Heat of Condensation". This is a process of transferring the sun's energy, collected in the warm ocean waters, back into the atmosphere.

1. *Water retains heat*

The sun's energy heats the earth. Land heats and cools faster than water – land also experiences more extreme temperatures than water. Conversely, water heats and cools more slowly and to less extreme, but the heat collected in water is more persistent and is retained longer. Oceans act as a heat collector, much like a solar panel, but on a global scale. Consider the fact that our world is three-fourths water and you get an idea of how much heat our oceans collect and exchange in a given summer.

2. *Energy to change state*

Water has three different states of mass: liquid, ice (solid), and gas (water vapor). Heating and cooling water is much different than air. Scientifically speaking, it takes one calorie of energy to heat (or cool) one gram of water 1° Celsius (C) - one gram is approximately .035 fl oz. This is true up and down the temperature scale, except when water passes through one of the changes of state – ice to water, water to gas, gas to water, or water to ice.

In these instances it takes more energy – much more – to change the water's state, without changing its temperature. A pan of water takes only a few minutes to heat to the boiling point 212°F (100°C) and takes relatively little energy (heat). But when the water reaches the boiling point, it takes longer and much more energy for the water to boil at 212°F, creating water vapor (steam).

It takes one calorie of energy to raise the temperature of one gram of water 1°C. As the water temperature reaches 212°F it slowly converts from liquid water to water vapor, as evidenced by the bubbles that form at the bottom of the pan. In order to change the state from water to vapor, it takes an additional 540 calories of energy per gram to just change the water's state without changing the temperature.

3. *Condensation*

Evaporation is a cooling process — it removes heat from its surroundings.

When a swimmer gets out of the water, the air flows over their body and removes heat to fuel the evaporative process of water on the skin. This is why the body shivers; heat is actually being removed from the body. This principle is also why evaporative coolers work well in dry Southwest desert areas.

Conversely, condensation is a warming process because heat is released back into the atmosphere as water vapor condenses back into liquid water. Rainfall is a good example of condensation. Hurricanes spread enormous amounts of rain over hundreds of thousands of square miles.

For this reason, hurricanes are fueled by the Latent Heat of Condensation. If it takes 540 calories to convert 1 gram of water to vapor, just think of how many trillions upon trillions of energy calories are generated by the enormous rainfall amounts hurricanes produce. It has been said that one hurricane produces enough energy to power the entire United States for a full year. If only we could harness this unbridled power of nature.

Development of a Hurricane

Most Atlantic hurricanes start as small disturbances off the West Coast of Africa. Created by weak atmospheric perturbations, these disturbances become Tufts, small clusters of thunderstorms. At those latitudes, predominant wind pattern is from east to west in the equatorial regions around the southern edge of the Atlantic High Pressure Cell. These winds are known as "Trade Winds."



▼ Hurricanes 101: continued

As **Tufts** move on the Trade Winds, they move out over warmer water, which starts the fueling process. Numerous Tufts develop and die over the course of any given summer; however, when upper atmospheric dynamics are just right, barometric pressure drops with the thunderstorm activity and any given Tuft can turn into a Tropical Depression.

Tropical Depressions are classified as storms with winds less than 38mph. Tropical Depressions form a cyclonic low-pressure center, which begins the organization process necessary for hurricane development. Tropical Depressions can also form in the Caribbean and/or Gulf of Mexico, as well.

When Tropical Depressions reach the warmer shallower waters of the Caribbean/Gulf of Mexico, their intensity usually increases. **Tropical Storms** are classified as storms with winds 38-73mph. Because of the proximity of the South American continent, the Trade Winds start deflecting more northerly out of the tropical latitudes. When this happens, the earth's rotation influences the directional flow through Coriolis Force.

Coriolis is a spherical force which is caused by the curvature of the earth. The further north from the equator, the smaller the earth's diameter becomes. This natural curve tends to deflect wind flow to the right in the Northern Hemisphere. Generally speaking, this is why the further north a hurricane goes, the more it will re-curve its path towards the North and sometimes East. This is a primary reason why the United States' Gulf Coast and Eastern Seaboard are prime targets for hurricane landfall. The dynamics, both atmospheric and geographical, are near perfect.

Hurricanes become a self-generating process when warm ocean currents reach 80°F or more. As long as hurricanes remain over warm waters, they will continue to regenerate themselves. Once a storm makes landfall, or moves over relatively cooler ocean waters, it becomes cut off from its energy source and rapidly weakens and dies.

If a weakened storm moves back over warm ocean waters, it may regenerate to be as strong, if not stronger, than it was previously. This happened with Hurricane Wilma – it weakened over the Yucatan Peninsula before it

strengthened again and made landfall in south Florida as a strong Category 3 hurricane.

According to the Saffir-Simpson Hurricane Scale, there are five categories of hurricanes: Category 1 storms measure winds 74-95 mph; Category 2, 96-110 mph; Category 3, 111 to 130 mph; Category 4, 131 to 154 mph; and Category 5, winds greater than 155 mph.

Hurricane Season

As the earth rotates from winter to spring and summer, the days become longer and nights shorter. The Summer Solstice marks the longest day of the year – normally June 21. It's also where the sun reaches its maximum tilt northward. This is known as the Tropic of Cancer (23.5°N) and runs through the Straits of Florida between Cuba and the U.S. mainland. After the solstice, the seasonal days get shorter and the earth's apex to the sun slowly moves southward back toward the equator.

The Summer Solstice also roughly correlates with the start of the annual hurricane season. July and August are historically the warmest months of the year even though the days are getting shorter. This is, in part, because the atmosphere has been warmed by months of summer sunshine collected in the oceans and the lack of cold in the Polar Regions, which are now in constant sunlight. There's relatively little cooling in the Arctic to counter-balance summer's warmth.

As summer wanes into August and September, the Fall Equinox (September 21) signals that day and night are of equal length and the sun is directly back over the Equator. As the weather cools, Fall begins, but the oceans still team with massive amounts of heat energy collected over the summer. The potential for hurricanes exists as long as the oceans remain warm. October and November may produce devastating hurricanes as the oceans release their heat energy.

Components of a Hurricane

An average hurricane is about 300 miles in diameter, but larger storms can be as much as 500 miles across. In the Northern Hemisphere, these storms spin counter-clockwise, or from right to left.



courtesy photo

The hurricane's **Eye** is normally 20 to 40 miles in diameter, but can be much larger. Eyes are distinguished by relatively calm and clear weather in midst the maelstrom. At the edge of the Eye is the **Eye Wall**, which is the most intense and destructive part of the storm. Winds are their strongest and the storm surge can reach as much as 30 feet high or more, as what was witnessed with Hurricane Katrina.

Storm surge is caused by the extreme low-pressure in the Eye. The lack of atmospheric pressure allows the ocean surface to rise higher than the surrounding ocean. This rise in sea surface is whipped by the violent winds and creates massive violent swells. As the Eye Wall comes ashore, it encounters shallow coastal waters, which catapults the storm surge to greater heights.

Storm surge is often the most devastating part of a hurricane and claims more lives due to the extreme flooding and violent forces of raging water. Low-lying areas become inundated with angry seas and the shear force of wind-whipped water turns sturdy homes into matchsticks. Katrina's storm-surge caused catastrophic damage as the storm moved ashore. The hurricane's eye passed just east of New Orleans, and brought an enormous storm surge into the Mississippi Sound, which breached Lake Ponchartrain. Levees broke and massive flooding inundated the city.

A hurricane's right-front quadrant can be equally destructive, as it possesses severe Squall-Line thunderstorms, torrential rains, and deadly tornadoes in its spiral bands. **Spiral bands** also rotate counter-clockwise around the storm. They are the storm's leading edge as it begins to make landfall. Katrina's Eye Wall and storm surge actually made landfall near Bay St. Louis, MS, and literally destroyed the small coastal communities of Waveland and Pass

▼ Hurricanes 101: continued

Christian, among others. Here, the winds were estimated at greater than 140 mph and the storm surge was nearly 30 feet. The storm surge flooded many miles inland, leaving complete devastation in its path.

Theories

This was the most active hurricane season on record. There are many different theories as to why, some of which tie into the concept of **Global Warming**. It makes sense that if the oceans are warming and collecting solar heat, then the planet's atmosphere will also warm as a result.

Another theory, which also makes sense, is the earth moves and rotates in **cyclic patterns**: day to night, season to season, year to year. The earth also has a 22-year solar cycle where the earth reaches its solar maximum every 11 years then rotates to a solar minimum 11 years later. In the year 2000, we reached our "Solar Max". In the years leading up to the 2000 Solar Max, weather records indicated an increase in global temperatures, which seems natural. We also saw a greater activity in the El Nino and La Nina oceanic patterns. These anomalies affect and change global weather patterns, as well. In the 1980s, the meteorological mantra was "The Next Ice-Age". This was a period when the solar cycle was approaching its minimum and the earth and oceans were experiencing relatively cooler temperatures. Cooler oceans would indicate slower hurricane seasons. Only time will tell how these cyclic patterns truly affect the earth's climate and hurricane cycles.

Tracking the Storm

Today's world is much more technically prepared to warn its citizens of a hurricane's approach. Satellite imagery and Doppler Radar provide ample warning days in advance.

The famous Hurricane Hunters fly C-130 aircraft missions through hurricanes to collect and provide critical weather information. Radiosonde data – weather instruments with a radio transmitter are dropped from the plane at



regular intervals to paint a vertical cross-section of wind, temperature, pressure, and moisture contained in the storm.

This information gives scientists at the National Hurricane Center in Coral Gables, FL much needed data to plot and forecast a hurricane's development and projected path. Their forecasts have saved innumerable lives through the years. They also provide emergency managers advanced warning and landfall projections to allow the necessary time to pre-stage and stockpile water, food, and other emergency supplies. They also give the public and businesses adequate time to board up and secure their buildings and belongings.

Hurricanes are the most dynamic and destructive of all atmospheric storms. They are also an integral part of the planet's heat exchange. Without them parts of the northern latitudes would be uninhabitable.

We cannot stop hurricanes, so we must learn to get out of their way. Advanced warning is the most crucial part of the mitigation process, and learning more about these dynamic forces helps us to better understand and contend with nature's most devastating storms.

John Gerrish, CWS's Sales Manager and Certified Meteorologist, assisted hurricane relief efforts at his local church which provided the photos on page 4 and 6.



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*Our office will be closed
Friday, December 23 through
Friday, December 30. We will
re-open on Monday, January 2.*

*Best Wishes for a
Wonderful Holiday
Season
from
Columbia Weather
Systems!*

