



**38th NWA Annual Meeting
Student Session
North Charleston, SC**

Unlimited Opportunities for Private Sector Meteorologists

Kenneth Carey

Vice President for Science and Engineering
Earth Resources Technology, Inc.

October 13, 2013

**“A Meteorologist is one of the Top
50 Best Careers of 2013”**



December 2012

Where Do I Go From Here??

- **Public Sector**

- National Oceanic and Atmospheric Administration (NOAA)
- Department of Defense (Air Force, Navy; active duty/civilian)
- National Aeronautics and Space Administration (NASA)

- **Academic Sector**

- Public and private university instructors, researchers
- Secondary, primary school teachers

- **Private Sector**

- Broadcast Meteorologist (TV, radio, webcasts)
- Certified Consulting Meteorologist (CCM)
- Product Provider (e.g., AccuWeather, WSI, Baron Services)
- Consultant/Systems Engineering (e.g., Raytheon, Northrop Grumman, ERT, ITT, Aerospace Corp, own company)
- Energy, Reinsurance (e.g., Willis Re, AWS Truewind, LLC)
- Scientific/Educational (e.g., AMS, UCAR, Weather Museum)

Qualifications of the Ideal Candidate



- Technically sound
- Creative
- Uses sound judgment
- Works well with others
- Communicates well
- Likes challenges
- Solves problems
- Understands that there is more to life than work
- Wants to improve skills

www.rayjobs.com/campus

Alan Sealls – Weather Broadcasting



WHY BE A METEOROLOGIST?



Be a trusted source of weather information



Brad Nitz



Glenn Burns

- Warn for dangerous weather
- Communicate environmental information
- Provide local area forecast expertise





JOHN MORALES

Jefe de Meteorologia

AMS
CERTIFIED

73°
11:17



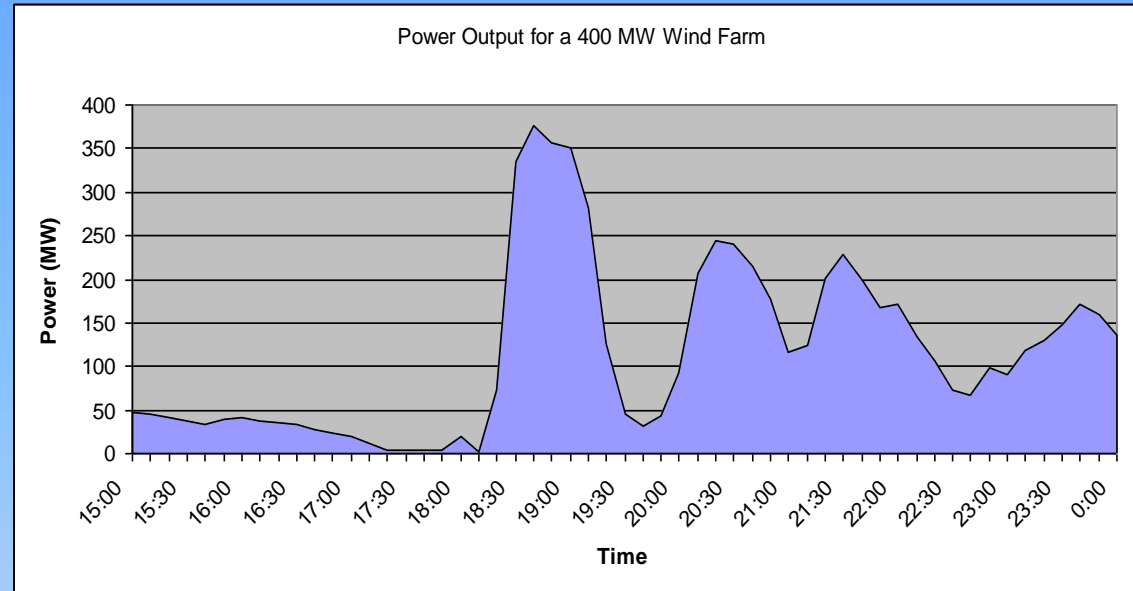
Reasons To Work In The Private Sector As A Wind Power Meteorologist



- **Jobs, Jobs, Jobs!**
 - The wind power industry is growing rapidly and its growth is projected to continue. There are many opportunities for meteorologists in this field.
- **Develop cross-disciplinary skills**
 - Working in the wind power industry as a meteorologist provides opportunities to learn about other disciplines such as renewable energy, the transmission grid, and the operation of utilities.

A Wind Power Meteorologist can...

- **Apply meteorology in innovative ways to solve problems**
 - As a meteorologist you can help utilities forecast the wind power output of wind farms or help wind farm developers decide where to build new wind farms
- **Break new ground!**
 - The wind power industry is rather young and skilled meteorologists are needed to solve some of the industry's problems.

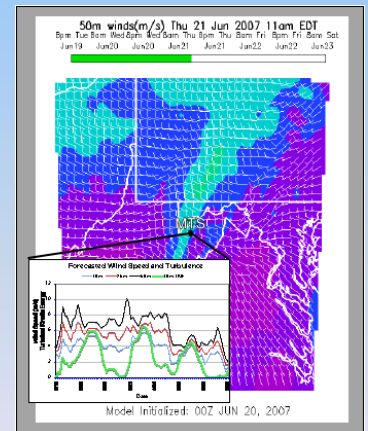


- o How could the wind power output be predicted ahead of time for this wind farm? Could it be predicted 10 minutes ahead? 3 hours ahead? Or what about 1 day ahead of time?
- o What meteorological phenomena caused the power output to fluctuate so greatly?
- o Rapid increases and decreases in wind power output create difficulty for utilities in managing a balanced grid. Better wind power forecasts will help to drive down wind power integration costs for utilities.

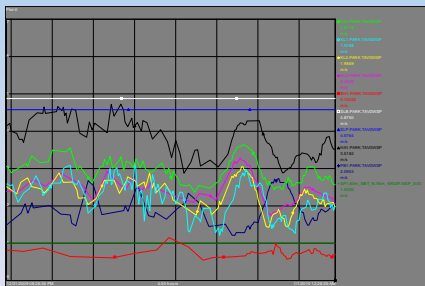
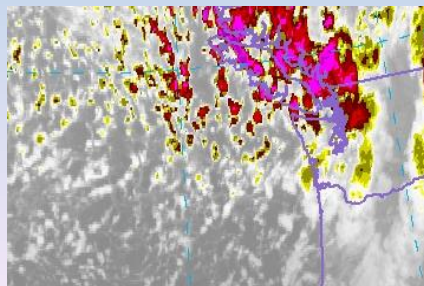
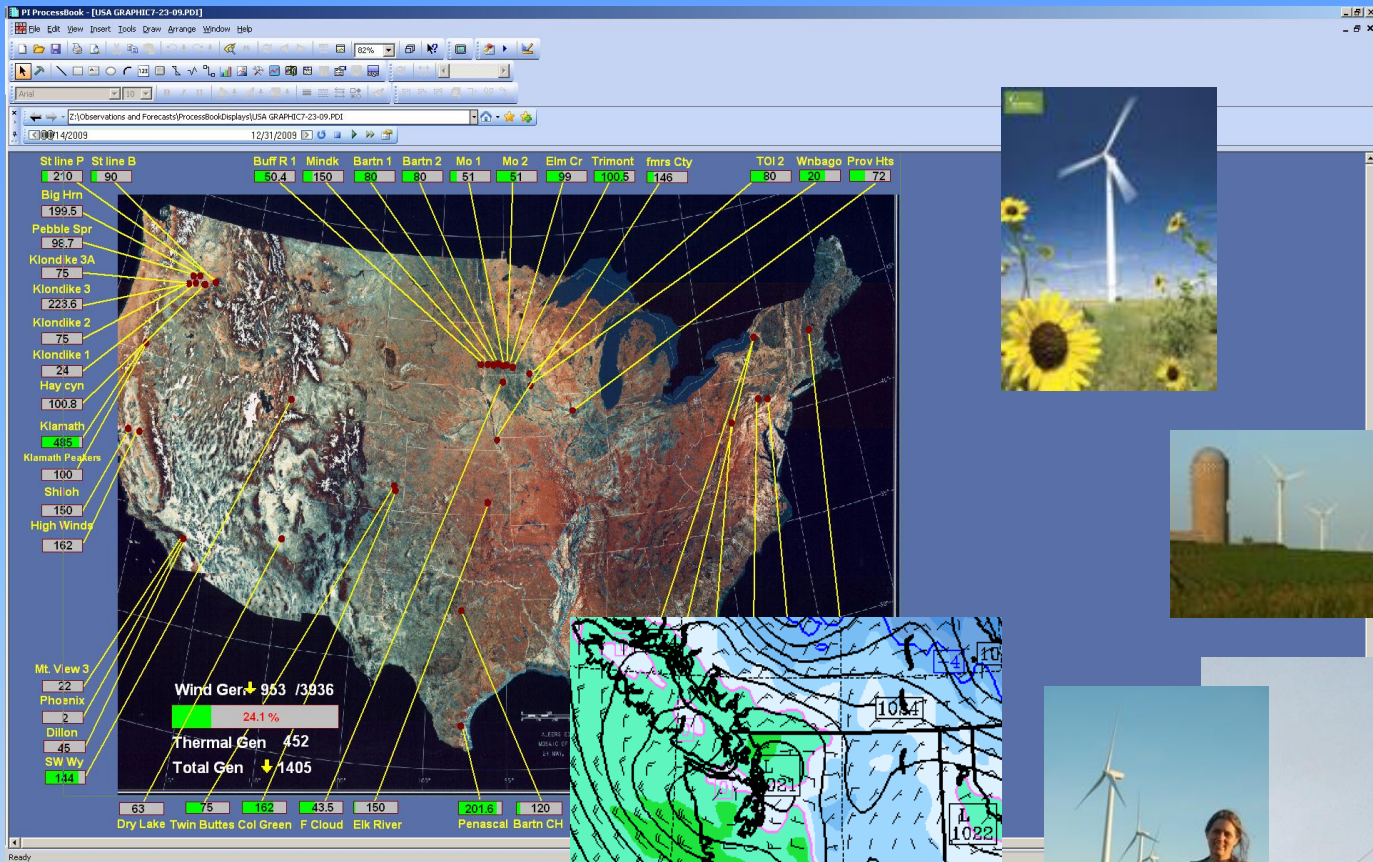
Careers for Meteorologists in the Wind Energy Industry

Activities

- Siting Projects
- Measurement
- Modeling
- Forecasting
- Applications
 - Engineering
 - Environmental
 - Financial
 - Regulatory
- Research
- On Land & Offshore



Clean energy will be one of the fastest growing industries.



Iberdrola Renewables

How much damage would a historical hurricane cause if it struck today?

Welcome to the ICAT Damage Estimator website!

View an introductory video about how to use this site.



View the Top 10 damaging storms based on Current Damage in 2009.

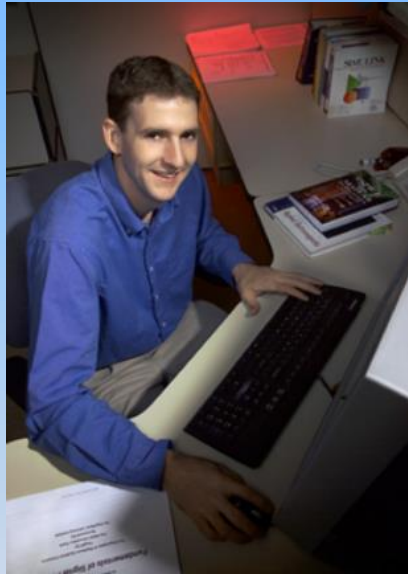


No thanks, just take me to the site.

☐ Do NOT display this screen again.

<http://www.icatdamageestimator.com/>

Why Work in the Private Sector?



- **Growth Opportunities**
- **Technology Employment**
- **Long-Term Pay/Benefits**
- **Unique/Diverse Job Challenges**
- **Innovative Mentors**



Selected Customers

Internet



Television



Advertising



Wireless



Newspapers



Business Services



Meteorologists work at AccuWeather:

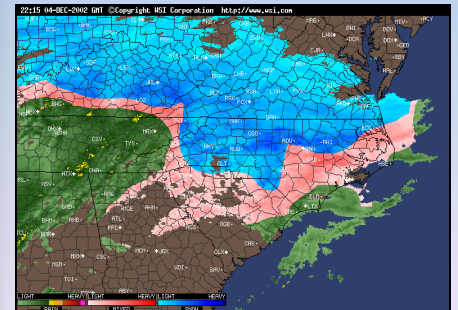
- Operational Forecasting
- Innovation and Development
- Information Technology and Programming
- Sales and Marketing
- Management and Business Administration
- QA, System and Client Support

Meteorologists work at AccuWeather:

- Operational Forecasting (offices in State College, PA and Wichita, KS)
 - Forecasts/warnings for business/government/institutions
 - Radio and video broadcasting
 - Newspapers
 - Graphics
 - News content and reporting
 - Television Briefings
 - Long range/energy forecasting

Weather Services International

- Located in Andover, MA
- Europe office in Birmingham, UK
- Operations Center is staffed 24/7 by degreed meteorologists



Private Industry - WSI

- **Many options for employment**
 - Meteorological Operations
 - Forecasting: Aviation, Energy, Agricultural
 - Media/Broadcast
 - Weather-Based Tech Jobs: Software/Systems Engineers, Customer Support, IT, Quality Assurance, Programming...
- **Able to move around within one company**
 - Good for those who want to settle down in one area rather than moving from state to state chasing jobs.
- **Tons of weather data at your fingertips!**
 - 5-minute Nexrad data; global satellite imagery; global surface obs; model data; live lightning feeds; global volcanic reports; solar alerts, etc.
- **Opportunity to forecast all types of weather all over the world!**
 - Severe, tropical, winter, etc.
 - Not just for the US, but South America, Europe, Asia, Africa, and Australia as well.



UNIVERSITY CORPORATION FOR ATMOSPHERIC RESEARCH (UCAR)

Undergraduate summer internships

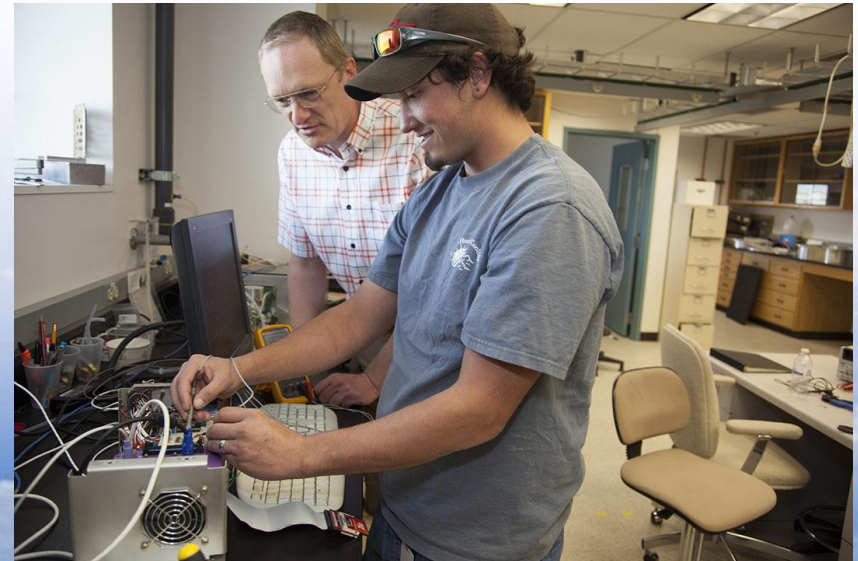
- Climate, weather, related environmental and social science
- Computer science and applied mathematics
- Engineering & technology for observing systems
- The Sun-Earth connection
- Career possibilities (one-week Undergraduate Leadership Workshop)

www2.ucar.edu/opportunities/undergrad



For example:

- Summer Undergraduate Program for Engineering Research (SUPER)
- For electrical, mechanical, optical, aerospace, software engineering majors
- Mentored by engineers and technicians in NCAR's Earth Observing Laboratory
- Real-world problems
- Hands-on experience with scientific instrumentation



•Graduate fellowships

- 3- to 12-month visits in pursuit of thesis research with NCAR's Advanced Study Program

—www2.ucar.edu/opportunities/grads



Postdocs

- Advanced Study Program
- Visiting Scientist Programs
- Project-focused fellowships at NCAR

www2.ucar.edu/opportunities/postdocs



Workshops

- Across the broad range of NCAR & UCAR activities, for example:
 - Community models (CESM, WRF)
 - User workshops (Unidata, COSMIC)

–www2.ucar.edu/opportunities/workshops

Sabbaticals, Visitor Exchanges

- ASP Faculty Fellowship
- UVisit
- Visitor programs in each NCAR Lab
- Early-career scientist activities

www2.ucar.edu/opportunities/professionals

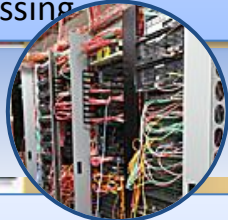


Earth Resources Technology



Science and Technology Support

- Science data systems, standards, and data management
- Scientific algorithm development
- Modeling, data assimilation and visualization
- Big data, data analysis and post-processing



Information Technology Support

- Architecture design and development
- Cloud email, IT security
- Software & Web architectures, design, and development
- Sys admin & data center support
- Infrastructure management



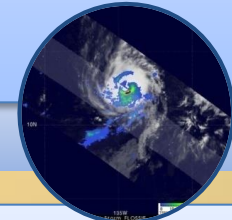
Excellent Performance on over 30 prime contracts

- Successful management of large and small subcontractors
- EVMS and Performance-Based contracting experience
- Successful transitions with high retention (98%) and no disruption – 9 contracts, 200+ staff and 70+ tasks in a two-year period
- Strong portfolio in science and engineering/IT support



Environmental Services

- Environmental Conservation
- Environmental compliance, pollution prevention and sustainability
- Environmental Restoration
- Geophysical and hydrographic survey



Engineering Support

- Full System Life Cycle Systems Analysis
- System, Electrical, Mechanical and RF Engineering
- Field Deployment and Maintenance Support
- System integration and testing

ERT's technical and management maturity are ready for successful performance

Private Forecasting – Marine Sector

Industries Supported:

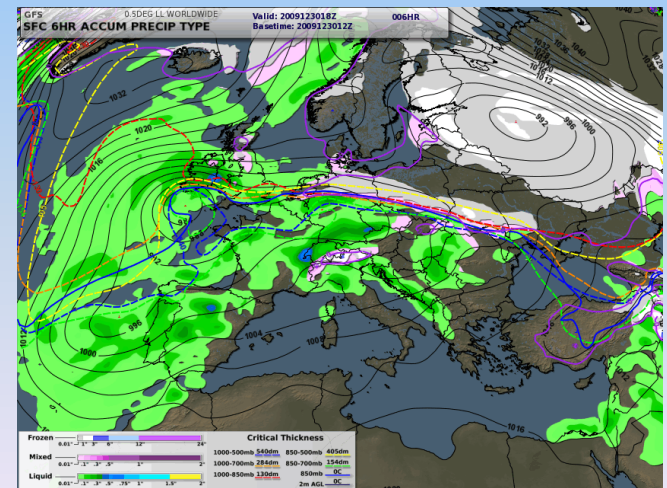
- Offshore Oil & Gas
- Marine Construction (Pipelines, Cable Lay, Dredging, Instrumentation, etc)
- Shipping & Cargo Transport
- Recreational & Commercial Fishing
- Yachts and Cruise Lines
- Marine Engineering
- Military & Government
- Companies/facilities affected by tropical weather (worldwide)



Private Forecasting – Marine Sector

Advantages of working in private sector - marine forecasting:

- Frequent employment openings for entry level forecasters
- Worldwide weather forecasting (all continents and ocean basins) including tropical weather – not just US
- Trained heavily on global weather patterns: specifically synoptic and tropical weather prediction in its application to marine interests
- Future career positions with oil companies (“metocean” departments), consulting firms, NWS, NOAA, NHC, and of course higher management in marine forecast companies
- Onsite work (offshore on rigs, vessels)
- Direct consultation with clients on how the weather forecast will affect the specifics of an operation



Private Forecasting – Marine Sector

Companies who directly hire marine meteorologists:

- Wilkens Weather Technologies
- Impact Weather
- WeatherNews
- Meteoconsult
- UK Met Office
- Aerospace & Marine International
- Oceanweather, Inc.
- Fugro GEOS
- Oil Companies & Consultation Firms

Vaisala--A global leader in environmental and industrial measurement

- Building on more than 70 years of experience, Vaisala provides a comprehensive range of observation and measurement products and services for meteorology, weather critical operations and controlled environments.
- The Vaisala Group
 - 1300 employees worldwide
 - 27 offices worldwide
 - Net sales of 242.5 MEUR in 2008 (340 MUSD)
 - Main markets Europe (35%), North America (28%) and Asia Pacific (32%)
 - Vaisala products used in over 120 countries
 - A-series shares quoted in NASDAQ OMX Helsinki



Research and Development

- Research and development activities are a key prerequisite for the success of the Vaisala Group.
- The R&D expenditure is over 10% of net sales
- In addition to internal research activities Vaisala
 - partners with leading research organizations (e.g. NOAA, Colorado State University)
 - supports meteorological programs and studies
 - supports student research internships and fellowships.

www.vaisala.com



Meteorology, Atmospheric Science, & Communications in Antarctica

Raytheon

Customer Success Is Our Mission

Simulated NPOESS Orbit
Satellite Approaching McMurdo
Green Dots – Upper Air Stations

Satellite Position

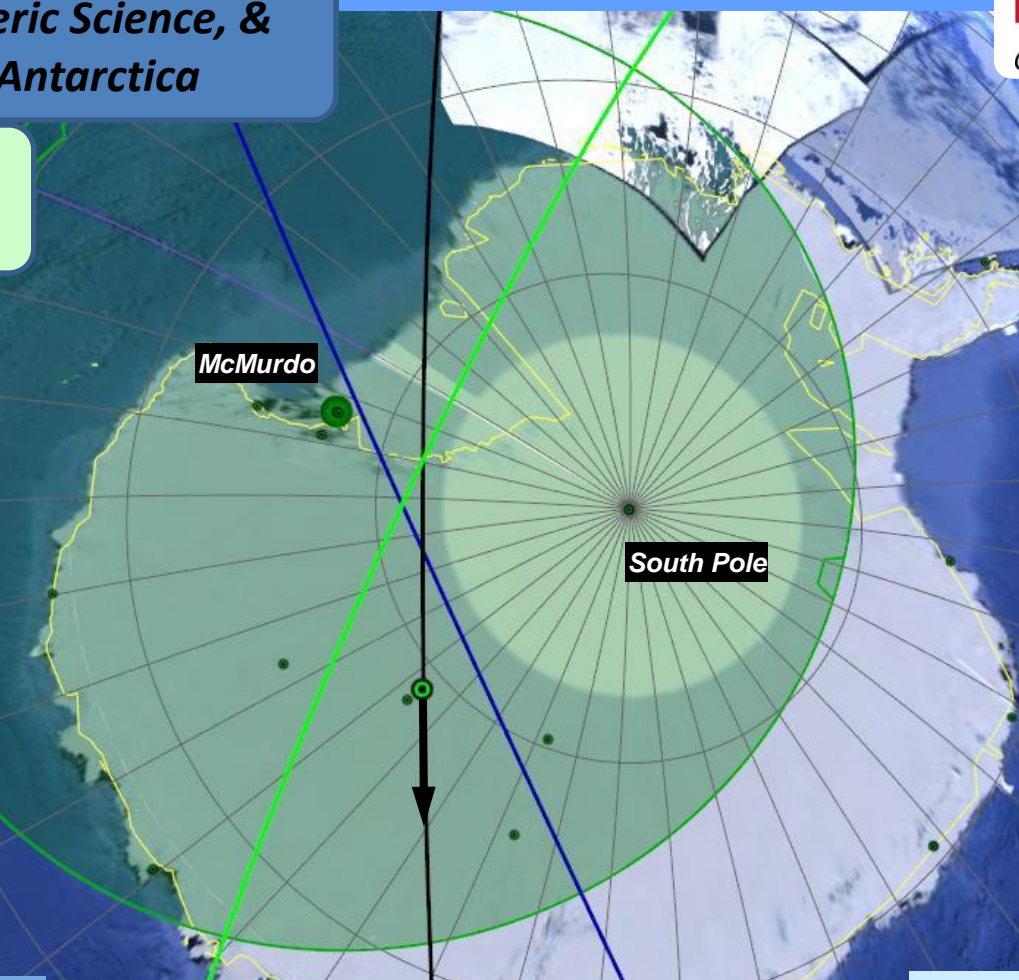
Time	Lat	Lon	Alt
18:39	-79.19	106.54	730.9

Position From McMurdo Fines

Az	El	Range
234.57	22.43	1539.1

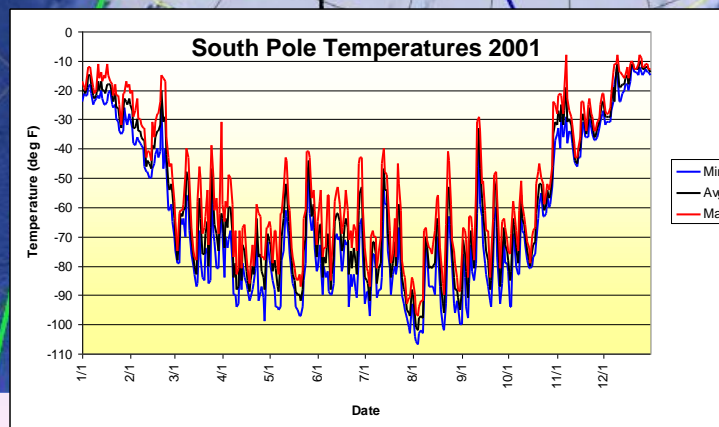
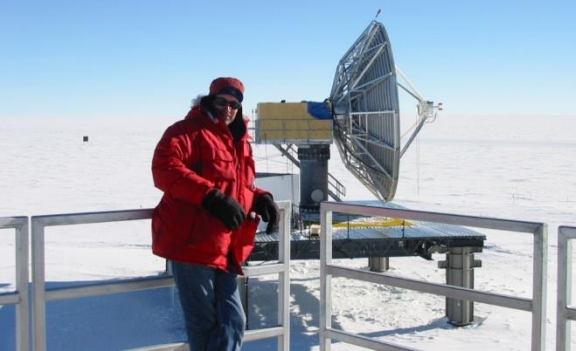
Upper Air Obs Summary

WMO Block #	No. of Obs
80-88	148
89	24
91	54
93	16
94	66



**Rawinsonde Launch
South Pole**

**South Pole MARISAT GOES Terminal
Communications Engineering**



Practical Application of Venturi Effect
New South Pole Station upwind bevel
increases wind under station
minimizing snow accumulation



FULLY INTEGRATED SOLUTION

DETECTION



Baron Radar

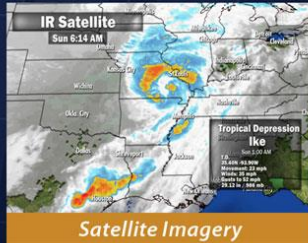


Legacy Radar



Lightning

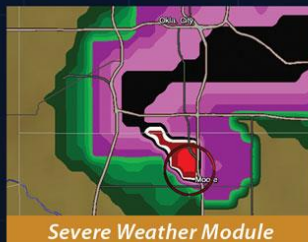
DATA PROCESSING



Satellite Imagery

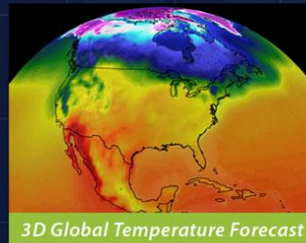


Predictive Storm Movement

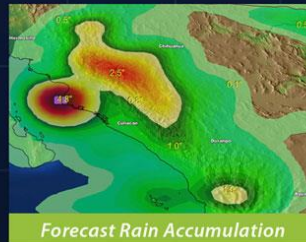


Severe Weather Module

DYNAMIC MODELING



3D Global Temperature Forecast



Forecast Rain Accumulation



Air Quality

DISPLAY INTEGRATION



Live VIPIR



2D Storm Tracking



Temperature Forecast

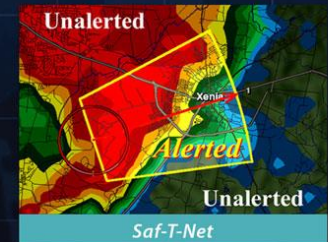
DISSEMINATION



Mobile Threat Net



Threat Net Plus



Saf-T-Net

Baron Services

LI-COR®

Biosciences

Measuring Change in a Changing World™

Scientists enabling
Scientists.
World-Wide Research.
Making an Impact.



CO₂/H₂O Analyzers

A complete line of gas analyzers for
CO₂ and H₂O gas measurements.
Maximum flexibility without
compromising measurement accuracy.

LI-7700 Open Path CH₄ Analyzer

Designed for Remote Field Deployment
and for Eddy Covariance Measurements



LI-COR has been
designing and
developing, high-
precision, scientific
instrumentation for
over 38 years.



Careers @ LI-COR
Seeking talented people
for exciting careers

Light Measurement

- Quantum (PAR) Sensors
 - Terrestrial
 - Underwater
- Pyranometer Sensors
 - Solar Radiation
- Photometric Sensors
 - Architectural Studies
- Datalogger
- Light Meter





Weather Impact on Primary Energy Trading Commodities

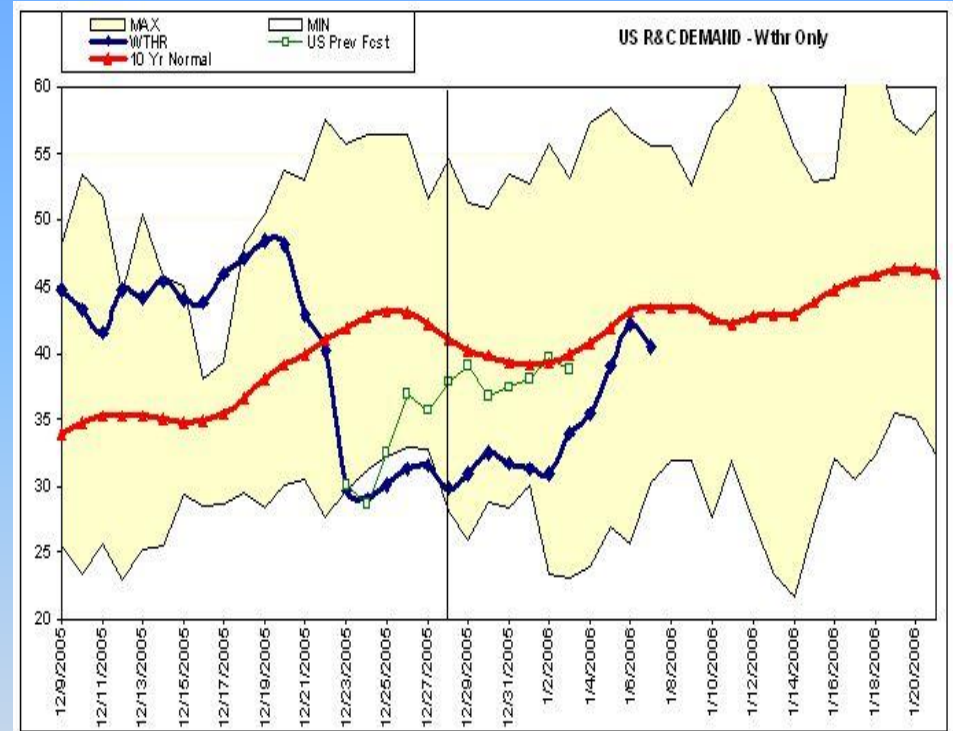
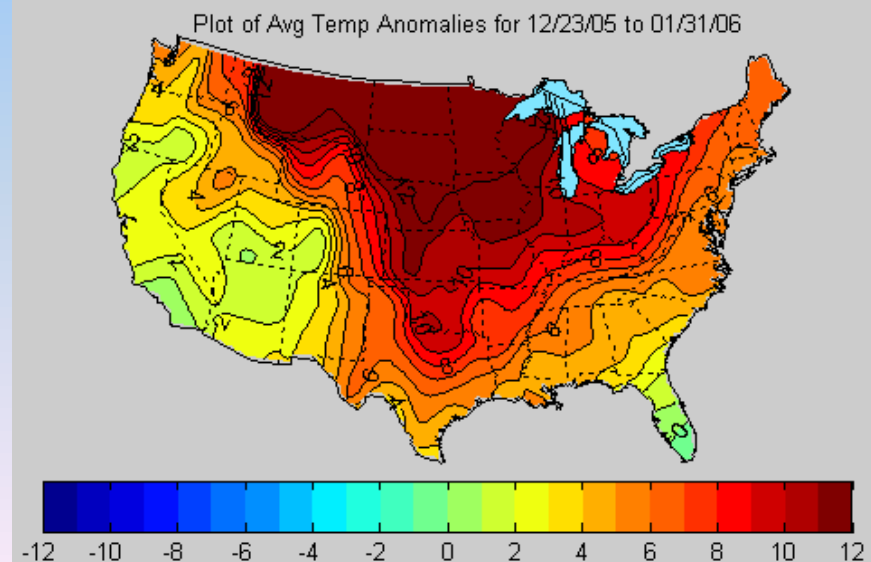
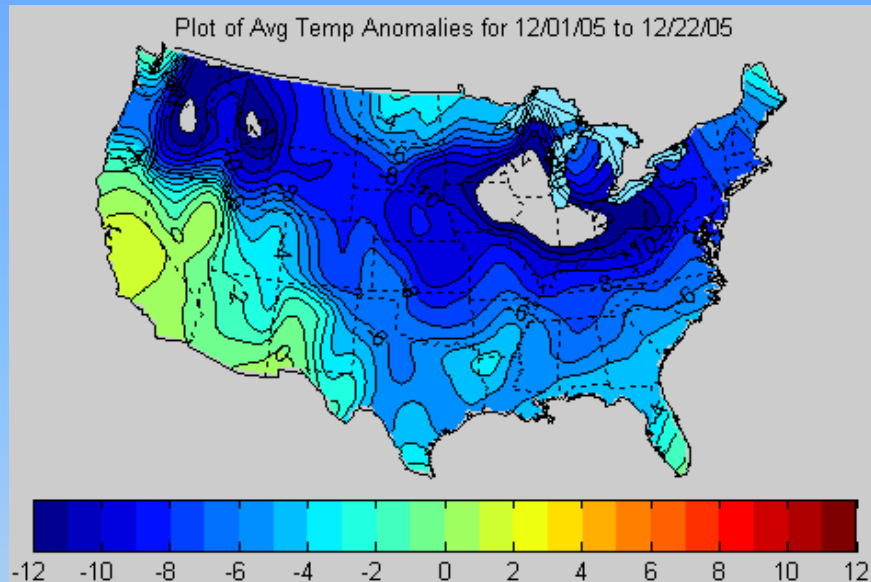
■ **Natural Gas (Crude Oil): NYMEX / OTC**

- Primary Weather Impact Variables:
 - » Extreme Temperatures – Particularly **COLD** Weather
 - » Tropical Cyclones – Primarily affecting the Gulf of Mexico

■ **Power: OTC**

- Primary Weather Impact Variables:
 - » Extreme Temperatures – Particularly **HOT** Weather
 - » Tropical Cyclones – Affecting All Regions Including Gulf

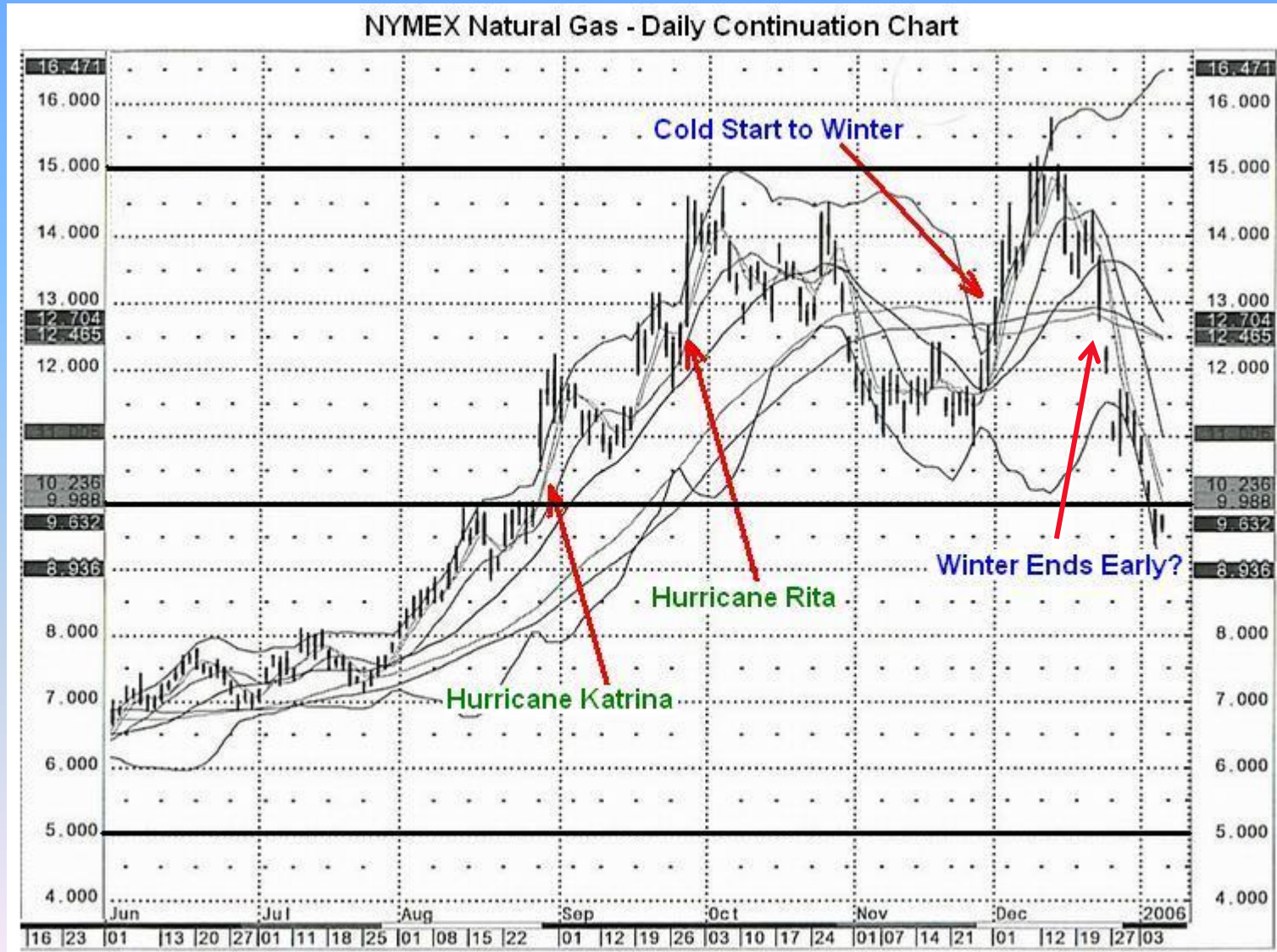
Energy Impacts – Forecast / Model Flip



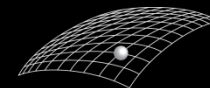
Significantly **warmer** (less energy demand) forecast post Christmas 2005 resulted in a major price move in U.S. Natural Gas price.

NYMEX Natural Gas Prompt Month Price Chart

June 2004 – January 2006



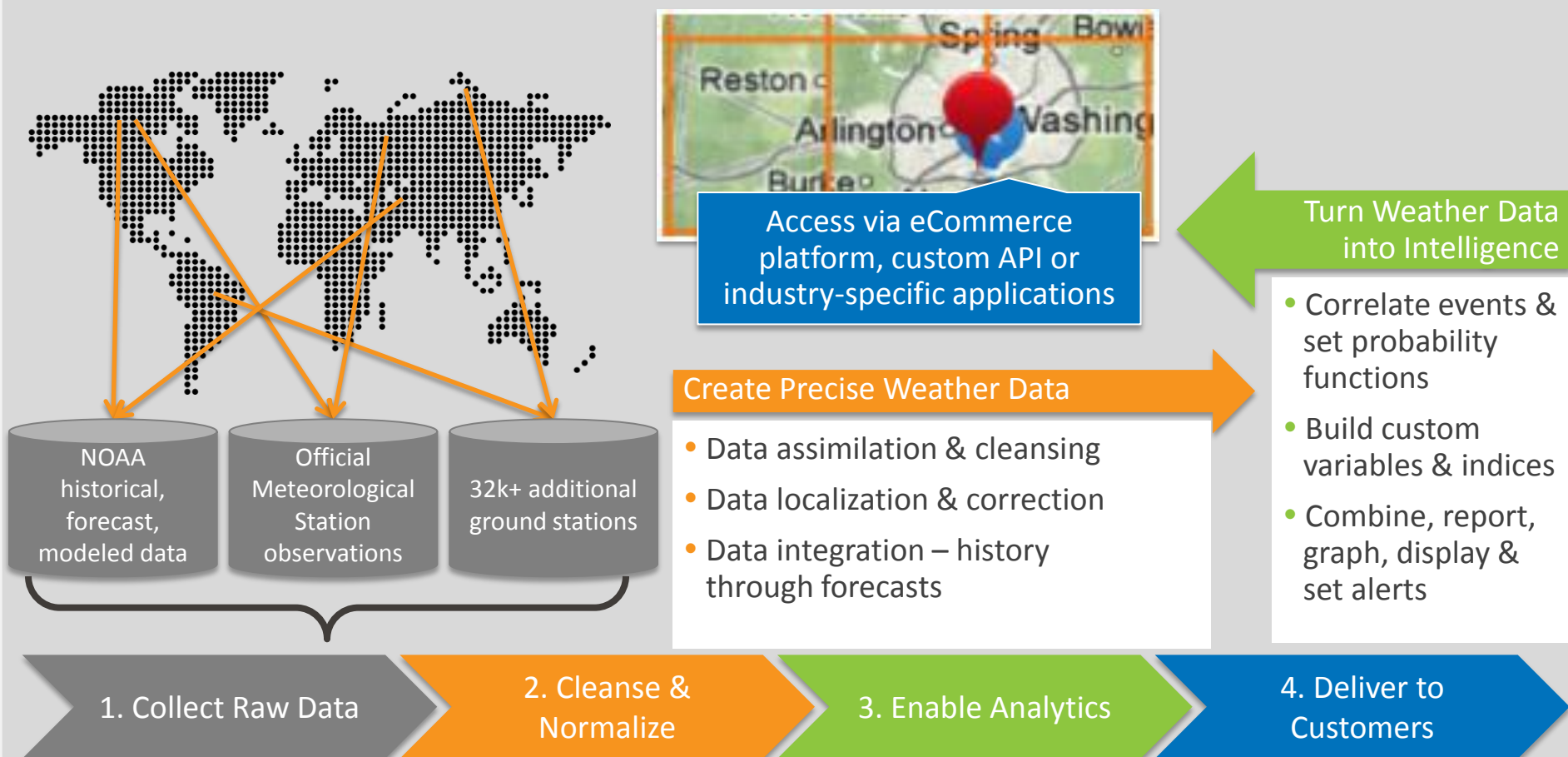
Weather Analytics



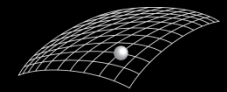
Weather Analytics™
Precise Global Intelligence

- Who we are
 - Team of meteorologists, programmers, business people who solve tough weather related problems
 - A gap free, global database of historical, current and forecasted weather content
 - An online database of 500+ variables that couples weather information with proprietary analytics
- How we do it
 - Aggregate 33 years of historical content (CFSR)
 - Supplement with world-wide surface observations
 - Cleanse, rationalize & filter data for quality assurance
 - Ensure statistical stability
 - Fuse ground-station data with remote-sensing & modeled data

HOW WEATHER ANALYTICS DELIVERS

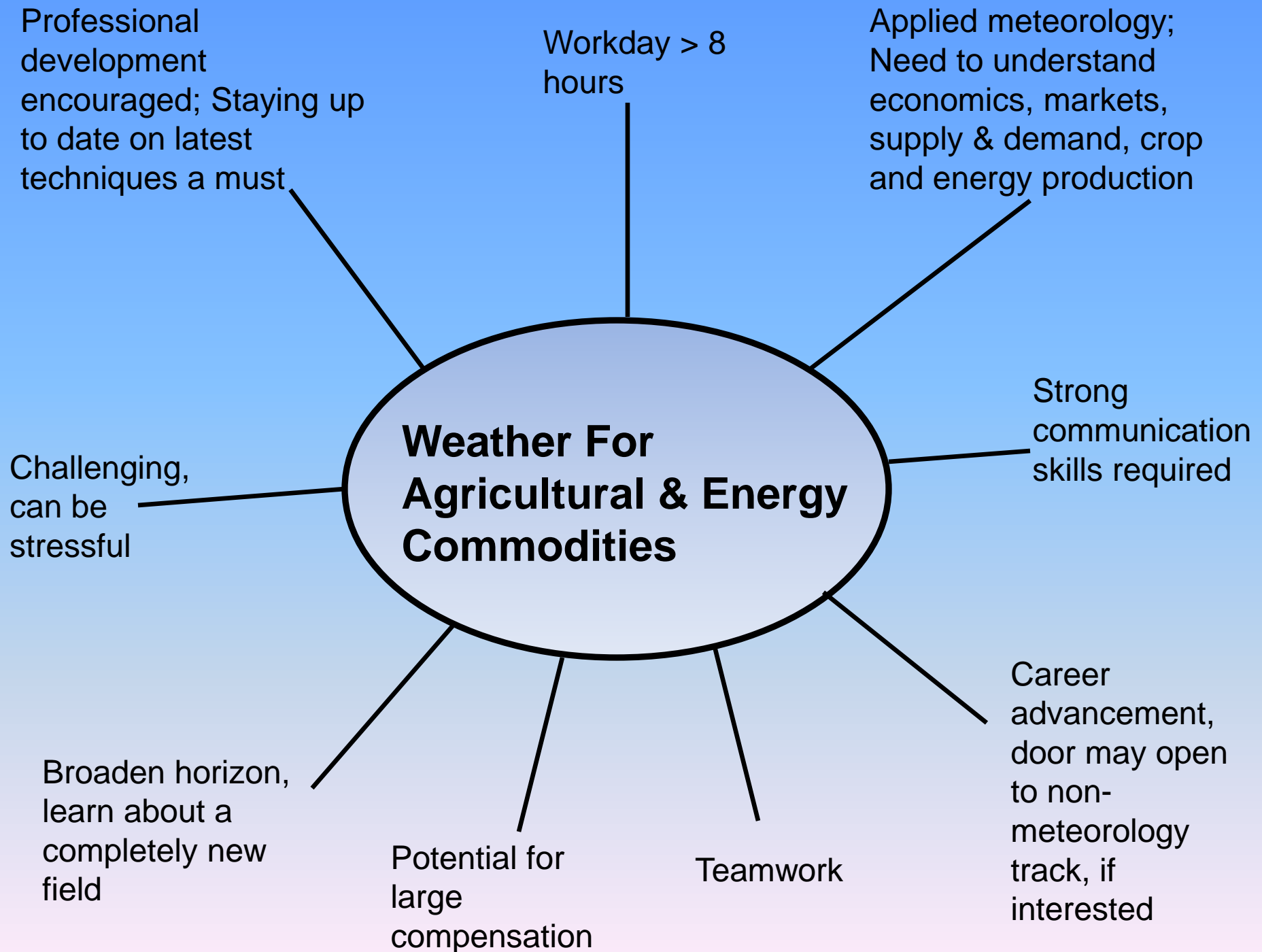


Weather Analytics



Weather Analytics™
Precise Global Intelligence

- We help customers by
 - Validating insurance claims
 - Improving insurance underwriting decisions
 - Forecasting energy consumption and crop productivity
 - Mapping more cost-effective transportation routes and construction sites
 - Predicting consumer buying behaviors
- Join our team
 - Listings at:
<http://weatheranalytics.com>
- We look for:
 - Degree in weather
 - Strong IT skills: programming and data manipulation
 - Ability to work in small teams with varied talents
 - Hire 2-4 young professionals per year



WEATHER RISK MANAGEMENT = METEOROLOGY + FINANCE



What is weather risk management?

- Weather risk management is concerned with mitigating the financial impact of weather events on businesses, municipalities, and society.

Why is it important?

- The U.S. Department of Energy estimates that \$1 trillion of the global economy is exposed to weather risk.
- Climate change could increase the frequency of extreme weather events.

Who is Nephila?

- Nephila Capital is the leading investment firm that is dedicated solely to providing insurance against weather risk.

Which skills are needed?

- Atmospheric: synoptic meteorology, forecasting, climate science
- Quantitative: math, data analysis, programming
- Financial: investments, risk management, corporate finance

A Day in the Life....

- 6:30: Board ferry; catch up on news/e-mails
- 7-8: Plan day's activities w/ colleagues; check latest short- and long-term weather forecasts
- 8-11: Gather snowfall data and structure a weather insurance product for a U.S. ski resort
- 11-12: Weekly investment meeting to reassess insurance contracts sold-to-date and likelihood of making payments
- 12-12:30: Lunch; catch up on market news
- 12:30-1: Phone call with insurance broker to discuss a European utility's need for insurance against a warm winter
- 1-2:30: Finalize presentation for upcoming renewable energy conference
- 2:30-4:30: Create monthly risk report for our investors
- 4:30-5:30: Read journal article on impact of climate change on drought frequency and severity
- 5:30: Board ferry for home

CASE STUDY: U.S. SKI RESORT

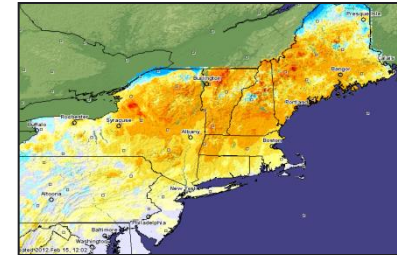
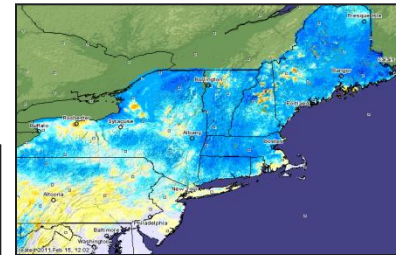


How does snowfall insurance work?

- Lower-than-normal snowfall during winter decreases sales of ski goods/passes and increases cost of snow making.
- A customized weather insurance product can be structured to mitigate this risk.
- When snowfall is **high**, the ski resort experiences **good** financial performance which offsets the premium paid to the insurer for coverage.
- When snowfall is **low**, the ski resort experiences **bad** financial performance which is offset by the insurance policy payments received from the insurer.



Snow Depth Departure from Normal
In mid-Feb 2011 (left) and mid-Feb 2012 (right)



Insurance Contract Terms

Weather Index	Cumulative snowfall
Risk Period	Oct 1 – April 30
Snowfall Trigger	20 inches
Payment per inch below trigger	\$500,000 / inch
Maximum payment amount	\$10,000,000

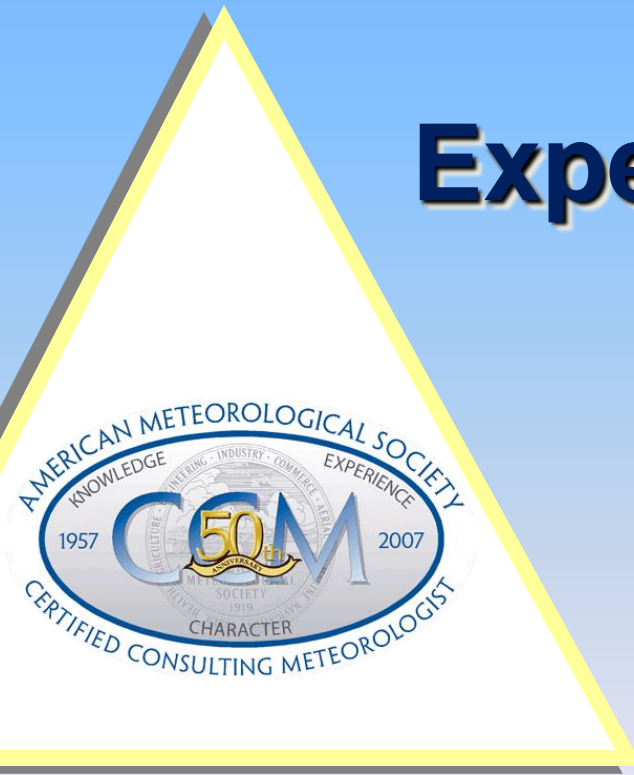
What are the Basic Qualities of a CCM?

Knowledge

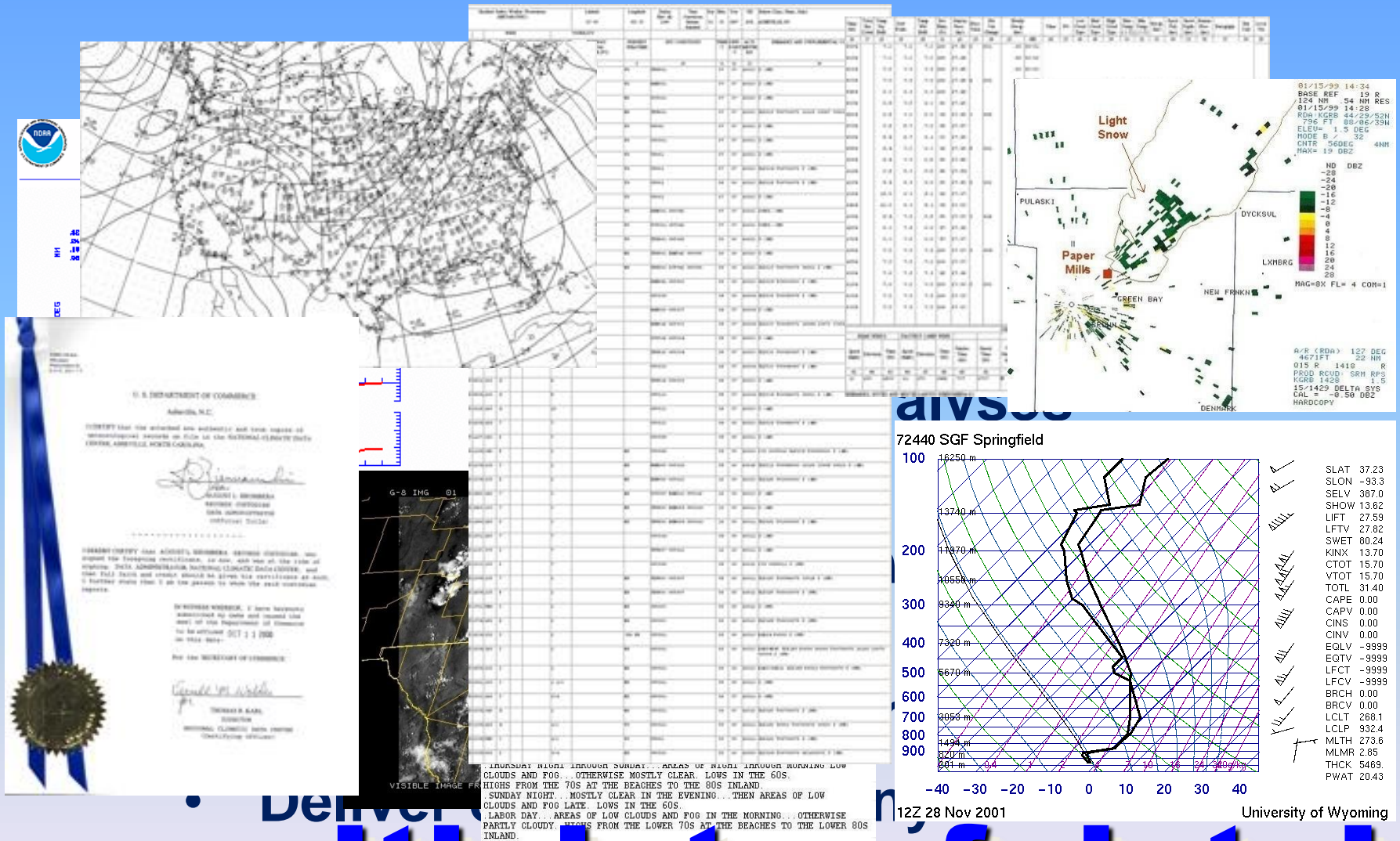
Experience

They assist the court in the search for the truth by presenting the most accurate description possible of the meteorological events pertinent to the case in litigation.

Character



How Do CCMs Get to the “Truth”?



...with lots of data!

CCM Job Diversity

- Litigation Proceedings
 - ❖ Criminal
 - ❖ Civil
- Investigations
 - ❖ Insurance
 - ❖ Environmental Impact Assessment

Personal Injury

- Hourly temperatures
- Snow and ice accumulation
- Visibility
- High Winds



Property Damage

- Wind data
- Rainfall records
- Thunderstorms
- Hail
- Lightning



Construction Delays

- Heavy rainfall
- Flooding
- Temperature
- High Winds



Criminal Cases

- Pan Am Flight 103 Trial (2000)
- Oklahoma City Bombing Trial of Timothy McVeigh (1997)
- William Kennedy Smith Rape Trial (1991)
- O.J. Simpson Murder Trial (1995)
- Clay Shaw Trial for Conspiracy to Assassinate President John F. Kennedy (1969)

AMS Mentorship Program

[http://www.ametsoc.org/boardpges/
bpsm/mentorprogrambrochure.pdf](http://www.ametsoc.org/boardpges/bpsm/mentorprogrambrochure.pdf)

Final Thoughts

- Pursue excellence in everything you do
- Follow your heart and your passion
- Build positive and long-term relationships
- Don't forget to help those who follow you

“Though one may be overpowered, two can defend themselves. A cord of three strands is not quickly broken.”

I welcome follow-up discussions with you!

ken.carey@ertcorp.com
301-323-1397