Unlimited Opportunities for Private Sector Meteorologists

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

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“A Meteorologist is one of the Top 50 Best Careers of 2013”
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
WHY BE A METEOROLOGIST?

Be a trusted source of weather information

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

- 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?

- What meteorological phenomena caused the power output to fluctuate so greatly?

- 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.
<table>
<thead>
<tr>
<th>Location</th>
<th>Wind Speed (m/s)</th>
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<tbody>
<tr>
<td>K3A.PARK.TAVGWSP</td>
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</table>

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.

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
- abc NEWS
- CNN
- The New York Times
- GANNETT
- washingtonpost.com
- Irish Times
- Telegraph

Television
- at&t
- CBS
- Univision
- Fox
- DIRECTV

Newspapers
- The Wall Street Journal
- The Boston Globe
- advance.net
- Scripps
- The Washington Post

Advertising
- Scotts
- Ace
- Digitas
- Omnicom

Wireless
- NOKIA
- Connecting People
- verizonwireless
- Samsung
- T-Mobile

Business Services
- Disney
- Honda
- USDA
- Six Flags
- BlueCross BlueShield of Florida
- Symantec
- Lowe's
- Raytheon
- IBM
- BNSF

Advertising
- Google
- ExonMobil
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
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](http://www2.ucar.edu/opportunities/grads)

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**Postdocs**

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

  [www2.ucar.edu/opportunities/postdocs](http://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](http://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](http://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

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

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

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

Satellite Position

<table>
<thead>
<tr>
<th>Time</th>
<th>Lat</th>
<th>Lon</th>
<th>Alt</th>
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<tbody>
<tr>
<td>18:39</td>
<td>-79.19</td>
<td>106.54</td>
<td>730.9</td>
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Position From McMurdo Fines

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<tr>
<th>Az</th>
<th>El</th>
<th>Range</th>
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<td>234.57</td>
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Upper Air Obs Summary

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<th>No. of Obs</th>
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<td>80-88</td>
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<td>89</td>
<td>24</td>
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<td>91</td>
<td>54</td>
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<td>93</td>
<td>16</td>
</tr>
<tr>
<td>94</td>
<td>66</td>
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South Pole MARISAT GOES Terminal Communications Engineering

South Pole Temperatures 2001

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

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

LI-7700 Open Path CH₄ Analyzer

Designed for Remote Field Deployment and for Eddy Covariance Measurements

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
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

• 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

9/12/2013
www.weatheranalytics.com
HOW WEATHER ANALYTICS DELIVERS

1. Collect Raw Data
   - NOAA historical, forecast, modeled data
   - Official Meteorological Station observations
   - 32k+ additional ground stations

2. Cleanse & Normalize
   - Data assimilation & cleansing
   - Data localization & correction
   - Data integration – history through forecasts

3. Enable Analytics
   - Correlate events & set probability functions
   - Build custom variables & indices
   - Combine, report, graph, display & set alerts

4. Deliver to Customers
   - Access via eCommerce platform, custom API or industry-specific applications

Access via eCommerce platform, custom API or industry-specific applications

Turn Weather Data into Intelligence

- Correlate events & set probability functions
- Build custom variables & indices
- Combine, report, graph, display & set alerts

Create Precise Weather Data

1. Collect Raw Data
2. Cleanse & Normalize
3. Enable Analytics
4. Deliver to Customers
Weather Analytics

• 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

9/12/2013
Weather For Agricultural & Energy Commodities

- Broaden horizon, learn about a completely new field
- Applied meteorology; Need to understand economics, markets, supply & demand, crop and energy production
- Teamwork
- Potential for large compensation
- Career advancement, door may open to non-meteorology track, if interested
- Workday > 8 hours
- Challenging, can be stressful
- Strong communication skills required
- Professional development encouraged; Staying up to date on latest techniques a must
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: 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 201 (left) and mid-Feb 2012 (right)

Insurance Contract Terms

<table>
<thead>
<tr>
<th>Weather Index</th>
<th>Cumulative snowfall</th>
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<tbody>
<tr>
<td>Risk Period</td>
<td>Oct 1 – April 30</td>
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<tr>
<td>Snowfall Trigger</td>
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<tr>
<td>Payment per inch below trigger</td>
<td>$500,000 / inch</td>
</tr>
<tr>
<td>Maximum payment amount</td>
<td>$10,000,000</td>
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</table>
What are the Basic Qualities of a CCM?

Knowledge

Experience

Character

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.
How Do CCMs Get to the “Truth”? 

• Acquire and interpret data 
• Advise client on importance of weather 
• Prepare written report 
• Evaluate report or opinion of opposing expert 
• Perform specialized analyses 
• Produce visual aids for presentation 
• Deliver expert testimony 

...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

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