

## **Weather and Climate; Understanding the Basic Science: facilitated by Paul Belanger and Jim Keller**

This course will draw on selected DVD lectures from two of the Great Courses' series:

1. **Meteorology: An Introduction to the Wonders of the Weather and**
2. **The Science of Extreme Weather**

Each week will also include slides and enhanced explanations and discussion of key points.

Additionally, there will be a presentation of what controls climate and how man is affecting climate change – aka: Anthropogenic Global Warming (AGW) and why the burning of fossil fuels in the last century is perturbing our climate by our emissions of Green House Gases (GHGs).

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**1<sup>st</sup> DVD set: Meteorology: An Introduction to the Wonders of the Weather;**

<https://www.thegreatcourses.com/courses/meteorology-an-introduction-to-the-wonders-of-the-weather.html>

Famed physicist Richard Feynman once said, "Anyone who has been in a thunderstorm has enjoyed it, or has been frightened by it, or at least has had some emotion. And in those places in nature where we get an emotion, we find there is generally a corresponding complexity and mystery about it."

In the world of weather, you don't have to look far for that complexity, that mystery, or that heart-pounding emotion.

Consider, for example, the rushing Santa Ana winds that sweep into the Los Angeles basin with startling force. They descend from the cold heights of the mountains, yet they are dry and hot as any desert, bringing with them the smell of fire and parched summer days. What drives these powerful winds, and what is the source of their searing heat?

Or imagine that symbol of fierce prairie weather, the tornado. How do these intense swirling winds acquire their spin? And why do we find these twisting winds in the flat lands of the Midwest, but in few other places?

Pursuing the answers to questions like these is more than just an interesting intellectual exercise. Weather affects our lives each and every day, often determining where we can go and what we can do. But meteorology—the study of weather—is also a grand puzzle. From the swirling winds to the transformation of water vapor into clouds, each meteorological event is a tremendously complex interaction of forces and factors. To grasp the mystery of these phenomena is to understand a remarkably complex system and, ultimately, to gain a glimpse into the way all complex systems work.

In **Meteorology: An Introduction to the Wonders of the Weather**, you embark on a fascinating foray into this complex and enthralling field of study. In 24 engaging lectures, you explore the often surprising, always intriguing workings of the weather, guided by expert atmospheric scientist and Professor Robert G. Fovell. Bringing together geography, chemistry, physics, and other scientific disciplines, the study of weather offers insights into the world around you while also providing an opportunity to grasp the complex interactions that make up our world's climate.

### **A Complex Subject Made Accessible**

Why is it often cooler by the shore than it is inland? Why are there deserts in some regions and rainforests in others? What makes the sky blue, clouds white, and the setting sun red?

With Professor Fovell's guidance, you'll probe the reasons behind everyday phenomena and gain a comprehensive understanding of the dynamic relationships and physical laws that shape our planet's climate. Professor Fovell takes a practical approach to weather, providing explanations that draw on common sense and everyday experience to make intricate interactions clear and accessible.

The course opens with a series of lectures that introduce the fundamental concepts of meteorology:

- the structure of the atmosphere
- the physics of gases, liquids, and solids
- the impact of the Earth's shape and movement on weather
- the factors that drive winds and affect the ability of air to hold moisture
- the effect of solar radiation on the Earth and its atmosphere
- the processes that create clouds

In later lectures, you build on these fundamental concepts to develop a full understanding of large-scale weather events, such as tornadoes and hurricanes, and global climate patterns.

Along the way, Professor Fovell brings these concepts to life with concrete demonstrations, illustrative examples, and compelling videos and images. With each explanation, Professor Fovell describes these complicated phenomena in down-to-earth, easy-to-understand terms to create an accessible picture of the Earth's weather.

### **Probing Weather's Mysteries**

As you build your knowledge of how weather works, you'll delve into remarkable meteorological phenomena that offer a window into the mysterious force of nature. With Professor Fovell's lucid commentary, you'll grow to appreciate the complex patterns that create the weather around us.

You'll learn, for example, how hurricanes are the result of complex but comprehensible forces that can be mapped, studied, and understood. The extreme weather of El Niño, the towering swirl of the cyclone, the crash of thunder that follows the lightning—each mystery is unveiled as you investigate the science behind these remarkable phenomena.

You'll also encounter a treasure trove of intriguing and often surprising facts and insights, including these fascinating tidbits:

- To the casual observer, lightning appears to be one quick stroke from cloud to ground, but a typical lightning stroke actually has four parts—two strokes down, two up—and the upward strokes pack the biggest punch.
- Our perception of "dry" and "moist" does not reflect the actual amount of moisture in the air. There may be more water vapor contained in the air on a hot, dry, early summer day in Death Valley than on a cold, foggy, winter day in Minnesota.
- Although the build-up of greenhouse gases in our atmosphere could have deleterious effects on the world's climate, if the atmosphere contained no greenhouse gases, the Earth's surface would likely be frozen everywhere, including in the tropics.
- One of the most influential impacts on the weather is that seething reservoir of energy, the ocean. Because of the ocean's movement, waters off the coast of California are much cooler than those at the same latitude off the coast of Asia.

## **An Intriguing Glimpse into the Meteorologist's Art**

With so many forces interacting, how do meteorologists make sense of the weather happening around us? How do they comprehend these patterns on a regional and global level? And how do they use their knowledge to forecast tomorrow's weather?

Professor Fovell sheds light on the art and science of meteorology, describing the tools scientists use to explain and predict the weather. You'll examine weather maps to see how meteorologists create a picture of conditions at any given moment and learn about advanced computer models that allow scientists to forecast how storms may develop over time. As you explore the meteorologist's art, you'll gain a deep appreciation for the fascinating work done to try to explicate the ongoing mystery of the world's weather.

You'll find no better guide than Dr. Fovell. An experienced instructor and noted meteorological researcher, Professor Fovell provides a comprehensive introduction to this fascinating field. Using everyday examples, vivid demonstrations, and visual aids, Professor Fovell conveys his excitement about the intriguing puzzle of the natural world while making this complex topic accessible to all viewers.

Join Professor Fovell as he explicates one of nature's most compelling mysteries. Guided by his expertise, you'll never look at the weather in the same way again.

[Hide Full Description](#)

**24 lectures** | 30 minutes each

- 1 Nature Abhors Extremes
- 2 Temperature, Pressure, and Density
- 3 Atmosphere—Composition and Origin
- 4 Radiation and the Greenhouse Effect
- 5 Sphericity, Conduction, and Convection
- 6 Sea Breezes and Santa Anas
- 7 An Introduction to Atmospheric Moisture
- 8 Bringing Air to Saturation
- 9 Clouds, Stability, and Buoyancy, Part 1
- 10 Clouds, Stability, and Buoyancy, Part 2
- 11 Whence and Whither the Wind, Part 1
- 12 Whence and Whither the Wind, Part 2
- 13 The Global Atmospheric Circulation
- 14 Fronts and Extratropical Cyclones
- 15 Middle Troposphere—Troughs and Ridges

- 16 Wind Shear—Horizontal and Vertical
- 17 Mountain Influences on the Atmosphere
- 18 Thunderstorms, Squall Lines, and Radar
- 19 Supercells, Tornadoes, and Dry Lines
- 20 Ocean Influences on Weather and Climate
- 21 Tropical Cyclones
- 22 Light and Lightning
- 23 Prediction and Predictability
- 24 The Imperfect Forecast

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**2<sup>nd</sup> DVD set: The Science of Extreme Weather;** <https://www.thegreatcourses.com/courses/the-science-of-extreme-weather.html>

Extreme weather captures our attention, perhaps now more than ever. Great writers and artists have depicted it in powerful works such as Shakespeare’s *The Tempest* and Winslow Homer’s *The Gale*. Movies such as *The Perfect Storm*, *Twister*, and *The Day After Tomorrow* entertain—and terrify—us. Weather apps, websites, and TV channels alert us to our local weather around the clock and also warn us about severe weather.

And yet, we can’t control the weather. Indeed, its most extreme forms plunge us into a struggle for survival, in catastrophic events such as these:

In January 1888, a thaw on the Great Plains was followed by a sudden temperature drop and a blinding blizzard, trapping many children in one-room schoolhouses, miles from home, without adequate clothing. The “Children’s Blizzard” claimed 235 lives.

In July 1976, a typical afternoon thunderstorm in the Rocky Mountains lacked the usual wind shear to keep it moving. The result was a stationary deluge that initiated a flash flood in the Big Thompson River, killing 144 who could not outrun the rapidly rising water.

During just a few days in August 2005, Hurricane Katrina evolved from a cluster of ordinary storms into a monstrous hurricane that left more than 1,200 dead and ranks as America’s costliest natural disaster to date.

We may be helpless to prevent such weather, but thanks to an ongoing revolution in the science of meteorology, we can now understand how extreme weather conditions arise, extract far more useful information from forecasts, and know how to protect ourselves when dangerous conditions develop.

**The Science of Extreme Weather** is your field guide to the worst that Earth’s atmosphere can inflict. In 24 exciting, informative, and potentially life-saving half-hour lectures aimed at weather novices and amateur forecasters alike, you gain a surprisingly powerful tool in the face of such overwhelming forces: *knowledge*.

Guided by meteorologist, storm chaser, and award-winning teacher Eric R. Snodgrass of the University of Illinois at Urbana-Champaign, you learn the fundamental science that underlies blizzards, flash floods, hurricanes, tornadoes, heat waves, and more. Never again will you under- or overreact in the face of an emergency weather “watch” or “warning,” because you’ll understand the difference between the two, the nature of the impending threat, the reasoning behind the prediction, and the measures you need to take for protection.

### Think Like a Meteorologist

Illustrated with beautifully rendered graphics, stunning storm images, and entertaining demonstrations of meteorological principles, **The Science of Extreme Weather** teaches you to think like a meteorologist. In search of potentially life-threatening conditions, you learn to interpret clues in the sky and the significance of temperature, pressure, humidity, and wind direction and speed. Simple and practical forecasting rules, such as that falling air pressure signals stormy weather and rising air pressure heralds clear skies, will suddenly make perfect sense. You’ll also learn to decipher technical data, such as Doppler radar images, which provide velocity information on the motion of precipitation inside storms—like an X-ray into the shrouded birthplace of tornadoes.

In addition, you will be enlightened about widespread extreme weather myths, such as that lightning never strikes twice in the same place, or that a ditch or an underpass are safe refuges if you are caught in the open near a tornado (instead, stay in the car, where the seat belt and airbags will help protect you). And you will be alerted to some truly ominous warning signs, including these:

- **Lightning:** If you are ever outdoors in stormy weather and your skin starts to tingle and your hair stands on end, you are about to be struck by lightning. If you can’t take shelter immediately, then crouch down on the balls of your feet. Don’t run and don’t lie down.
- **Flooding:** Climb to higher ground instead of trying to outrun a flash flood—and never enter a flooded roadway. Six inches of swiftly moving water can sweep you off your feet. Two feet of floodwater can carry away a car. Even if the water doesn’t look too deep, the road could be eroding from beneath, making it prone to collapse under the weight of a vehicle.
- **Heat and humidity:** Heat-related fatalities may well be the deadliest form of weather on Earth. And when combined with high humidity, even seemingly bearable temperatures can kill, due to the body’s inability to cool off. Know the symptoms of heat exhaustion and heat stroke.

### Explore the World’s Wildest Weather

Raised in the heart of Tornado Alley, the region of the U.S. with by far the most tornadoes of anyplace on the planet, Professor Snodgrass has long been fascinated with the supercell thunderstorms that sweep across the plains, spawning tornadoes when a precise combination of meteorological factors coincides. This interest led him to become a scientist and storm chaser—a cautious stalker of extreme weather, using the tools of his discipline to decipher what makes dangerous storms form. Each year he leads more than 1,500 University of Illinois students through a course focused on severe and hazardous weather.

In **The Science of Extreme Weather**, this exuberant meteorologist and gifted educator takes you on a virtual expedition into the heart of the world’s wildest weather, investigating the mechanisms behind storms such as these:

- **Tornadoes, class EF5:** Tornado wind speeds can range from 65 mph to more than 200 mph. The Enhanced Fujita (EF) scale classifies the most destructive as EF5. Professor Snodgrass explains how tornadoes achieve such strength, highlighting the history of several of the deadliest.

- **Tropical cyclones:** A typical tornado is 100 feet wide, while a tropical cyclone (called a hurricane in the Atlantic and a typhoon in Japan) is hundreds of *miles* wide. Major Atlantic hurricanes are those in category 3, 4, or 5, with sustained winds of 111 to 157 mph or higher.
- **Lake-effect snowfalls:** The region downwind of the Great Lakes routinely experiences epic snowfalls, with a 2014 storm burying parts of Buffalo, N.Y., in 5 to 7 feet of snow over the course of several hours. Professor Snodgrass describes how cold air flowing over a relatively warm lake incited this paralyzing event.

All of these extremes, and many more that you learn about in this course, may make it seem that our planet is barely survivable. But as Professor Snodgrass points out, we thrive on Earth. Even as the population of the globe continues to increase, fewer and fewer people are dying from extreme weather. The credit goes to improved forecasting tools along with more accurate computer models that weigh the countless data points that represent the ever-changing atmosphere. As a result, it is rare for a severe weather event to catch meteorologists by surprise.

Extreme weather has another side: it is nature's way of restoring balance. For example, tropical cyclones in the Atlantic and Pacific are fundamental to Earth's energy and water budget. They act as a safety valve for high levels of temperature, moisture, and pressure that would become much worse without such storms. After watching **The Science of Extreme Weather**, you'll come away with newfound appreciation and respect for the atmosphere's most awe-inspiring phenomena.

## 24 lectures; 32 minutes each

- 1 Extreme Weather Is Everywhere
- 2 Temperature Extremes and Cold-Air Outbreaks
- 3 Low Pressure and Earth's High Winds
- 4 Extreme Humidity, Rain, and Fog
- 5 How Radar Reveals Storms
- 6 How Satellites Track Severe Weather
- 7 Anatomy of a Lightning Strike
- 8 Lightning Extremes and Survival
- 9 Thunderstorm Formation and Weather Balloons
- 10 Wind Shear and Severe Thunderstorms
- 11 Squall Line Thunderstorms and Microbursts
- 12 Supercell Thunderstorms and Hail
- 13 Tornadoes and Their Amazing Winds

- 14 Tornadoogenesis and Storm Chasing
- 15 Mountain Windstorms and Avalanches
- 16 Ice Storms: Freezing Rain Takes Over
- 17 Epic Snowfall and the Lake Effect
- 18 Blizzards and Winter Cyclones
- 19 Flash Floods and Deadly Moving Water
- 20 Drought, Heat Waves, and Dust Storms
- 21 Where Hurricanes Hit
- 22 The Enormous Structure of a Hurricane
- 23 Storm Surge and Hurricane Intensification
- 24 El Niño and Cycles of Extreme Weather