

The Orthodox Fellowship of the Transfiguration

Myths and False Narratives about Global Climate Change

The Major Objections from Climate Deniers

by OFT
Santa Rosa, California

The Orthodox Church has been warning its members about climate change for over thirty years. Beginning with HAH Patriarch +Dimitrios in 1989, the Church has been concerned about this issue because of the moral, ethical and spiritual principles which mandate taking good care of God's creation. The Scriptures, the Saints and Church mothers and fathers emphasize this as well. Today human experience shows that storms are becoming stronger, average temperatures are increasing, dreadful forest fires are becoming more numerous, and ocean levels are rising. Climate scientists affirm all of this and provide detailed measurements that document the changes now taking place in the world's atmosphere and weather systems.

Nevertheless political and economic considerations intervene and deny the seriousness of climate change. This is the primary reason why such a wide variety of opinions and false information exists about climate change. One consequence of this misinformation, sometimes deliberately promoted by institutions whose financial interests are involved, is that a high level of distorted perspectives exist about climate change. This is why discussions in parishes sometimes begin with different assumptions about why climate change is taking place or how serious it is. This then results in a variety of perspectives. Because parishes lack a common grasp of facts, possess differences of perspective, and these opinion differences can cause discussions to spiral out of control.

As Orthodox Christians we strive to discern the truth about God, Jesus Christ and even the conditions that confront the Church and our life in society. Clearly there is a truth about this issue, but what is it? Our film ***THE FACE OF GOD: THE ORTHODOX CHURCH AND CLIMATE CHANGE*** begins the journey to an honest and accurate view of climate change. It seeks to define our vocation as protectors of God's handiwork. As Christians, alternative views are not a valid option or merely some secondary aspect of our Orthodox Christian journey. We must study to understand what is happening and take action to address what is degrading and corrupting God's good creation. See our introductory film at : www.FaceofGodfilm.com

To initiate our journey into an accurate and honest view about climate change, let us eliminate some of the falsehoods that have been perpetuated. Here are a few of the most common myths that deny or obscure climate change and our ancient responsibility to take good care of God's creation which is also our common home as long as we are in the world.

1. The climate has always changed.

Yes, the climate has changed throughout history, but scientists say the climate change we are now witnessing is happening more rapidly than any previous shift in climate. What makes this change so serious is that it is caused by human beings putting more heat-trapping greenhouse gases into the atmosphere. In particular, this means the burning of fossil fuels – coal, gas and oil.

Carbon dioxide, but also methane and several other gases, collectively called “Greenhouse gases,” are implicated in most of the climate changes in Earth’s past.

Whenever those gases have receded, the global climate became colder. Whenever they have increased, the global climate became warmer. When changes were massive and rapid (as they are today), the consequences for life on Earth become dire – in some cases causing mass extinctions. In all of the world’s major climate changes, they took place gradually over long lengths of geological time. The changes happening now are taking place rapidly and inside the lifetime of people now living.

According to climate scientists, global warming occurs when carbon dioxide (CO₂) and other greenhouse gases increase in the atmosphere. The nature of carbon dioxide is such that it holds onto heat and retains the warmth that might otherwise radiate out into space. Like a glassed in greenhouse, the warmth of the sun is retained and so the planet warms.

In the United States, the burning of fossil fuels, primarily to produce electricity or for transportation, is the largest source of heat-trapping pollution. Coal-burning power plants are by far the biggest polluters. The country’s second-largest source of carbon pollution is the transportation sector, which generates about 1.7 billion tons of CO₂ emissions a year.

Curbing dangerous climate change requires very deep cuts in emissions, plus a transition to the use of alternatives to fossil fuels. The good news is that we’ve started a turnaround: CO₂ emissions in the United States actually decreased from 2005 to 2014, thanks in part to new, energy-efficient technology and the use of cleaner fuels. And scientists continue to develop new ways to modernize power plants, generate cleaner electricity, and burn less gasoline while we drive. The challenge is to be sure these solutions are put to use and widely adopted.

The infographic videos below describe how the rise of CO₂ in the atmosphere (measured in parts per million) correlates with the Earth’s temperature and climate change.

How Greenhouse gases warm the earth

<https://www.youtube.com/watch?v=FkwnVZf5vWw>

The Greenhouse Effect and Global Warming

https://www.youtube.com/watch?v=d7Ci_EooW-k

Climate 101: Ozone Depletion | by the National Geographic Society

<https://www.youtube.com/watch?v=aU6pxSNDPhs>

2. Scientists disagree about the science of the climate crisis.

Actually, over 97% of genuine climate scientists say that climate change is happening now. If some disagreement, it comes from a tiny fraction of individuals who are not climate scientists.

Real climate scientists who check and verify their findings through published peer reviewed reports are virtually unanimous about the underlying data that supports information about global climate change and its origins by human activity.

The National Aeronautics and Space Administration (NASA) in the U.S. publishes the following statement about climate change:

“Multiple studies published in peer-reviewed scientific journals show that 97% or more of actively publishing climate scientists agree: “Climate-warming trends over the past century are extremely likely due to human activities. In addition, most of the leading scientific organizations worldwide have issued public statements endorsing this position.”

View the videos below for a spectrum of more detailed information from top scientists:

Dr. James Hansen: “Why I must speak out about climate change”

<https://www.youtube.com/watch?v=fWInyaMWBY8>

Dr. Michael E. Mann, “On The Impact Of Climate Change Denial”

<https://www.youtube.com/watch?v=idFgNP7L9XU>

Dr. Christiana Figueres, Architect of the 2015 Paris Climate Agreement, Interview

<https://www.youtube.com/watch?v=JyfYWvs4AsY>

Dr. Michael E. Mann, “On the Race to Save the World From Climate Change”

<https://www.youtube.com/watch?v=WFQrmOzHx24>

3. The average person can't do anything about such a big problem as global climate change

Climate change is the result of an overemphasis on fossil fuel energy, abuse of the land and forests, and generally on the consumer mentality. As a society we take too much of the world's resources and the planet cannot sustain our level of consumption.

We are witnessing the effects of a lifestyle that uses too much of the world's resources, too many fossil fuels, and that forgets to live within the capacity of the world's biological and ecological systems. As a human civilization, we are collectively creating an exhaust from our lifestyles that is harming and polluting the atmosphere of the planet.

Yes, one person's actions alone are not going to stop the climate emergency. But one person who repents of harmful actions can change his or her life and, in turn, influence others and the communities in which they live and work. We are all on this planet together and will have to cooperate to correct the errors in our social vision and behavior.

As an op ed in The New York Times reports, "One house with solar panels can lead to others in the neighborhood installing solar panels of their own. Likewise, we tend to conserve our electricity consumption when our utility bills tell us how our usage compares with our neighbors,"

Our present predicament is a call to repentance in how we design our lives. We each have to change how we choose to live. Ordinary people can take the lead in making corrections. Regular citizens can call their elected officials and make sure they're making decisions about energy and lifestyle in ways that help our world address climate change. Such actions can lead to changing the world much faster than we might think.

From National Geographic:

"Cars replaced horses within 15 years in many places. For thousands of years we got along without plastic, and then in a few decades it was everywhere. Throughout history, we've been both ingenious inventors and quick to adopt new technologies. With popular will and the right policies, we'll have no problem creating new energy and transportation infrastructures, goods made without toxins or carbon emissions, biodegradable plastic substitutes."

Yes, we can make the changes that are before us. It is simply a matter of priorities and recognition of the problem. These changes take place one person at a time. This is why the individual person is the critical foundation for the changes that are important for our world to make.

4. Why should I do anything? The financial markets will take care of the problem.

Free market capitalists believe that the market can solve all issues. But is this concept really true? Industrial capitalism, following the lead of the market, and promoting industrialism, mechanized agriculture and consumerism generally, has in less than 200 years, made the climate 1.2° F. hotter , and is certain to push it at least two degrees higher than the pre-industrial average by 2050.

It is true that many corporate leaders see the market as the ultimate expression of human rationality. They have believed the so-called “mechanism of the free market” would spur the correct allocation of resources to meet the Paris target of a two-degree cap. This is pure ideology following the economic philosophy of the all-knowing market which has over and over again been proved plain wrong.

HAH Ecumenical Patriarch Bartholomew has bluntly declared,

Climate change is ...closely related to our model of economic development. An economy that ignores human needs ...leads to exploitation of the natural environment” (HAH, June 5, 2018, Athens).

HB Russian Orthodox Patriarch Alexey II says something quite similar:

“Solutions to the environmental crisis are to be found in the human heart, not in the economy, technology or politics” (HB Alexey, Social Policy of the Russian Orthodox Church, Moscow, 2000).

Church leaders repeatedly warn us that the climate issue is every person’s issue.

“No single initiative or institution, no nation or corporation, neither science nor technology, are in a place to respond to the ecological crisis alone, without working closely together.... An economy that ignores human beings and human needs inevitably leads to an exploitation of the natural environment.

(HAH Ecumenical Patriarch Bartholomew, Athens, June 5, 2018).

In April of 2017, HAH Ecumenical Patriarch Bartholomew was invited to address the World Council of Churches meeting in Canberra, Australia. In the following statement he provides key insights about climate change.

The environmental crisis cannot be solved without a genuine conversion of human actions. In this sense, ecology is linked with economy. A society that does not care about the well-being of all human beings is a society, that mistreats God’s creation, is blasphemy. For this reason, the ecological challenge of our Churches is to awake the world to the irreversible destruction of God’s creation because of human sinful actions. The necessity of ecological education is not only a problem for our states, but should also be the problem of our Churches. ...

Scientific knowledge, supported by statistics and climatic models... has confirmed that the climate is changing because of human activities and that such change will prove disastrous for life on this planet...

As Rev. Deacon Sergei Kapral aptly states, “The Church knows. The Church knows very well what the [corrective] measures and actions should be,” (the film, “The Face of God,” 2020).

Unless we all perceive in our attitudes and actions, as in our deliberations and decisions, the faces of our own children – in the present and in future generations – then we shall continue to prolong and procrastinate the development of any solution; we shall persist in obstructing or restricting any implementation. ...

We strongly believe that churches cannot be indifferent to the suffering or abuse of children that exists in the world, particularly those who are wounded or refugees. Let us therefore develop ways to end violence against children and young people in our contemporary society. Let us promote better participation and integration of our children and youth in the worship and in the life of our churches. Let us make our children and youth aware of the responsibility of Christians in the environmental crisis and educate them to adopt adequate behavior and actions facing issues such as water and climate change.

Several conclusions:

A first lesson is that a healing of this problem requires everybody. All sectors of society must participate. This means all parishes and all parishioners are part of the grand solution to climate change. Everyone has a role to play in this global challenge.

Second, any presumption of a market-led initiative to solve climate change is utopian thinking. The market is only one part of the global panorama of systems and processes that humans have established to guide our interactions.

Third, Rebecca Henderson, Professor of Business Economics at the Harvard University School of Business, says is that unchecked capitalism destabilizes the environment and harms human health. She makes the case for companies to step up and help fix the climate crisis they're causing. In fact she bluntly says, “Business is screwed if we don't fix climate change.” And it is not the market mechanism that will save the day. “To save the climate, we have to reimagine capitalism.”

See her video statement on why business should fix capitalism as one step in fixing climate change.

https://www.youtube.com/watch?v=fua_rUk0zk0

A fourth conclusion surprises many parishioners, even clergy. In the Book of Revelation, just as in the Gospel of Matthew, there is a scenario of the Last Judgement. The Apostle John, guided by the Angel of Inspiration, reports that the prophets and the saints and even the little people who fear the Lord find their reward, but he adds, “those who destroy the earth, God will destroy” (Rev. 11:18). This should be good incentive for all Orthodox Christians to avoid being destroyers and become part of the great team that works to preserve and protect God’s good creation.

So why the difference in these two accounts? It's a mercy. It's like a second chance. If a person failed to discern Christ in his or her neighbor, then what did you do to the earth?

5. Orthodox Christians should worry more about other important issues, but not climate change and science.

The history of Christian caring for God's creation goes back millennia, dating all the way back to the creation story in the Book of Genesis. The Bible is a strong and frequent voice for care of the earth. The Scriptures repeatedly call believers into care of God's earth.

Throughout the Church's long history, countless saints and theologians have recognized that it is our duty to care for God's creation.

In our day, Orthodox patriarchs and hierarchs across all jurisdictions are unanimous in their commentary about the importance of taking good care of God's creation.

This is not just a European issue as some have suggested. Across the United States and through all Orthodox jurisdictions, clear and vigorous agreement exists about the need to address global climate change.

Why is this? It is because climate change has a monstrous capability to disrupt the ecological support systems of the planet and society, harm the health and wellbeing of young and old alike, drastically increase mortality (the death rate), and possibly even bring a collapse to the biological systems upon which human life depends, and then to civilization itself.

The Orthodox Bishops during the period between 2004 and 2007 intently studied this problem in the Moral and Ethics committee of what was previously called SCOBA (the Standing Conference of the Canonical Orthodox Bishops of America). After three years of study, presentations and dialogue, they developed a formal declaration about climate change.

6. The Bible clearly states in Genesis 1:28 that humans are given “dominion” over the earth. This gives us the right to do with the world as we see fit.

That is a Protestant misreading of the Bible and specifically the concept of dominion.

Genesis 1:28 reads, “God said unto them, ‘Be fruitful and multiply, and replenish the earth, and subdue it; and have dominion over the fish of the sea, and over the fowl of the air, and over every living thing that moveth upon the earth.’”

What does “have dominion” mean? The word dominion comes into English from the Latin word, *dominus*. This simply means “Lord.” We are to treat the creation as Jesus Christ would treat it. This further means we are to enter into the mind of Christ and bring the love and care and concern for its ultimate purpose into our own hearts and vision and behavior to rightly live upon God’s world so that our actions glorify and praise Him for the goodness of the gift of creation.

It does not mean we may do whatever we please to the earth. Dominion is further informed by the mandate “to dress and keep the creation.” Other translations render this as “protect and serve” the creation. This indicates that dominion implies a kind of service and implies a thoughtful use of the world for the benefit and good of all life.

For a right dominion we pray that the Lord bless and keep us. Thus we follow the Lord, and enter into his prior love and care for the world. On at least ten occasions, we are told that “The Earth is the Lord’s” (Cor. 1:10:26). This means it is not ours. The earth was here before us and it has been given to us as a gift to treasure and leave in better condition that we inherited it. These basic principles allow us to respond to the charge that Judaeo-Christian thinking means, on the basis of the Genesis account which grants humans ‘dominion’ over the earth (cf. Gen 1:28), an unbridled exploitation of nature. No such thing is true. Some Protestant clergy might claim this, but this is not the ancient Christian understanding which Orthodox inherit from the saints and patristic writers. For Orthodox Christians, dominion means love, service, respect and care.

Further, dominion is a call, following Jesus Christ, to serve as priests of creation. This means we are not only to serve the earth, and steward its resources, we are to consecrate it with praise and thanksgiving back to its Creator-Maker.

HE Archbishop Elpidophoros, writing to the clergy and faithful of the Greek Archdiocese of America, makes this calling explicit in this Pastoral Letter of September 1st, 2019:

As Orthodox Christians, we must admit our failure to integrate our theology with our practice. Now those problems have intensified, while the challenge requires a more urgent response by the Church.

Our response, however, is fraught with difficulties and barriers because we are captive to a mentality of consumption and greed that is fundamentally foreign to Orthodox Christianity and contradictory to the spirit of communion and generosity. Instead, we are called to participate in the “cosmic liturgy” of creation (St. Maximus the Confessor), where “everything that breathes praises the Lord”

(Psalm 150:1), where “the heavens and the hills, the trees and the animals exalt the name of God” (cf. Psalm 148:4–13), and where every drop of water and grain of sand offer glory and gratitude for the presence of the Creator.

Of course, we all recognize that we can no longer desecrate God’s creation, whose origin and destiny are inseparably identified with ourselves. What we refuse to do is take the next step that is required of us as priests of creation, which entails consecrating creation to the Creator. *Avoiding desecration* is only a partial response to the ecological crisis; accepting and *advocating consecration* is the fulfillment of our divine mandate to “serve and preserve the earth” (Gen. 2:15). Such a sanctification and offering to God of “*His own of His own, on behalf of all and for the sake of all*” (From the Divine Liturgy) also unleashes the transformative potential and restorative capacity of all creation for healing and wholeness.

However, in order to heal the earth, we must purify our hearts and transform our habits. Every act of defilement on the body of creation is ultimately contempt for the Body of Christ. Whereas when we demonstrate respectful consideration for the earth’s natural resources, then we can also begin to discern the perspective of the kingdom “on earth as in heaven” (From the Lord’s Prayer).

This statement gives us a genuine Orthodox Christian understanding of the depths of meaning hidden in the biblical mandate to take dominion over the creation of God.

7. There's no way to know how much the climate is changing because we don't have temperature records from past centuries

It's true that we do not have thermometer readings from thousands of years ago, writes Christina Nunez of National Geographic.

But we do have an abundance of natural records that help us know what temperatures were like in the distant past. For example, trees store information about the climate in the location where they're rooted. Each year trees grow thicker and form new rings. In warmer and wetter years, the rings are thicker. In drier times the rings are thinner. Old trees and wood can tell us about conditions from hundreds or even thousands of years ago.

Windows [to] the climate records of the past are also buried in lake sediments and oceans. Pollen, particles, and dead creatures fall to the bottom of oceans and lakes each year, forming sediments and sometimes fossils. Sediments contain a wealth of information about what was in the air and water when they fell. Scientists reveal this record by inserting hollow tubes into the mud to collect layers of sediment going back millions of years.

For a direct examination of the atmosphere in past times, scientists drill cores through the Earth's polar ice sheets. Tiny air bubbles trapped in the ice are actually samples from the Earth's past atmosphere, frozen in time. That's how we know that the concentrations of greenhouse gases since before the Industrial Revolution were much lower then and are much higher now than they've been for hundreds of thousands of years."

Even rocks have a story to tell and the history of ancient climates are written in the geology of the world, and they too can tell a story.

Through analysis and study the whole world has the potential to relate a history that reveals the long stretch of past centuries and millennia. In the languages of geology and chemical analysis the past can serve as a witness to the climates of the past and provide a long string of lessons for us in the present about what we are doing to the future, unless we can repent and change our thoughtless behavior regarding the fossil fuel energies that we are using.

8. Orthodox concern for climate change sounds like some new innovation. Besides the Bible says nothing about climate change. If it is so important, why didn't Jesus tell us about this?

Care for the earth is part of the ancient tradition that Orthodox Christians inherit from the past. Until the modern era populations were smaller and had much less of an impact upon the earth. With the rise in populations, and particularly with the rise of science and technology, the human impact has grown. Thus the world is now substantially different than in times past when peoples lived close to the land. Additionally individual people, embellished by the technological tools of the modern age, have far more impact upon the world than did people in past centuries.

Ecumenical Patriarch Dimitrios first began to talk about the danger of what was then called “the greenhouse effect” back in 1989. Pope John Paul II also began to address the danger of climate change in the same year as well as many other Christians leaders.

Christians everywhere recognize that we all have a responsibility to care for and protect the world and to address the changes in the world. Clergy have a higher responsibility and are called to provide spiritual direction to the faithful so that we might all live harmlessly and in accord with the ancient principles of Christian faith.

Across the Orthodox Church, numerous statements have been made to guide the faithful into meaningful responses. Here are a few of the most pertinent comments:

On September 1, 1989 HAH Ecumenical Patriarch +Dimitrios prophetically addressed the issue of global climate change just as it was emerging into popular awareness:

Scientists and other men of learning warn us of the danger, and speak of phenomena which are threatening the life of our planet, such as the ‘phenomena of the greenhouse’ whose first indications have already been noted. We paternally urge all of the faithful of the world to admonish themselves and their children to respect and protect the natural environment.

HAH Ecumenical Patriarch Bartholomew spoke of the moral dimensions of the emerging climate crisis. On August 12, 2005 he delivered the following message:

Climate change affects everyone. Unless we take radical and immediate measures to reduce emissions stemming from unsustainable - in fact unjustifiable – excesses in the demands of our lifestyle, the impact will be both alarming and imminent.

On May 25, 2007, the Standing Conference of Canonical Orthodox Bishops in America issued a statement on global climate change. This was jointly signed by HE Archbishop Demetrios of the Greek Archdiocese of America; HB Metropolitan Herman of the Orthodox Church in America (OCA); HE Metropolitan +Philip of the Antiochian Orthodox Christian Archdiocese of North America; and all of the other top hierarchs of

America. Here are excerpts from that important declaration:

Faithful to the responsibility that we have been given..., it is prudent for us to listen to the world's scientific leaders as they describe changes occurring in the world's climate, changes that are already being experienced by many people throughout the world....

The impact that climate change will exert upon society is great and diverse, inevitably including conditions which deeply disrupt the lives and livelihoods of people on an unprecedented scale.

Climatologists [identify the causes of] these changes as the result of measurable increases of carbon dioxide... in the atmosphere. These gases are produced primarily by the burning or combustion of gasoline, coal and other fossil fuels.

Importantly, the conditions that we observe now are only the early alterations to our climate. Much larger and far more disruptive changes will result unless we reduce the forces causing climate change.

In 2007, HAH Ecumenical Patriarch Bartholomew commissioned a special Arctic symposium to examine the effects of climate change around Greenland.

If there is one single message in the information which we have received, it is this: "Time is short."

For the human race as a whole, there is now a *kairos*, a decisive time in our relationship with God's creation. We will either act in time to protect life on earth from the worst consequences of human folly, or we will fail to act. On behalf of all of us, allow me to offer up a public prayer: *'May God grant us the wisdom to act in time.'*

In November of 2013, in a presentation before a gathering at Saint Sophia Cathedral in Washington, DC, His Eminence Archbishop Demetrios made a strong and impassioned declaration about the importance of addressing global climate change.

The most recent scientific report on climate change and its effects, issued ... by the International Panel on Climate change (IPCC) and compiled by hundreds of scientists from dozens of countries, raised concerns in the form of dire conclusions, which we cannot afford to ignore. These include unequivocal deductions concerning climate change in the form of global warming, rising sea levels, increasing concentrations of greenhouse gases, and melting ice sheets.

The human influence on the climate system is evident from a variety of observations and analyses.... Human influence has been the dominant cause of the observed temperature patterns and increases since the mid-twentieth century.... The long-term trend seems unmistakable and there is no excuse for complacency....

HB Patriarch Theodoros II, Pope of Alexandria and All Africa, delivered a statement at the opening of the Orthodox Church's first office dedicated to addressing climate change. On June 18, 2014 he issued the following message:

In our efforts to contain global warming, we are demonstrating how prepared we are to sacrifice our selfish and greedy lifestyles. When will we learn to say: "Enough!?" When will we understand how important it is to leave as light a footprint as possible for the sake of future generations?

On September 1st, 2018 Ecumenical Patriarch Bartholomew issued a statement that reminds us of the urgency of climate change. He calls us to develop "practical endeavors" that address rising levels of carbon dioxide and other greenhouse gases:

We know that the greatest threat to our world today is climate change and its destructive consequences even for our survival on the planet....

The burning issue of climate change, along with its causes and consequences for our planet and everyday life, offer an opportunity to engage in dialogue based on principles of theological ecology, but also an occasion for specific practical endeavors. It is vitally important to emphasize action at the local level. The parish constitutes the cell of church life as the place of personal presence and witness, communication and collaboration—a living community of worship and service.

In an Open Letter on Climate Change, January 22, 2019 by Rev. Fr. Christopher Bender, Dean, Saint Nicholas Greek Orthodox Cathedral, Pittsburgh, Pennsylvania, provided the following key insights:

The scientific evidence is overwhelming and frightening: Global warming (climate change) is real. It is caused primarily by human activity in burning fossil fuels which has released billions of tons of greenhouse gases into the atmosphere.... If unchecked, its destructive effects... will eventually lead to dire consequences.... [including] eventually, the collapse of the worldwide food production system....

Climate change is a *moral* issue. In fact, it is a *pro-life* issue! What good does it do... to protect the unborn, if we are creating conditions that will make life nearly impossible for those children when they grow up?

When we who are Christians support sane efforts to reduce the peril of climate change, we are behaving in a manner that is totally consistent with our faith.

In response then, yes, Jesus through the Holy Spirit is teaching us, through his many servants. Just as St Paul could invoke a "Cloud of Witnesses" (Heb. 12:1) to embrace Jesus Christ, now we have a new contemporary Cloud of Witnesses urging us to address global climate change as the great challenge of our generation.

9. Climate models come from computers and thus they may be way off and wrong

Climate modeling is a difficult and complex process to be sure, and all mathematical models have limits to their effectiveness. That assertion might have held some validity back twenty years ago at the turn of the century when climate models were in their infancy.

Now in 2021 the science of climate models have become highly sophisticated. Science now has decades of experience with such projections through computer models, and the science has progressed a long way.

Scientists have intensely studied how past climate models have fared. In fact, as we enter 2021, scientists can answer from experience and say, “most of the models are quite accurate.”

One 2017 study compared 17 model projections of global average temperature developed between 1970 and 2007 with the actual global temperatures changes.

“The results indicated that ten of the model projections closely matched observations. Moreover, after accounting for differences between modeled and actual changes in atmospheric carbon dioxide and other factors that drive climate, the number increased to 14. The authors found no evidence that the climate models evaluated either systematically overestimated or underestimated warming over the period of their projections,” wrote Alan Buis of NASA’s Jet Propulsion Laboratory.

“The results of this study of past climate models bolster scientists’ confidence that both they as well as today’s more advanced climate models are skillfully projecting global warming,” said Gavin Schmidt, study co-author and director of NASA’s Goddard Institute of Space Studies. “This research could help resolve public confusion around the performance of past climate modeling efforts.”

10. We cannot change the institutions of society. Fossil fuels are essential for a working world. This means that logistically speaking, the world cannot stop the climate crisis.

What a fatalistic complaint! We build our communities according to how we think. As our vision recognizes the seriousness of climate change and strives to transit over to clean sources of energy, we can change our behavior and how we think about social design.

Besides we know that solar and wind energy are far less expensive than the old fashioned fossil fuel systems. Through improving a host of energy efficiencies — in buildings, power plants, agriculture, housing and elsewhere — and by improving fuel economy, we can make big strides in reducing the amount of carbon emissions we're emitting.

Better yet, as ordinary citizens recognize how the price of renewable energy, including wind and solar power, has dropped dramatically in recent years, we will all see the economics of making changes over to clean sources of energy. This is making such a just transition feasible, writes John Cook, a climate communication research fellow.

We also can work for a just transition for most of the economy to go from running on expensive fossil fuels to running on clean sources of electricity. The solutions are out there, Cook writes.

“Make no mistake, transitioning our society to a carbon-free future is a huge and difficult challenge. Nevertheless, we have the technology that is required — we just need the political and social will to make the change. Every action we take now will reduce the risks we face from future climate impacts,” he wrote on www.BeforeTheFlood.com.

“And the cost to reduce emissions is relatively small compared to the cost of climate impacts on the economy, which will grow larger and larger over time. Economists estimate that the money saved by not acting now will be dwarfed by the costs of damage in the future. The old saying still holds: ‘An ounce of prevention is worth a pound of cure.’”

As Orthodox Christians we should also recognize the moral, ethical and spiritual reasons for making the necessary changes. This puts us all on a trajectory away from uses of polluting gas and oil and toward the use of clean and harmless sources of energy.

11. It is all a ‘Great Big Fabrication.’ Temperatures are not really increasing. It often feels like they are even dropping and the world is getting colder in some places.

We all need to test and verify the assumptions that we hold and represent. Otherwise we can become deluded into all sorts of strange beliefs. For this reason, the Apostle John tells us to “try the spirits, whether they are of God” (1 John 4:1). This verse applies to information about climate change as well as any other topic.

Every major religious organization has already studied the climate problem, often taking years to study the issue and take testimony from science and industry and all perspectives. Each of those who have studied the climate issue concludes similarly: that climate change is indeed serious, more urgent than was formerly understood, and an issue that requires attention now.

We should also remember that from the perspective of science, climate is different than weather. Climate is an overall average over a period of time (usually 30 to 50 years). Climate change refers to a shift in this average across whole regions of the planet.

Weather is the local experience of climate and this varies and changes on a daily and even hourly basis all around the world. This means one cannot with integrity make a determination about climate based merely on several cold freezing nights.

A common approach by those who deny global climate warming is to point to some narrow local anomaly in a particular geographic area that may have seen relatively steady or even cooler temperatures in recent years. In fact, the earth as a whole has been gradually warming for most of the present century.

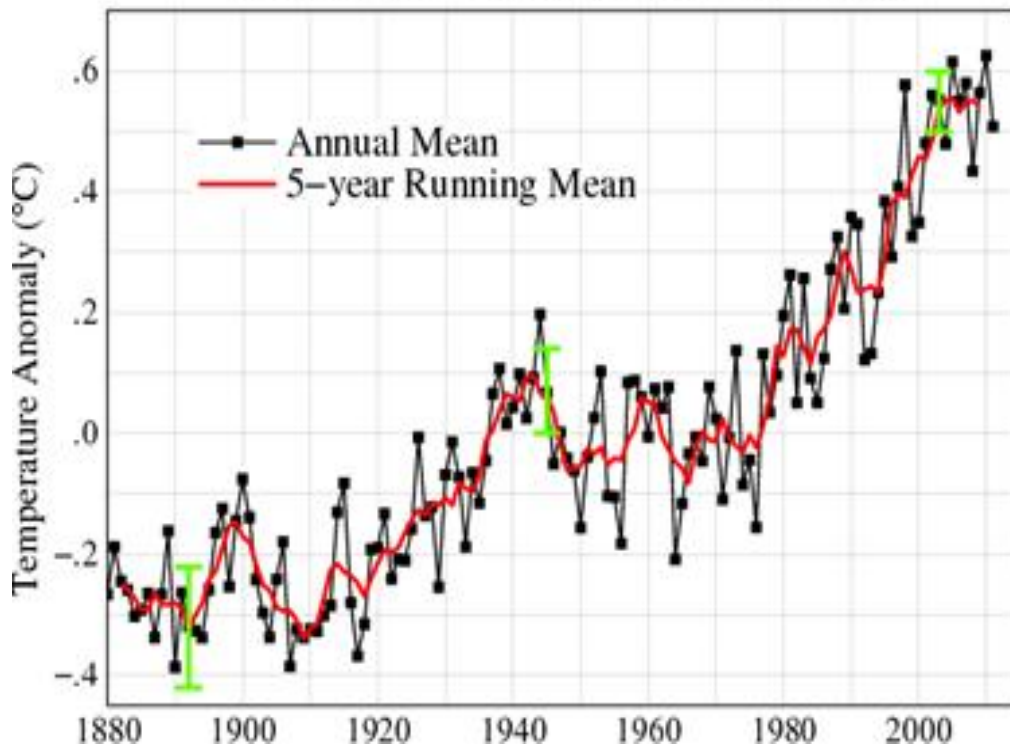
According to the Intergovernmental Panel on Climate Change (IPCC), which was constituted in 1988 by the United Nations to bring together the world’s top climate scientists from every nation, “surface temperatures have so far increased by about 0.74° C (1.33° F) over the past hundred years,” with especially rapid warming over the second half of the 20th century.

Each decade since the 1970s has been warmer than the decade before it, and 9 of the 10 warmest years on record have been recorded since 2000.”

The measurement of global average temperature comes from many sources, including thousands of land and sea measurements taken every day, weather balloons, and satellites.

(Sources: The IPCC; 4th Assessment Working Group I, FAQ 3.1. The Royal Society’s Climate change: a summary of the science pdf . NASA Goddard Institute for Space Studies, Global Temperature in 2011, Trends, and Prospects).

Global Land–Ocean Temperature Index



Scientists from around the world are in agreement about the urgency of the problem and on the basic data which documents the changes now taking place. This is the unanimous conclusion of all of those who properly study and have come to understand this challenge facing world society.

12. There is no correlation between rising temperatures and CO2 emissions. This has to mean, therefore, that humans can't be the cause of climate change.

This is clearly false. Carbon dioxide is one of the major greenhouse gases in the atmosphere. High School texts describe the world's atmosphere as composed of four major components. According to Wikipedia on "the content of the world's atmosphere." It reports, "By volume, dry air contains 78.09% nitrogen, 20.95% oxygen, 0.93% argon, 0.04% carbon dioxide, and small amounts of other gases."

That small percentage of carbon dioxide is critical because that is what holds the warmth of the sun and keeps temperatures hospitable for life.

However, as more and more cars and trucks fill the world's highways and streets, as more reliance has been placed on coal, oil and other dirty fuels, as long distance jet travel and other transportation increases, as industry continues to use fossil fuels, as buildings still use fossil fuels for heating and cooling, as population has increased now to over 7.8 billion people worldwide (as of New Year's Day, 2021), all of these sources of greenhouse gases have increased steadily and even remarkably.

As humans exhaust more greenhouse gases into the atmosphere, the global average temperature has gone up. As we begin the year 2021 European scientists are declaring that last year, 2020, was the warmest in recorded history. In addition the top five average global temperatures have all taken place since 2015.

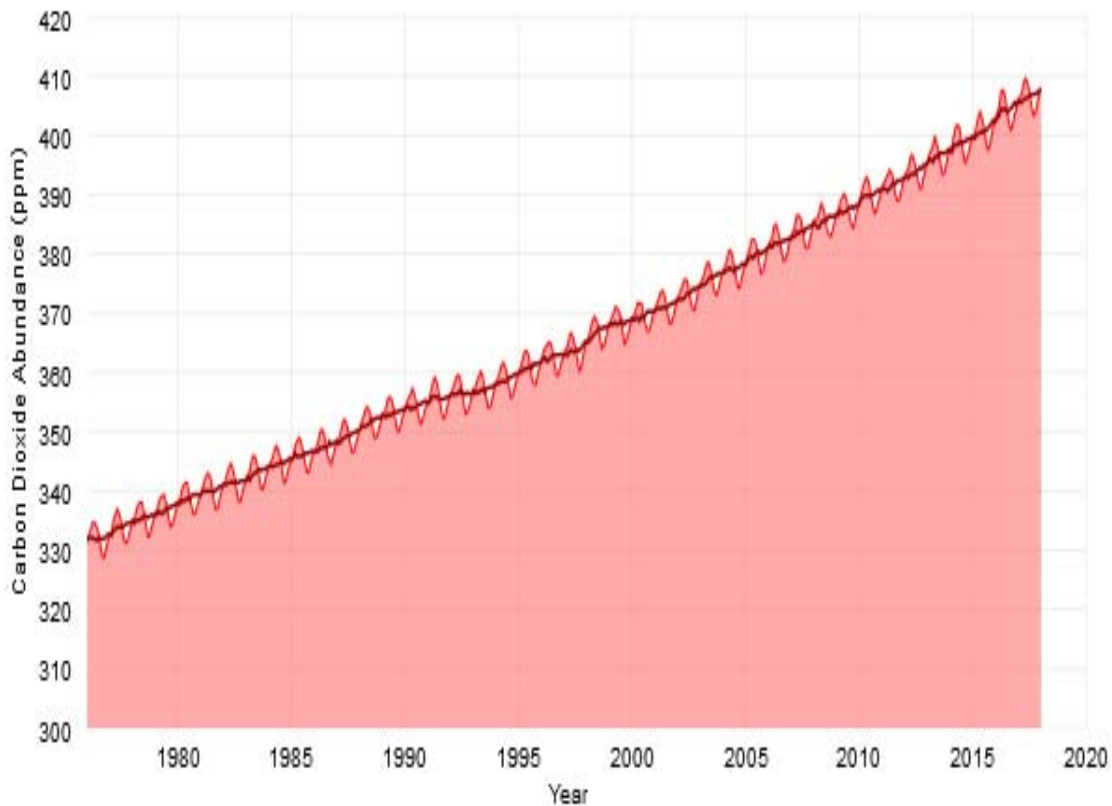
The amount of CO2 in the atmosphere began rising in the mid 1800s, and has steadily increased over the past 50 years. Ice cores show that the current level of CO2 in the atmosphere is higher now than at any time in at least the last half-million years. Temperature increases have followed this upward trend, with the second half of the 20th century being the warmest 50 year period in millenia. (IPCC 4th Assessment Working Group I, FAQs 6.2 , 7.1, and 9.2 .)

In 2016 the National Oceanic and Atmospheric Administration (NOAA) together with the American Meteorological Society (AMS) issued a report on the State of the Climate. They found that the amount of CO2 in the atmosphere has been going up at a slow but steadily increasing rate since well before 1960.

See below for a simple graph that reflects that report:

The global growth rate of atmospheric CO2 has risen from 0.6 ppm per year in the early 1960s to an average of 2.3 ppm per year during the past ten years since 2010.

However, the increase in CO2 from 2015 to 2018 was 3.5 ppm, the largest rate of annual increase observed in the 58-year atmospheric measurement record.



Chart, National Oceanic and Atmospheric Administration (NOAA) (2016)

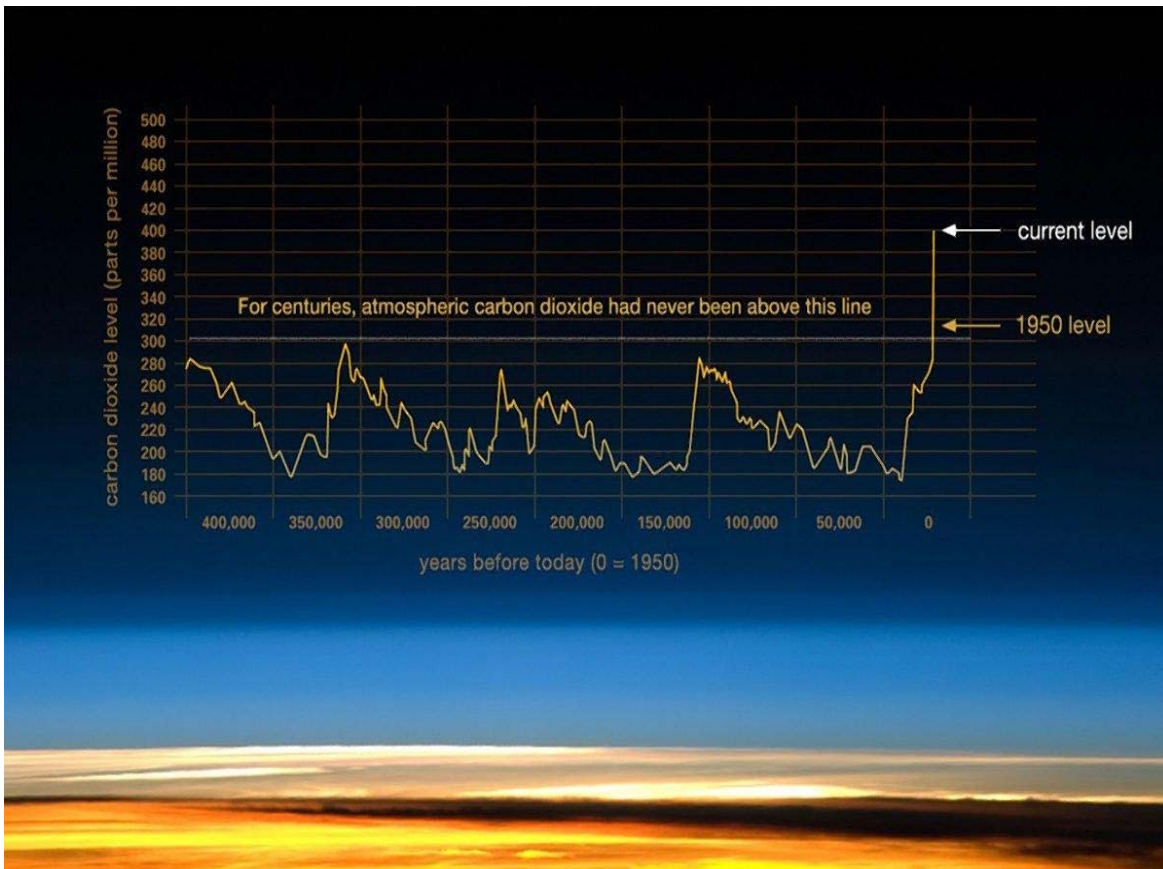
This simple graph from NOAA and the American Meteorological Society displays the steady growth of CO₂ in the world's atmosphere over the past years since roughly 1965.

Notice in particular how steady the growth rate of CO₂ has been during this time period. A full graph would begin in the 1860's after the Civil War. At that time CO₂ levels were about 275 ppm. That would more accurately depict how much change has taken place since that time because of our use of coal, gas and oil.

This rate of growth is what we have to correct as the present growth trajectory is leading into disastrous levels of climate change.

Next, let's take a longer term view and look back over 400,000 years. In this next graph, produced by NASA, we can observe a tight correlation between the ancient ice ages and times when CO₂ levels were low. When CO₂ levels were low, the world was in an Ice Age. Then whenever CO₂ levels rose slightly, the world would enter an inter-glacial period. This information is based on ice core samples from the polar ice caps which have remained in place through millenia.

Through all of these 400 centuries, CO₂ levels never rose higher than 290 parts per million (ppm). Then suddenly, around 1950 CO₂ levels for the first time crossed over that 300 ppm level. Since then we have every year been increasing the volume of CO₂ in the atmosphere. Now we are at a point over 415 ppm. This is why scientists are so worried. This is why temperatures are beginning to warm at a higher rate.



NASA

chart, 2015

This is why the ice caps are melting and oceans are warming. As the ice caps melt, that ice melt is the primary cause for ocean rising. This is also why hurricanes are becoming stronger, because they draw strength from warmer ocean temperatures. As average temperatures increase, forests become drier and thus we are increasingly experiencing huge forest fires at levels never previously witnessed. These are just the beginning of climate change fueled disasters and sorrows.

All of these emerging conditions are no accident. These changes are the direct result of burning too many fossil fuels and allowing these heat trapping gases to increase in the world's atmosphere.

This is also why informed Church leaders are righteously worried and why, as part of their service to God and Jesus Christ, they are warning us to take action now so that together we can hold off far worse consequences in the future.

13. CO2 and other Greenhouse gases are not causing this change in climate. The problem is actually the sun, or maybe volcanoes, or some other force.

All of these different natural forces do exert some impact on the climate. Output from the sun has slightly increased over the past 150 years, which has warmed the planet to a tiny fraction of a degree. However we know that the sun cannot be the primary cause, because the changes that are taking place and the increase in CO2 in the atmosphere is only happening down at the lower levels of the atmosphere. They are not showing up in the upper atmosphere. If the sun were the cause of these changes, then the increases would show in the upper atmosphere as well as the lower atmosphere. Since that is not the case, scientists say we have to conclude that the sun cannot be the primary cause of the current changes.

Volcano eruptions can also have short term (2-3 years) influences upon the climate. However, volcanic eruptions send plumes of gas and debris into the atmosphere and these have the effect of filtering and obscuring the sun. This would have a cooling effect if it were taking place, not a warming influence.

The last few decades have seen a period of low volcanic activity. The obvious conclusion is that this cannot be the cause either. Besides scientists account for these natural changes in their climate models to show the difference between natural changes and human influences over long time-scales.

Some individuals working for climate denier institutions, sponsored primarily by fossil fuel money, have theorized that water vapor might be the cause. Yes, water vapor does hold heat. However this can't be the primary cause either as droughts are increasingly taking place and besides water vapor evaporates and its level rises and falls dramatically according to moisture and a variety of other influences.

The only option left that we can observe and measure remains fossil fuels. We can observe their increase by precise measurements and we know the properties of these gases. We know how they originate. Scientists as early as the 1890s were able to foresee that an increase in these heat trapping gases would cause the effects which we are experiencing now. Among climate scientists there is no controversy that the human release of carbon dioxide and methane, both greenhouse gases, are the causes of the climate changes that we witness now.

14. Some claim that scientists are creating this commotion about climate change for their own personal gain, and publishing alarmist studies because this is a good way to capture research grants and make more money.

What a huge scam that would be! However, there is no evidence to support this preposterous argument. Besides it is terribly cynical. Scientists come from a variety of backgrounds and many are regular church-going people with integrity and a striving to be upstanding, honorable and truthful observers and servers of the world. Many have gone into the fields of science to discover how the world works and to study and advance awareness of the deep intricacy of God's creation.

It should also be recognized that the climate scientists who participate in the IPCC climate assessments are not paid, nor are those who participate in panels for the U.S. National Academy of Sciences.

Career advancement in the sciences is not based upon holding popular views, but on publishing original research and advancing humanity's awareness of the world around us.

In contrast, many climate deniers are the ones who actually receive substantial funding from entities with a financial stake in the fossil fuel-based energy system. Major oil companies are known to have paid out hundreds of millions of dollars to obscure the data about climate change – just as tobacco companies did over thirty years ago. The motive for obscuring information is that as long as some doubt persists in the mind of society, remedial action can be delayed. This will prolong the value of fossil fuels that still remain in the ground. Oil companies in their stock portfolios count the value of assets in the ground as part of the valuation of their companies. This keeps stock values high.

Here a real financial issue comes into focus. It is called “stranded assets.” If society recognizes the seriousness of climate change and makes the switch to cheaper and even free sources of energy – such as wind and solar, society will stop using those dirty sources of energy. Then stock values for the oil, gas and coal companies will drop, perhaps sharply, and those who are rich today might lose major parts of their fortunes. Thus their assets will not be worth as much. This is the underlying basis for the financial problem of “stranded assets.” The term “stranded” is because investments in those sectors will no longer be worth as much, and maybe even worth nothing at all.

15. Climate scientists dodge the big topic of Water Vapor as the real cause of climate change.

Every single climate model includes all of the heat trapping gases, and water vapor is always a major consideration.

The role of water vapor in the greenhouse effect is discussed and examined in every climate model and climate textbook. This is basic knowledge about the world's atmosphere. It is the strongest greenhouse gas, contributing between 36% to 66% to the overall effect for vapor alone. When clouds are included that figure goes up to 66% to 85%. What makes water vapor significantly different is that it is not considered as a climate "forcing" factor because the amount of H₂O (water) in the air varies as a function of temperature.

If you artificially increase the level of H₂O in the air, it rains out almost immediately (in terms of climate response times). Similarly, due to the abundance of ocean on the earth's surface, if you somehow removed all the water from the air, it would quickly be replaced through new evaporation.

This has the interesting consequence in that if you could somehow remove all CO₂ from the atmosphere, the temperature would begin to drop, causing precipitation to remove H₂O from the air, causing even further drops, in a feedback effect that would not end until no liquid water was left, only ice sheets and frozen oceans.

CO₂ put into the atmosphere by burning fossil fuels, on the other hand, stays in the atmosphere for centuries before natural sinks such as forests, soil and other vegetation finish absorbing the excess.

This is plenty of time to have substantial and long-lasting effects on the climate system. As the climate warms in response to CO₂, humidity rises and increased H₂O concentration acts as a significant amplifier of CO₂-driven warming, basically doubling or tripling its effect.

16. OK, Maybe climate change is real and is happening, but it'll cost way too much to correct or mitigate it.

Yes, there are costs to change the systems of society. Yes, it will cost money to reduce or mitigate our historical pollution and switch to clean energy.

The changes will require investment in new technology, a requirement to pay the true price of cleaning up for the past influences of dirty energy, and there will need to be a shift in how society does business. However, the cost of inaction will be far higher.

For many homeowners, the cost of transition to solar power runs between \$8,000 for a modest home and up to perhaps \$20,000 for a large dwelling with a lot of electrical uses and no financial subsidies from state or local government. But the savings are substantial as a homeowner can eliminate payments to local utilities and others who charge substantial amounts for owners to remain fossil fuel dependent. The payback period with solar panels normally ranges from six years up to ten or twelve years, depending on local policies, state rebates and other financial incentives, after which there are no more or perhaps reduced utility company payments, depending on the kind of system one depends upon.

For political reasons rebates and other incentives exist primarily in coastal states and often are non-existent in southern states where clean energy sources are not yet encouraged.

Another consideration is that many new jobs and professions will emerge as society switches over to clean solar power and clean wind power. Already there are more new millionaires in Texas and middle America because of wind power than new oil wells. This is a trend which will continue and probably grow in the years ahead.

The Organization for Economic Cooperation and Development estimated that transiting to clean energy and mitigating climate change could slow world Gross Domestic Product (GDP) growth by about 0.2% points per year. This could cost up to 5.5% of global GDP by 2050. Let's accept that estimate from the OECD.

In contrast the financial impacts of climate change are already increasing sharply and those costs of climate change's impacts (meaning climate fueled disasters) could reach as high as 14% of GDP, almost triple the cost of effective mitigating action. These costs presently derive from the damage from increasingly frequent and more damaging hurricanes, from sea rise and storm surges, from forest fires, from crop damages and drought, and from the costs of stronger storms in all parts of the world.

The Stern Review, conducted for the British Government, estimated the cost of inaction could be even higher. That report pegged the cost of effective mitigation at about 1% of global GDP annually by 2050, and the cost of climate change impacts as high as 20% of global GDP.

For more info, see (OECD Environmental Outlook to 2050: The Consequences of Inaction (2012). Stern Review on the Economics of Climate Change (2006).

17. Why should we in the United States address the climate problem when India and China do not?

As Christians we act because an action is right by God and right by Christian principles, not because of what others do or fail to do. We know that we are responsible for the growth of CO₂ because of our historic use and current continued use of fossil fuels. There we are culpable for his problem to some degree. This means that we need to set a right example for the world.

We also need to listen first to our Orthodox bishops and patriarchs who tell us to change how we live. We should also listen to our consciences. We embrace these changes because they are morally, ethically and scientifically right.

Additionally, it is significant to recall that the United States has historically released far more CO₂ than any other nation on earth, including China and India, by a large margin. Considering the relative population differences (a billion-plus each for China and India versus 330 million in the U.S.), the per capita emissions in the U.S. are many times larger than citizens of those countries. This has been true for the past 100-plus years of CO₂ pollution.

For the U.S. to refuse to take any steps until India and China do the same is like the fattest person at the table, upon realizing that food is running out, demanding that the hungry people who just sat down cut back just as much as him, at the same time.

There is no morally responsible assessment of the global warming problem that does not place a greater burden on the U.S., historically the world's foremost polluter. Perhaps we should divide global emissions by global population and allocate carbon credits according to census data. An approach on this basis that allocates equal shares of carbon pollution would be terribly shocking to US citizens when we realize how little other countries have contributed to the climate crisis. Justice demands some reflection on this dimension to the problem.

Finally, it is simply untrue that China and India are not doing their share to address the climate problem. In fact they have no choice. Beijing, the capitol city of China, is already experiencing dust storms and the encroachment of the Gobi desert into its norther regions. India is experiencing lower agriculture yields because of climate forces. Both are streamlining their transportation, switching to electric vehicles far faster than we in the U.S., and prioritizing wind and solar energy.

What comes next for them remains unknown, but this is not a fair argument as each country is changing, while also reaping intensifying disasters which spur us all into further emphasis upon clean renewable forms of energy.

18. Climate Change may not be such a bad thing. Besides our Christian heritage tells us to see the good in all things. Thus we should relax and find the good in the changes that are emerging.

Climate change deniers say that there is no reason to fight climate change. If it is getting warmer, that could be a good thing. They agree that the planet is getting warmer, but point out that the earth has had much warmer climates in the ancient past. What's so special about the current slight temperature increase? In fact, they claim that a warmer world might be a better place. People could move to North Dakota for its mild winters. And those in Arctic regions or Siberia could now grow tomatoes into the late fall. And maybe we could have a few more nice warm days at the beach each year? Doesn't this sound like an improved and better world?

It would be nice if this were true. Unfortunately, global warming does not mean more fun in the sun. In many places, temperatures will become far too hot. The climate crisis is real and it's already impacting people around the world. The reality of climate change is not a gentle slide into a slightly warmer planet. It involves massive and sometimes violent climate disruption and deathly hot temperatures. During the summer of 2020 the California desert registered a temperature of 130° F.

As we enter 2021 we already witness the initial effects of a world being transformed by rising heat levels, changing climate patterns, increasing hurricanes and typhoons, dreadful fires moving into urban areas, and rising seas. The outlook is far from a relaxing seaside escape.

Climate change will exert a powerful degrading effect on human health. As temperatures climb, we will see more heatwaves – and ever-more intense ones. Extreme heat can “overpower the human body” and cause dehydration, heatstroke, and major organ damage. Children, the elderly and the poor will be most impacted. Air quality will decline. Climate warming is linked to the increase in disastrous forest fires. The smoke from these fires carries fine particles that penetrate deep into peoples' lungs. Exposure is linked to burning eyes, heart and lung diseases, and in extreme cases even death.

Warmer temperatures will expand the range of insect-borne diseases from mosquitoes, fleas, mites, and ticks into new areas and bring more cases of malaria, Lyme disease, West Nile or Zika viruses, and skin infections, among many other health issues. Toxic forms of algae are already proliferating.

Extreme weather will increase. Already we witness more hurricanes and floods. New conditions are emerging including fire tornadoes, polar vortexes, atmospheric rivers and bomb cyclones. These new conditions will increase the incidence of property destruction and injuries. Floods alone can cause the spread of waterborne illnesses such as wound infections, dermatitis, conjunctivitis, and ear, nose and throat infections.

Climate change affects every aspect of weather, in large part, by intensifying the water cycle. In short, water evaporates into the atmosphere from both land and sea and returns to Earth's surface in the form of rain and snow. As the world warms, the rate of evaporation from our oceans as well as ocean warmth seems to be increasing, powering ever-stronger storms.

In conclusion to this silly and hugely uninformed objection, climate change is dangerous, deadly and dangerous. Healthy people need a healthy stable climate, and this is something which all of us will need to work toward.

19. The climate situation is so monstrously huge that it is hopeless to try and correct it.

In 2015, 197 countries united and signed the landmark Paris Climate Agreement, vowing to limit the rise of global temperature increase to below 2° Celsius, and push for a rise no greater than 1.5° C. This was considered impossible, but became possible as world leaders saw the problem and realized that we all have to work together and support one another if we will be successful in reducing our use of fossil fuels and ending their use as soon as practical. For this plan to be successful, all of us need to absorb this lesson which top world leaders have already embraced.

The pressure to make these changes takes a certain toll on the mental and emotional health of many people once they realize the depth of the climate crisis. This is especially the case for younger people who are understandably more worried about what sort of future they can expect on a hotter planet. Already we are seeing the rise of what mental health professionals are calling “climate grief.” This grief represents a fear of loss, combined with anger at the world that senior citizens have left to the future. It includes hopelessness, despair and distress caused by the implications of climate change and ecological decline.

Yes, it is true that climate change is big undertaking. Large numbers of citizens, especially young people, are facing new fears. It could involve the loss of animal species, forests or plants that we hold dear, or lifestyles we have grown accustomed to such as eating whatever we want whenever we want. As the time length between impacts and loss shorten, personal recovery times are reducing. At the same time there is increasing anxiety about what changes are still to come.

Yet there is no way to do justice to the threats we face without it becoming scary and provoking anxiety. This is a real question for clergy and parents: How do we face these warnings without falling into apathy, denial or simplistic optimism? How do we find a way to confront our climate and ecological reality and yet respond in a meaningful, purposeful way? How do we counsel children and others who are anxious about the climate changes now intensifying in the world?

Former UN climate chief Cristiana Figueres has said that the only way we can save the planet is with relentless, practical optimism. This is the kind of attitude that many of us are culturally trained to adopt, to keep looking on the bright side and remain hopeful, while at the same time taking the practical steps that will lead us into a fossil fuel free world. There is no shortcut. We have to roll up our sleeves and start make the changes now that will demonstrate our continued hope in the future.

We need to emphasize hope and particularly teach a vision of the path into a stable future. The Church gives us a vision of God “everywhere present and filling all things.” This should lead us into a reverence for every single thing in the world about us. This mentality should give us the strength to be careful to avoid those actions which perpetuate and intensify climate change.

With this vision foremost in our thinking, we should recognize that the past decade has seen a focus on what individuals can do to tackle climate change in their own life. This has resulted in a growing trend toward an eco-modern Christian who is acutely concerned with energy-efficient technologies, light bulbs and recycling rather than dissent, protest and structural change. Personal guilt comes to the fore when the virtuous lists and sustainable resolutions are not kept up with, and the issue is simplistically pushed out of mind.

Yes, the world is changing. An inevitable sorrow arises and for some a grieving for losses already occurring at a rapid rate in the natural world. As Dr. Gayle Woloschak comments in the Orthodox film "The FACE of God," in the last decade we have lost more animal species than in the previous thousand years.

This loss is a big cause of "climate grief." We address this grief by reminding ourselves about how much good fills the world. We need to ramp up the degree to which we are thankful to God for the goodness in this beautiful creation, a gift from God to each of us. We need to enjoy its beauties, but go beyond that and let beauty shape how we think and relate to each other. This will help us apply the lists of proper actions to take.

The world is at a critical turning point. We are called to embrace the mind of the Church and stand in the positive vision which is given to us by our Lord Jesus Christ and by his servants the patriarchs and top hierarchs.

One action that will help us counter the climate crisis is to stop thinking we are isolated individuals and tackle this climate challenge in concert with all of those who see the challenge and are willing to make the changes that are now necessary. We need to work in harmony with one another, so that we have the benefits and reinforcements that "parish as community" can bring to this effort.

In parish as community each family and each person can receive the benefit and blessing of being empowered to take those actions which reduce our human impact on the climate and which lead us into a safe and sane future.

What all of these steps together tell us is "yes," there is a way to change our lives and address climate change. It may not be easy, but there is a way and as long as we have the will, then we can do it. Let us then pray that we have the strength and stamina to enter into the prayer of the Church for stable weather and the blessings of our Lord to guide us into the future. Given the sins of our past, this is not an easy challenge, but it is the path that is set before us for those who will listen to the Church and walk the path that our leaders are directing us into.

20. Natural emissions from swamps and cattle dwarf the small level of human emissions.

Yes, but this is only one part of the larger picture. According to the United Nation's Intergovernmental Panel on Climate change (IPCC), every year about 150 billion tons of carbon dioxide go into the atmosphere from natural processes. The list of natural sources of atmospheric carbon, include outgassing from the ocean, decomposing vegetation and other biomass, venting volcanoes, naturally occurring wildfires, and even belches from ruminant animals. This volume is estimated at almost 30 times the amount of carbon which humans emit. What difference can we make?

Natural fluxes in the carbon cycle are larger than anthropogenic (human caused) emissions. But for roughly the last 10,000 years, until the industrial revolution, every gigaton of carbon going into the atmosphere was balanced by one coming out. Forests take up carbon dioxide, so do the oceans. So does the soil and all forms of plant growth.

These natural carbon sinks removed about the same quantity of carbon dioxide from the atmosphere as were produced by natural sources. This historically kept carbon dioxide levels balanced and in a safe range. But human sources of emissions have upset the natural balance by adding extra carbon dioxide to the atmosphere without removing the excess carbon.

By adding on top of the historical balance approximately 6 gigatons of carbon into the air but, unlike nature, we are not taking any of that imbalanced amount out. Thankfully, nature is compensating in part for our emissions, because only about half the CO₂ we emit stays in the air. About 35% of the additional amount of CO₂ is being metabolized into the world's oceans. This is why coral reefs are now dying. This extra CO₂ is causing a rise in carbonic acid in the world's oceans. This is why shellfish and lobsters and crabs are in danger. The increased ocean acidity metabolizes (dissolves) their shells and makes reproduction and growth far more difficult. Another 15% goes into plants and trees, accelerating their growth. Another part goes into algae and so toxic red tides are already on the increase.

Nevertheless, since we began burning fossil fuels in earnest over 150 years ago, the atmospheric concentration that was relatively stable for the previous several thousand years has become imbalanced and has now risen by over 52%. This is what is tipping the previously stable climate into levels of disruption that will impact human society in proportion to the extent that we continue to disrupt the world balance.

So whatever the total amounts going in and out "naturally," humans have clearly upset the balance and significantly altered an important part of the climate system. This explains why we must now stop the use of fossil fuels and seek to regain balance and stability to the world's atmospheric system.

21. The rise in global CO2 levels is a natural phenomenon and these changes should be expected.

This complaint from climate deniers is that over geological time spans, the world has witnessed even larger fluctuations than what we are seeing now. Therefore this is a natural condition and we should all relax and enjoy the changes in the world's atmosphere.

There is a tiny measure of truth in this claim, but it is taken far out of its historical context.

Yes, it is true from ice core evidence and geological history that CO2 fluctuates naturally over millenia. Therefore the climate deniers say it is bogus to assume today's rise is caused by humans.

World society emits billions of tons of CO2 into the air annually and, lo and behold, there is more CO2 in the air. Surely it is not so difficult to recognize that the CO2 rise is our fault. But if simple common sense is not enough, there is more to the case. (It is worth noting that investigation of this issue by the climate science community is a good indication that they are not taking things for granted or making any assumptions — not even the reasonable ones!)

It is true that CO2 has gone up on its own in the past, most notably during the glacial-interglacial cycles. During that time, CO2 levels rose and fell by over 100 ppm, ranging between around 180 to 280 ppm. But those rises, though they look steep over a 400,000 year timeframe, took 5,000 to 20,000 years, depending on the glacial cycle. Those changes were slow and gentle and animal and plant species were able to adapt to the gentle changes in climate.

In contrast, we now see an equivalent rise of 135 ppm in less than 150 years! The world has never experienced such a rapid rise in CO2 levels. These changes are a direct consequence of the industrial revolution and the technological benefits of every person having their own fossil fueled mode of transportation and the reckless use of fossil fueled vehicles for recreation as well as occupational necessity.

There is a lot more to this argument. By analyzing the isotopes of carbon and oxygen atoms making up atmospheric CO2, in a process similar to carbon dating, scientists can detect a human "fingerprint." What they have found via the isotope signatures can be thought of as "old" carbon, which could only come from fossil fuel deposits, combined with "young" oxygen, as is found in the air all around us. So present day combustion of fossilized hydrocarbon deposits (natural gas, coal, and oil) is recognized as the source of the CO2 currently accumulating — just as common sense tells us should be the case.

For more of the nitty gritty technicalities straight from the climate scientists, including links to the actual research that established this, visit RealClimate's article on how we know the CO2 is ours.

See: <http://www.realclimate.org/>

Of all the pillars holding up the theory of anthropogenic global warming, this is one of the most unassailable.