Climate Change: Ten Things you Need to Know

Luca Mercalli*

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* President and Editor-in-Chief of the Italian Meteorological Society Ets / Nimbus journal Collegio Carlo Alberto – Via Real Collegio 30, 10024 Moncalieri – Italy
info@nimbus.it

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Abstract. The book Il clima che cambia *(*The Changing Climate*), by climatologist Luca Mercalli and his colleagues at the Italian Meteorological Society, first published in 2009 and reprinted several times, has become a key reference work amongst essays on global warming. For this reason, BUR Rizzoli publisher has chosen to keep it in its catalogue, reissuing it in an updated edition in 2026. With the consent of the authors and the publisher, we reproduce below "ten things you need to know".*

On these issues, the Author gave a report at the V National Congress of the Italian Society of Psychoneuroendocrineimmunology, Rome, October 2026.

***Keywords**: Climate change; Responsibility; Outlook; Reliable forecasts; Actions; Italian policies.*

1) Is the climate really changing? Yes, the climate crisis is now "unequivocal", and we see this above all in the rise in global average temperatures (+1.4 °C over the last century and a half), the increased frequency of unprecedented heatwaves (in Europe: 2003, 2015, 2019, 2022, 2026...), resulting in the melting of glaciers (their surface area has shrunk by about two-thirds over two centuries in the Alps), rising sea levels (+4.7 mm/year), more frequent droughts and wildfires, changes in the

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geographical distribution of plants and animals, and species extinctions. Precipitation trends are less clear-cut: in some areas it rains more (Northern Europe), in others less (the Mediterranean), but in general, heavy downpours are increasing worldwide (including in Italy), because as temperatures rise, water evaporates more quickly from the oceans and the air can hold more water vapour (+7 per cent for every degree Celsius).

2) But there was a lot of snow in the Alps this winter… We must not confuse the concepts of weather – that is, local meteorological conditions over a timescale of hours or a few days, such as the heavy snowfalls of the winter of 2025–2026 in the Western Alps – with climate – that is, the evolution of average conditions over long periods, on a timescale of decades and centuries and at a global level. Even on a planet that is, on average (and rapidly!), warming up, short periods of unusually cold weather – albeit rarer (cold extremes are about 10 times less frequent than heatwaves) – or heavy snowfall can still occur here and there.

3) Who is to blame? In the past, the Earth's climate has always changed due to natural causes (characteristics of the Earth's orbit, variations in solar activity, volcanic eruptions), but the current warming is undoubtedly due to rising greenhouse gas emissions resulting from the use of fossil fuels and deforestation (CO_2, carbon dioxide), as well as intensive cattle farming (CH_4, methane). In 2025, a record emission of 38 billion tonnes of CO_2 alone from fossil fuel sources was reached; its concentration in the air is increasing by approximately 2.5 ppmv (parts per million by volume) per year; by May 2025, it had risen to 430 ppmv, the highest level in 14 million years according to a study published in 2023 in the journal *Science*. These figures are based on over a century of rigorous scientific research, beginning in 1856 with the pioneering (and long-forgotten) work of Eunice Foote, continuing in 1896 with the Swedish Nobel laureate in chemistry, Svante Arrhenius, and consolidated after 1988 with the establishment of the IPCC, the United Nations Intergovernmental Panel on Climate Change, the most authoritative source of shared knowledge on the global climate.

4) Who emits the most greenhouse gases? The richest, most industrialised countries with economies based on oil and coal and high levels of energy and raw material waste, emitting over 15–20 tonnes of CO_2 equivalent per capita per year (the USA, Canada, Australia, Saudi Arabia). In contrast, the poorest countries – sub-Saharan Africa, Afghanistan… where even basic levels of access to energy, food and services are not met – contribute very little to global warming (a few tens of kilograms of CO_2 per capita) yet suffer even more from its effects. Europe and

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Italy lie somewhere in between, with 7.1 and 6.3 tonnes per capita respectively (2024), whilst the contribution from emerging economies (China, India, Brazil) has increased.

5) What might happen in the future? Climate models indicate that if we do not reduce emissions immediately, by the end of this century global average temperatures could rise by over 4 °C (and by as much as 10 °C or more in the Arctic!), leading to a surge in deadly heatwaves and facilitating the spread of tropical diseases; more violent storms and downpours will alternate with longer droughts, hampering agricultural production; glaciers will melt (almost entirely in the Alps) and sea levels will rise by at least one metre, submerging coastal cities and plains currently home to hundreds of millions of people (Venice, London, New York, Mumbai, Jakarta...). These serious effects, largely unprecedented in the history of the human species, will have repercussions for millennia.

6) It is already difficult to predict what the weather will be like tomorrow; how can we possibly predict the climate a hundred years from now? Weather forecasts provide details on atmospheric conditions over a timescale of hours to days and across areas of a few kilometres and cannot reliably extend beyond about ten days. Climate projections, on the other hand, are obtained from complex simulation models run on supercomputers that integrate the atmosphere, oceans, the cryosphere (ice) and the biosphere, indicate the average evolution of the global climate on a decadal or centennial scale based on economic, technological and social scenarios (population, energy consumption, greenhouse gas emissions), without going into the details of what the weather will be like on individual days or in specific locations. This is why they are reliable, as they estimate an average global climate state based on various forcing factors, including greenhouse gas emissions.

7) Why should we be concerned? By radically disrupting the natural environments on which we depend within a very short timeframe, climate change threatens our civilisation, which has developed over the last 10,000 years of stable and favourable climate suitable for agriculture (the Holocene). If left unchecked, it will jeopardise human health and trigger unprecedented waves of migration and serious geopolitical tensions, which will compound the wars over access to natural resources – which are becoming increasingly scarce in an overpopulated world (drinking water and water for irrigation, arable land, oil and rare minerals, fish, timber, etc.).

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8) What can we do? We must immediately reduce human pressure on the environment and climate (the Anthropocene), by cutting back on our consumption of energy and raw materials, through a convergence of individual and collective strategies (from the bottom up) and policies (from the top down) that enable us to meet humanity's basic needs whilst remaining within the planet's physical limits ("doughnut economy"). Here are some priority actions: moderating birth rates through educational programmes and gender equality, particularly in poorer countries, to prevent continued population growth; avoiding air travel, particularly intercontinental flights; limiting the use and fuel consumption of private cars, by opting for small-engined vehicles or small electric cars, teleworking, public transport, local journeys and car-sharing; improve the energy efficiency of buildings (double- or triple-glazed windows, insulation of walls and ceilings, external thermal insulation, high-efficiency household appliances) and energy production from renewable sources (solar thermal and photovoltaic panels, wind power, biomass, geothermal energy), whilst also benefiting from tax relief (eco-bonuses) and savings on energy bills; choose electricity suppliers using renewable sources; prioritise durable goods (not single-use items), reduce waste at source, recycle, recover and reuse items (circular economy), buy products with less packaging, and shop using reusable bags and containers; choose seasonal fruit and vegetables, sourced locally wherever possible, and, if possible, grow your own vegetable garden; aim for a predominantly vegetarian diet or, at the very least, one low in beef; eliminate food waste (a quarter of greenhouse gas emissions stem from the food production chain).

9) What is the Paris Agreement? It is an international agreement painstakingly reached in December 2015 at COP-21 in Paris, which to date (March 2026) has been ratified by 193 countries (plus the European Union), accounting for around 80 per cent of global greenhouse gas emissions. It aims to decarbonise the economy (net-zero emissions by mid-century) in order to limit global warming from the industrial era to 2100 to below 2 °C, and ideally to 1.5 °C. Each country follows voluntary national emission reduction plans (NDCs = Nationally Determined Contributions), which are periodically reviewed and improved. In fact, the targets are still not sufficient: if current plans were implemented, the global temperature would still rise by almost 3 °C (enough to cause the West Antarctic ice sheet to melt). We must act quickly: the window of opportunity for effective action is closing. Indeed, given the sluggish pace of current climate policies and the continued rise in global emissions, many scientists now believe the chance to stabilise the climate at +1.5 °C has been lost – a threshold that is expected to be reached on a sustained basis as early as 2030.

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10) How is Italy faring? As in the rest of Europe, environmental awareness and decarbonisation efforts have increased somewhat in recent years: energy production efficiency has improved; renewable sources account for around 40 per cent of electricity consumption (though only around 20 per cent of total energy consumption, including, for example, fuels for heating and transport); and overall greenhouse gas emissions fell by 30 per cent between 1990 and 2024. However, we remain a country that consumes, wastes and pollutes too much (our national ecological footprint is equivalent to three planets), and we need to do more and invest more in the energy transition.

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Reference

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