Cambiamento climatico, ozono e radiazione UV

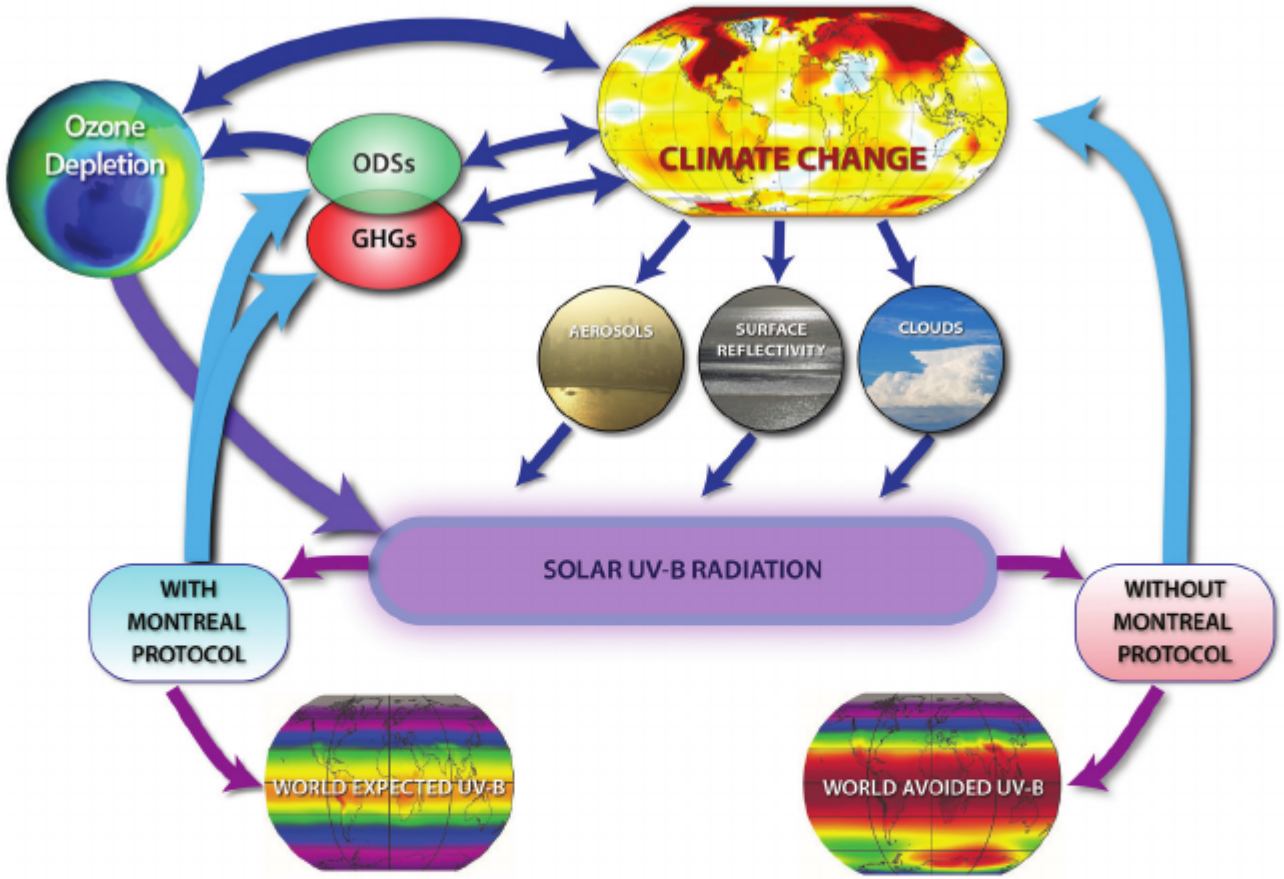


Fig. 1 Conceptual representation of the interactive effects of changes in greenhouse gases (GHGs) and ozone-depleting substances (ODSs) on climate and solar UV-B radiation at the Earth's surface. Increases of ODSs in the atmosphere have led to stratospheric ozone depletion and the ozone 'hole'. Actions prompted by the Montreal Protocol have resulted in decreasing ODSs and have helped to avoid large increases of solar UV-B radiation that would otherwise have occurred by the middle of the 21st century. Continued emissions of GHGs (*e.g.*, carbon dioxide, methane, and nitrous oxide) will change the climate and will also modify the recovery of stratospheric ozone, which is expected from decreasing concentrations of ODSs. Climate change will also affect clouds, surface reflectivity at high latitudes, where changes in sea ice and snow cover are expected, and aerosols near the Earth's surface. The combined effects of changes in ozone, aerosols, clouds, and reflectivity will determine future levels of UV-B radiation at the Earth's surface.

Cambiamento climatico, ozono e radiazione UV
Le attività di ARPA su ozono e UV solare

12 years of solar UV monitoring in the Aosta Valley

H. Diémoz [1] I. Fountoulakis [1] A.M. Siani [2]

[1]ARPA Valle d'Aosta, Saint-Christophe, Italy
[2]Sapienza Università di Roma, Rome, Italy

h.diemoz@arpa.vda.it

European Conference on Solar UV Monitoring
"UV Monitoring in the European Countries - Past, Present and Future"

Cambiamento climatico, ozono, radiazione UV ed effetti sulla salute

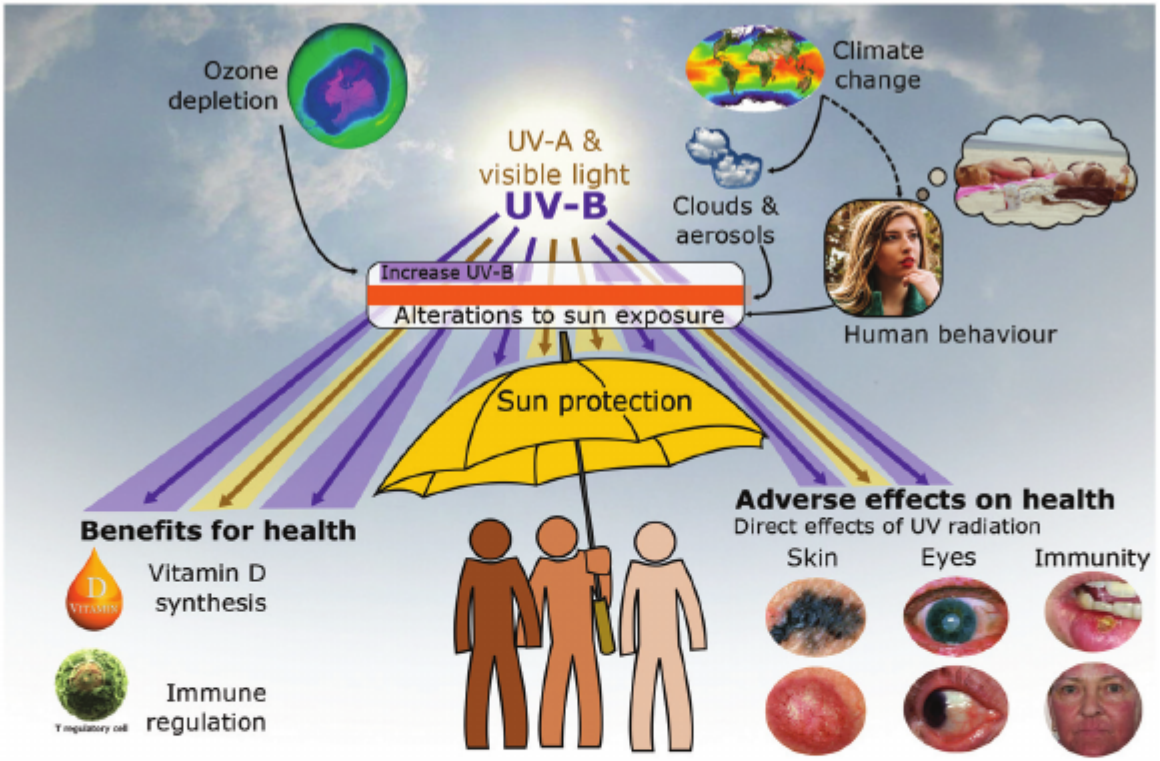
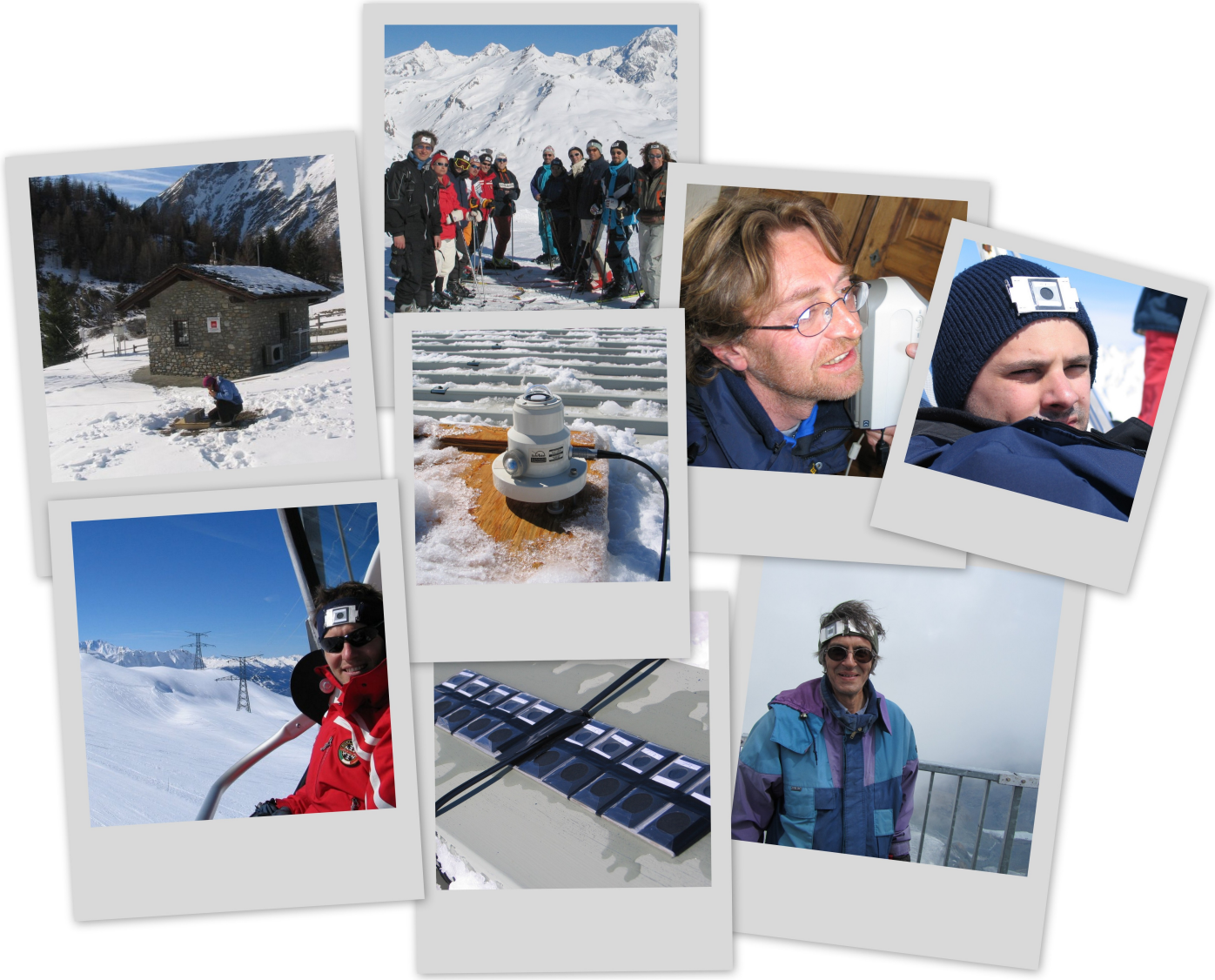


Fig. 1 Conceptual diagram. Depletion of stratospheric ozone causes an increase in UV-B radiation at the Earth's surface; in the future, recovery of the ozone layer will lead to a reduction in clear-sky UV-B radiation. Climate change will alter cloud cover and tropospheric air quality (aerosols) that will, in turn, affect solar radiation at the Earth's surface across all wavelengths. Human behaviour is a major modulator of the received dose of UV radiation. These factors thus work together to determine human exposure to UV radiation; the dose of UV radiation reaching sensitive tissues depends, in turn, on skin pigmentation and the use of sun protection including physical protections like sun umbrellas, as well as clothing, hats, sunscreen and shade. Adverse effects on health include skin cancers and photosensitivity disorders (photodermatoses), cataracts and other eye diseases, and immune suppression that leads to the reactivation of latent virus infections. Benefits include synthesis of vitamin D in the skin, regulation of immune function that may reduce the severity of some skin diseases and possibly systemic autoimmune diseases. Climate change will alter these risks and benefits to health through changing behaviour in relation to sun exposure, *e.g.*, due to changes in ambient temperature and precipitation. The photograph of the thinking woman was adapted from an image by Tyler Nix on Unsplash; the photograph of the sunbathers was adapted from an image by Maciej Serafinowicz on Unsplash (hiips://unsplash.com/collections).

Cambiamento climatico, ozono, radiazione UV ed effetti sulla salute
Le attività di ARPA sulla dosimetria UV personale



Cambiamento climatico, ozono, radiazione UV e qualità dell'aria

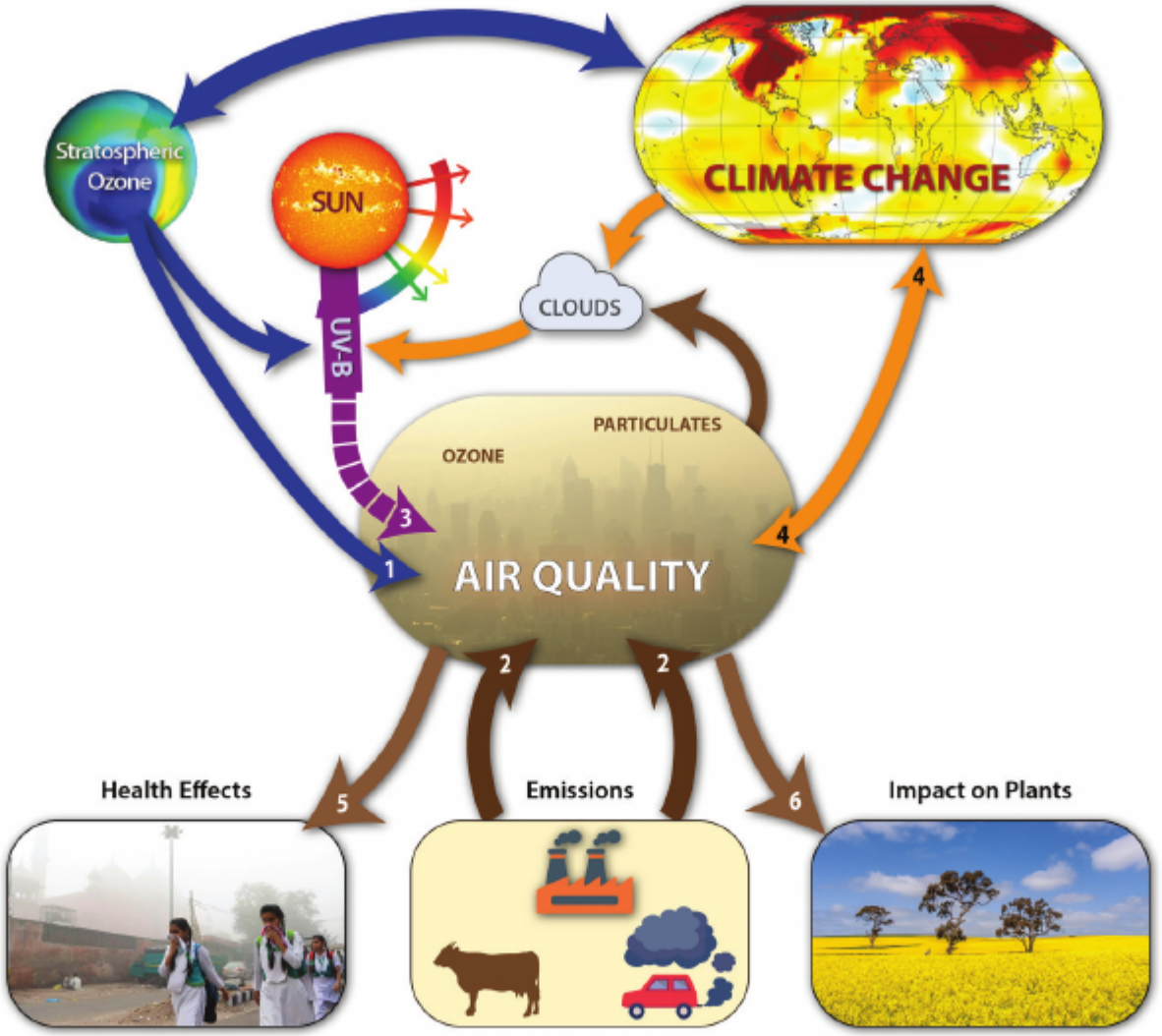
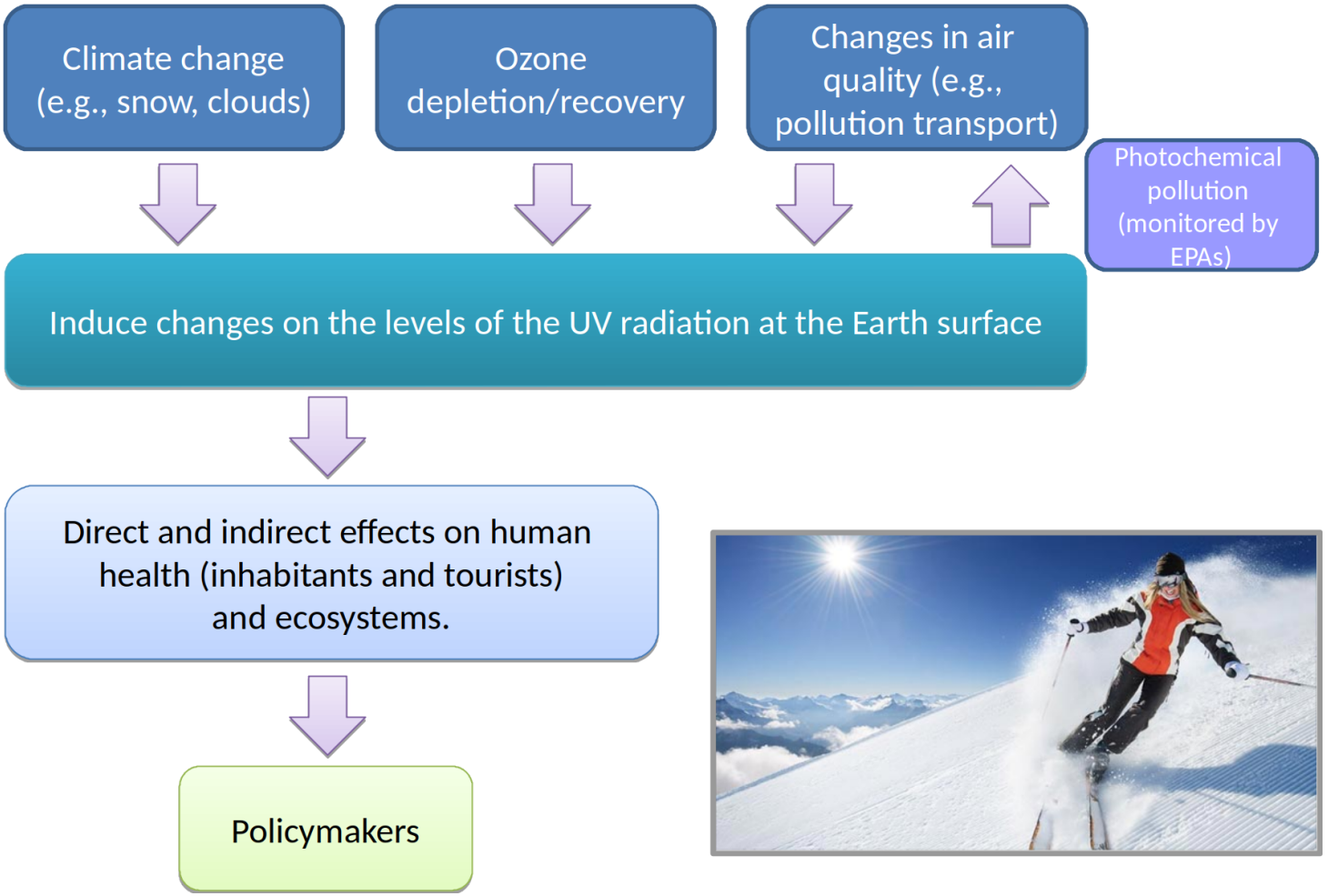


Fig. 1 Atmospheric composition is determined by the mixture of emissions to the atmosphere, transport within the atmosphere, and UV-B radiation. The key interactions determining the composition include (1) transport of ozone from the stratosphere, (2) emission of a wide range of substances from the ground, (3) transformation of material through the action of UV radiation (and particularly UV-B), and (4) mixing of the pollutants in the atmosphere. The resultant O_3 and aerosols, in turn, have impacts on human health (5) and plants (6).

Cambiamento climatico, ozono, radiazione UV e qualità dell'aria
Le attività di ARPA su radiazione solare e qualità dell'aria



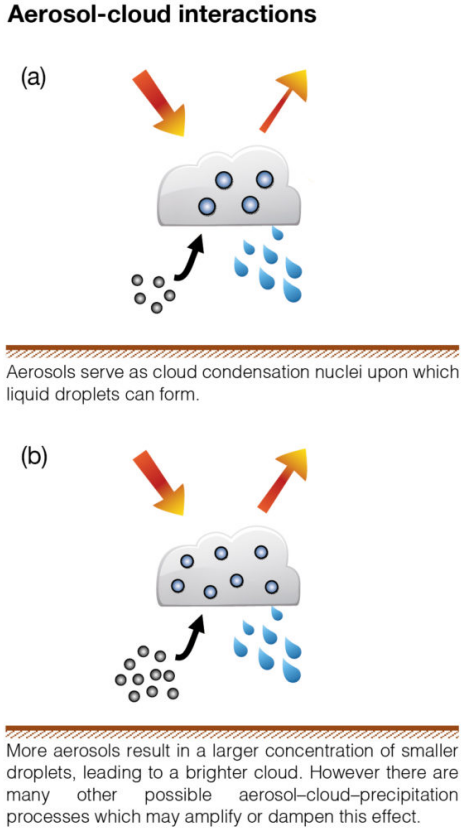
Cambiamento climatico, ozono, radiazione UV e qualità dell'aria
Le recenti attività di ARPA sull'aerosol trasportato dalla Pianura Padana

Air quality (effects on human health, ecosystems, etc.)

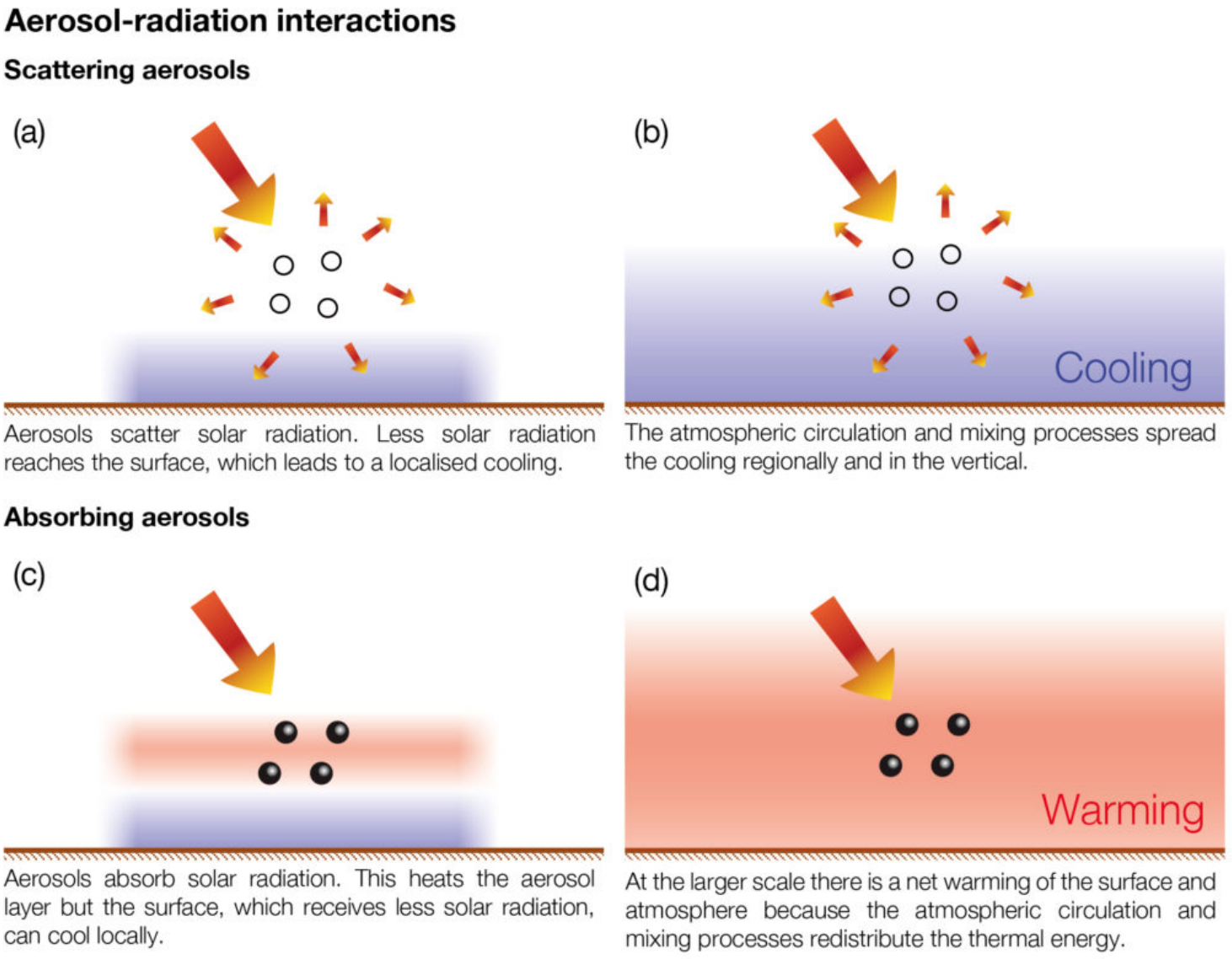
Direct/Indirect radiative effects (climate, weather forecasts, energy, etc.)

Loss of tourism revenues

Cambiamento climatico, ozono, radiazione UV e qualità dell'aria
Le attività di ARPA su aerosol e nubi



Cambiamento climatico, ozono, radiazione UV e qualità dell'aria
Le attività di ARPA sul black carbon



Cambiamento climatico, ozono, radiazione UV ed ecosistemi

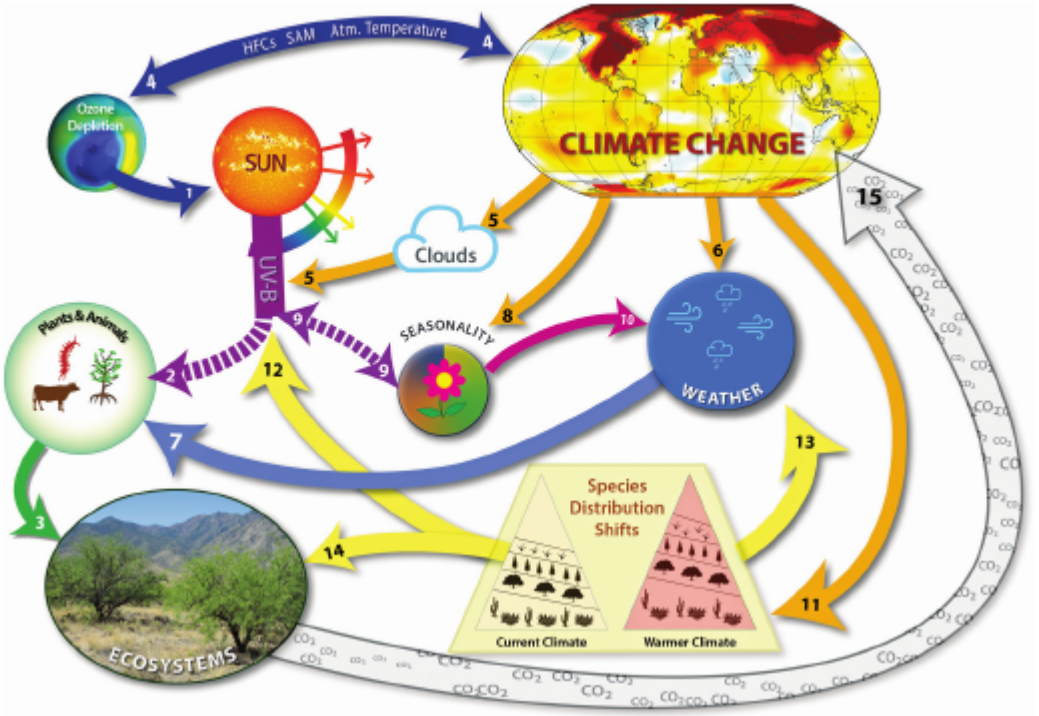


Fig. 1 Conceptual diagram illustrating known linkages between stratospheric ozone depletion, UV radiation and climate change on terrestrial organisms and ecosystems. Stratospheric ozone depletion alters UV radiation (primarily UV-B; arrow 1), which in turn directly affects plants and other organisms (arrow 2). The effects on organisms can then alter the function and structure of ecosystems (arrow 3). Ozone depletion can alter the climate, and climate change can affect ozone depletion *via* several avenues (arrow 4). Certain ozone-depleting substances (*e.g.*, hydrofluorocarbons (HFCs) and others) are potent greenhouse gases that can enhance global warming. Stratospheric ozone depletion in the southern hemisphere is directly altering climate *via* changes in the Southern Annular Mode (SAM) in addition to other climate changes. Resultant shifts in climate zones alter regional rainfall and drought and thereby change cloud cover; in turn, the changing cloud cover can increase or decrease exposures of organisms to UV radiation (arrow 5). Climate-related changes in weather patterns (arrow 6) alter temperature and precipitation patterns, which can directly modify plant growth and development, and the way in which plants respond to UV-B radiation (arrow 7). Climate change (including altered UV-B exposure) is also changing the seasonal timing of development (*e.g.*, phenology of flowering or bud break; arrow 8), such that wild plants and crops develop at times of the year when UV radiation can be either greater or less than was seen prior to current rapid climate change (arrow 9). These phenological changes further expose plants to novel combinations of UV radiation and other abiotic and biotic factors (arrow 10). In response to climate change many organisms are shifting their ranges to higher elevations and latitudes (arrow 11). As with phenological shifts, these changes in geographic ranges can potentially increase (elevation) or decrease (latitude) exposures to UV radiation (arrow 12), as well as subjecting organisms to new combinations of UV radiation and other abiotic factors (arrow 13). As species migrate to different environments they also encounter new combinations of competitors, pests and pollinators that may alter important ecosystem processes such as herbivory and competition (arrow 14). Alterations in certain ecosystem processes, such as decomposition, can modify soil carbon storage and emissions of carbon dioxide and other greenhouse gases to the atmosphere (arrow 15). Image of stratospheric ozone shows total ozone over Antarctica (October 2017, Source: hiips://ozonewatch.gsfc.nasa.gov/). Climate change map indicates surface temperature anomalies for February 2017 compared to the base-period of 1951–1980 (Source: hiips://data.giss.nasa.gov/). Sonoran desert ecosystem photograph by P. W. Barnes.