In this issue

Turbulence

Turbulence has presented a grand challenge to scientific community for many decades. Seemingly commonplace liquids and gases like water and air flow in a way that can be enormously complicated and can have effects that are striking like the swing of a fast cricket ball on a wet wintry day. The basic laws governing their motion describe conservation of momentum and mass in the framework of classical physics and they are of course well-understood. What comes as a surprise to many is the enormous difficulty in capturing the essential flow features numerically for flows under extremely simple boundary conditions. A. J. Basu *et al.* (**page 734**) present a bold calculation of an axisymmetric wake of a circular disc.

It is a notable example of scientific research driving technology development and benefitting from it. The calculation has been made possible due to the FLOSOLVER developed at NAL specifically for difficult yet important problems of fluid flows. It is in a class where supercomputing power is needed.

The calculation gives insight into how disturbances grow at moderate Reynolds number. In particular how streamwise vorticity, a local average indicator of fluid rotation, evolves in the wake after initial roll up and pairing of vortex rings. Similar calculations at higher Reynolds number would be possible with increasing computing power. What is heartening is that the supercomputing barrier imposed on certain countries can be penetrated, given, will, imagination skill and judgement.

Articles on ozone

There are three papers on atmospheric ozone in this issue.—Atmospheric ozone has, in recent years, become a matter of serious concern to both scientists and the general public alike. It has come to be accepted as an important atmospheric parameter for investigating the mechanisms of climate changes, whether they occur as a manifestation of natural variability or as a result of human activities. It was the discovery of the 'ozone hole' in the Antarctic spring in 1985 and the recently reported ozone depletion in the Arctic and in the high- and mid-latitudes in both hemispheres that led to greatly increased public interest and triggered considerable activity, both experimental and theoretical among scientists, as well as governmental action to control possible anthropogenic causes of climate change. After many meetings of various expert groups and the publication of several reports by the World Meteorological Organization (WMO) and the United Nations Environmental Programme (UNEP), a Convention for the Protection of the Ozone Layer was adopted in Vienna in 1985 and the Treaty of Montreal signed by 40 nations in 1987. Known as the Montreal Protocol the treaty was to freeze the production of ozone-destroying substances such as freons and halons to 1986 levels and then cut it by half by 1999. The Treaty has still to be signed by all countries producing and consuming freons and halons.

There are two schools of thought, one which ascribes the ozone loss entirely to ozone-destroying substances produced by man and the other to meteorological factors. The weight of observational evidence strongly suggests that both chemical agents and meteorological factors affect the ozone layer. The latest results demonstrate an undoubted chemical cause in the destruction of ozone by atmospheric chlorine but also point to special climatic conditions as the reason why depletion occurs so severely in the Antarctic and so little elsewhere. The 'ozone hole' has drawn attention to the spectacular way in which human activities can alter the Earth's environment and at a rate beyond human ability to reverse.

Dütsch (**page 701**) describes the pioneering work by Fabry and Buisson (1921), Dobson (1926–29), Götz (1931–34), Chapman (1930) and others in the early twenties and thirties, which established the existence and properties of the ozone layer and its causes. The advances in the observational knowledge of atmospheric ozone, especially from recent satellite measurements, are next described, followed by the modern photochemical theory of the production and destruction of ozone in the atmosphere. The 'ozone hole' in the Antarctic and its hemispheric consequences are dealt with dispassionately. The review concludes with a section on the possible causes of the northern mid-latitude ozone depletion.

In his review on the photochemistry of ozone, Wayne (**page 711**) concentrates on just one aspect of ozone photochemistry, that of photodissociation. The study of the vibrational photochemistry of ozone is another facet of interest which has emerged. He concludes by saying that as in all other aspects of atmospheric chemistry, laboratory studies are the key to quantitative interpretation of the atmospheric phenomena. In turn, the atmospheric observations provide a powerful stimulus to exciting and innovative laboratory investigations.

Edith Farkas (**page 722**) describes early ozone measurements in New Zealand during 1929–60, followed by those in the sixties and seventies, including some in the Antarctic. A study of long-term trends of total ozone showed significant decreases from 1975 to 1990. She does not rule out volcanic effects as a possible cause for the observed depletion.

We have also received other papers on ozone which will be published in due course.