ATLAS VIDEO

FACILITY

THE ATLAS VIDEO FACILITY

The Atlas Video Facility provides the equipment and expertise needed for producing animated sequences on video tape from computer models and experimental data; also for the reverse process of converting video input into computer data files.

Video animation provides a powerful tool for visualizing the significance of data, and can make a major contribution either to gaining insight into the process concerned, or as a highly effective teaching or presentation aid. It also has the advantage of considerable flexibility. Sequences can be recorded at any speed, or at several different speeds, even in reverse, and with interspersed or superimposed captions. A verbal or musical soundtrack, or some combination of the two, can be added. A single video may include all of these techniques.

There are many potential areas of application. For instance, it has been used already in Atmospheric Physics (studies of ozone depletion), Surgery (as a pre-operative aid), Materials Science (studies of damage propagation), and Ocean Modelling (study of ocean currents), among many others. Further potential fields include Economic or Financial modelling (the behaviour of markets) and the visualization of under-water or under-ground structures (for instance, topology of the ocean floor or geological structures over large areas).

The reverse procedure of accepting video film as input and converting it into computer files is also potentially of wide application. It offers the possibility, in particular, of transmitting video data over normal computer networks, or outputting it to CD-ROM.

Clients of the Atlas Video Facility are likely to vary greatly in the way they use the facilities. Some may have sets of still images already stored in a format suitable for animation; in this case our role would be to convert them into animated sequences on video tape using our suite of broadcast-quality equipment. Others may know only that they wish to convert their data into video form, but not know how best to proceed from that point; in that case we would in addition have a consultative and perhaps a data pre-processing role.

Charges for use of the Facility depend basically upon the resources needed. For straightforward production work, a firm quotation would normally be given. For work involving a significant amount of consultation or pre-processing of data, there would be a time-related or equipment-related additional charge, for which an approximate estimate would be given in advance. Extra consumables, such as extra copies of tapes, would be charged at cost.

Leaflets are available illustrating the potential of video animation in specific application areas, and there are video tapes containing extracts from past work in particular fields. This material can be sent on request, free of charge.

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EQUIPMENT AND SOFTWARE

TOPAZ2 COMPUTER

From Primagaphics Ltd, 1990. VME backplane. 2-D graphics hardware.
Tadpole TP32 processor board (with Motorola 68030, 33Mhz).
4 Mbytes onboard memory. Integral SCSI, Ethernet, RS232-C interfaces.
TV display controller, 24-bit framestore + 2 overlay planes. RGB output.
CCIR 601 board, converting RGB to and from YUV digital format as stored on Abekas video disk.
Unix-based system. Shared files with TOPAZ3 and Atlas filestore (via NFS).

TOPAZ3 COMPUTER

Supplied by Primagraphics Ltd, 1993. 3-D graphics hardware.
Based on Silicon Graphics Indigo but with VME backplane and extra Primagraphics boards.
MIPS 3000 processor, 36 Mhz. 32 Mbytes onboard memory.
Silicon Graphics Elan V board set, with full colour 3-D graphics.
Primagraphics boards include JPEG compression and 64 Mbytes RAM holding 90 secs compressed video.
SCSI, RS-232-C, Ethernet and FDDI interfaces. 5 Mbytes/sec VME-VME link to TOPAZ2.
Unix-based system. Shared files with TOPAZ2 and Atlas filestore (via NFS).
Public domain software includes URT and PBMplus. Packages include AVS and Explorer.

ABEKAS A60 DIGITAL DISK RECORDER

Stores up to 750 frames of video in CCIR 601 digital YUV format.
Allows playback forward and reverse, random access, variable speeds.
Digital video input from and output to TOPAZ2. Output in RGB or YUV available.
Ethernet interface.

PIONEER VDR-V1000P VIDEODISC RECORDER

Magneto-Optical recording/playback system with laser light source. Random access, variable speeds.
Removable 30 cm disc cartridges, each holding 48,000 frames (32 mins).
RGB, YUV, composite and audio analogue inputs and outputs.
Disc format: YUV with timebase compression for video; PCM for audio.
Dual heads allowing instantaneous switching during playback.

SONY VO-5850P U-matic VIDEOCASSETTE RECORDER with LYON LAMB ANIMATION CONTROLLER

Used for producing master tapes until superseded recently by Betacam SP. Analogue composite recording format.

SONY BETACAM SP VIDEOCASSETTE RECORDER

Broadcast-quality cassette tapes with up to 100 minutes recording time.
High-speed searching, forwards and reverse.
Separate video and audio editing, including advanced automatic editing facilities.
Recording in component (YUV) format. YUV, S-Video or composite inputs and outputs.

OTHER EQUIPMENT

Panasonic WJ-MX50 mixer for special effects. Four audio/video inputs.
JVC TK-1280 and TK-1070 cameras.
Audio equipment, including mixer, microphones and speakers.
Colour monitors, mainly JVC VMR-150 and TM-10.
Panasonic AG-7350 VHS and S-VHS videocassette recorder.
Abekas Cox PAL Encoder. Vortex PAL Decoder.
EV Waveform Monitor and Vectorscope.
Video-Logic Mediator.
Acron Synchronising Pulse Generator.
GPT Teleconferencing Codec.
JVC CD-ROM writer. Technics CD player.

HISTORY OF ATLAS VIDEO FACILITY

1987 Designed.
1988 (March) Commissioned with TOPAZ1 system, PAL Encoder, Lyon Lamb, SPG, U-matic and VHS VCRs.
1989 Memory and disk upgrades. Waveform monitor and vectorscope added.
1990 Much faster TOPAZ2 replaces TOPAZ1. Abekas video disk and other items added.
1993 TOPAZ3 added, allowing fast on-line 3-D graphics and JPEG compression. FDDI and Codec added.
1994 Betacam SP videocassette recorder, Pioneer videodisc and CD-ROM writer added.

CONTACT

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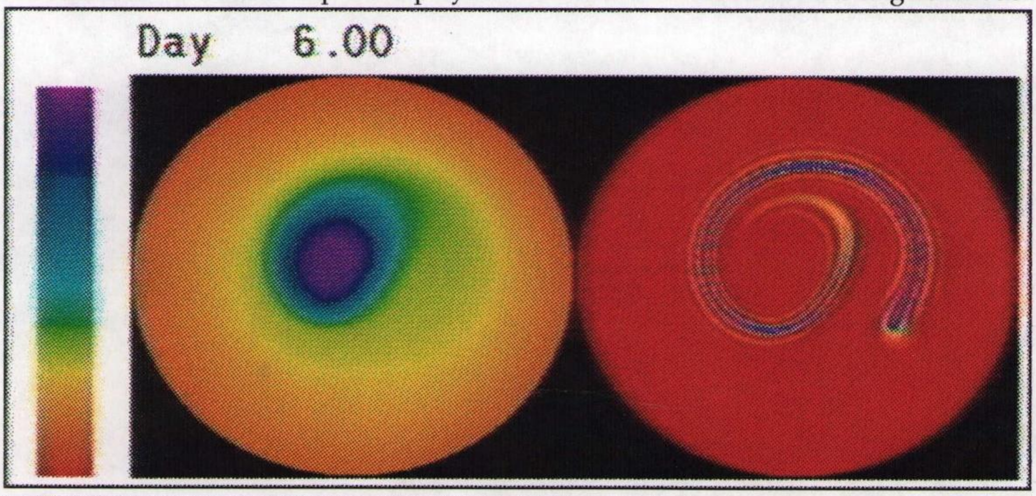
ATMOSPHERIC PHYSICS

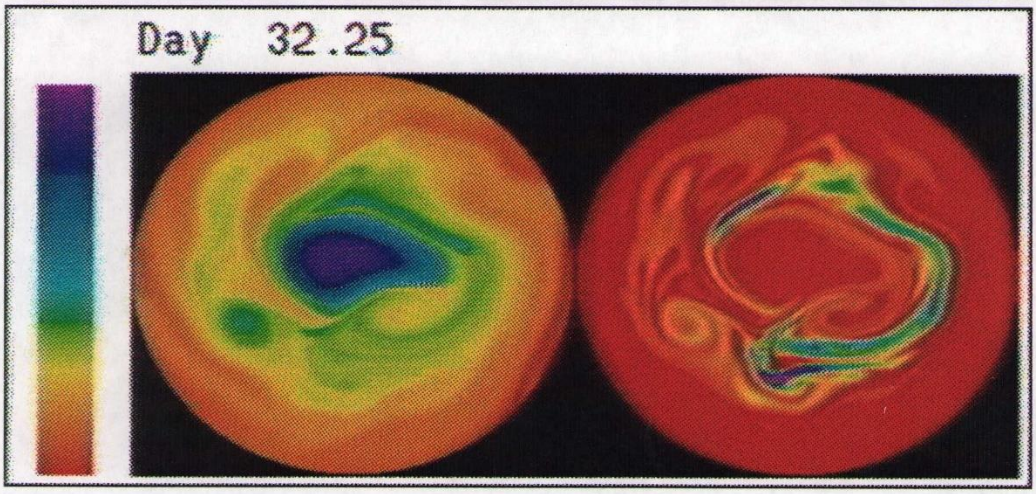
As part of the UK Universities Global Atmospheric Modelling Programme (UGAMP), the movement of CFC gases in one hemisphere of the Earth was simulated in a computer model for periods of up to 100 days.

The effect of releasing a cloud of CFCs at different places (pole, equator, and 45 degrees latitude) was then studied by feeding the necessary parameters into the model.

Conversion of the results into the form of colour-coded animated video sequences allowed the effects to be observed in a very immediate and graphic form. With a viewpoint vertically above the pole, looking down on the entire hemisphere, the viewer has the impression of watching the movement of the gases taking place, with a period of many days condensed into a sequence lasting less than a minute.

Production of the video sequences played a role in the refinement of the original model.





Simulation created and run by participants in UGAMP.

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METEOROLOGY

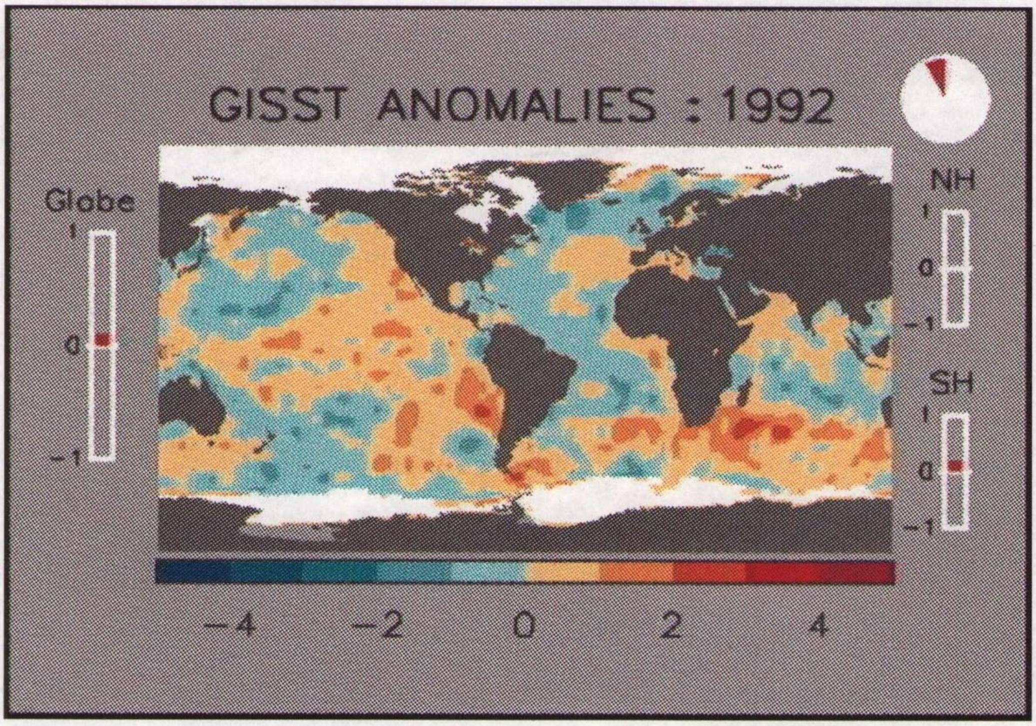
Staff at the Meteorological Office wanted to study global ice and sea surface temperatures (GISST) collected for many years by ships and recently by orbiting satellites.

From the data, they calculated the mean sea surface temperature for a given month of the year in each region of the ocean, and produced a computerised map for every month since 1871 showing deviations from the mean. These were depicted by colours ranging from deep blue (several degrees below the mean) to deep red (several degrees above). Each map also contained an indicator showing the amount of any global anomaly, and similar indicators for the two hemispheres separately.

They wished to be able to view the set of 1,464 maps as a continuous video sequence at different speeds, to see if this would suggest any long-term trends such as changes in ocean currents or global warming or cooling.

A video was produced at the Atlas Video Facility, showing the whole sequence at two speeds on the same tape: one month per second and then three months per second.

This is an example of a video based on physical measurements stored on computer rather than on a computer simulation. The data was supplied by the Hadley Centre at the Met Office; animation by the Hadley Centre and Atlas Video Facility.



Frame shown is for the twelfth month of 1992, as indicated by the clock at top right.

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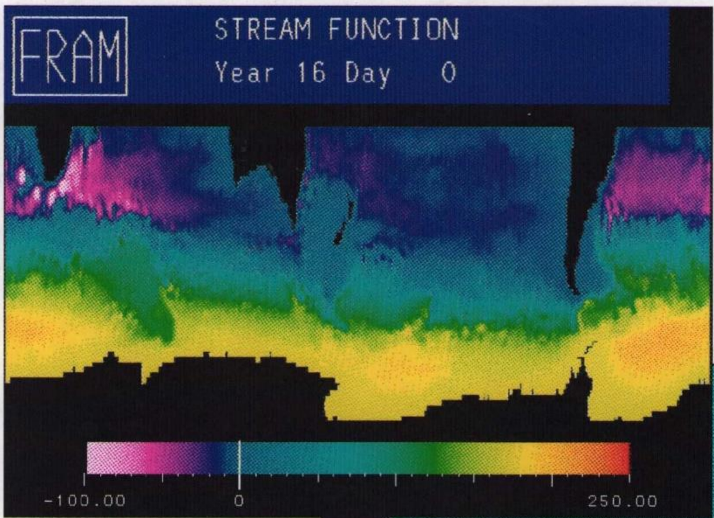
OCEANOGRAPHY

In the 'FRAM' project, the task was to create a large-scale simulation of the behaviour of the oceans around Antarctica and up to latitude 24 degrees South.

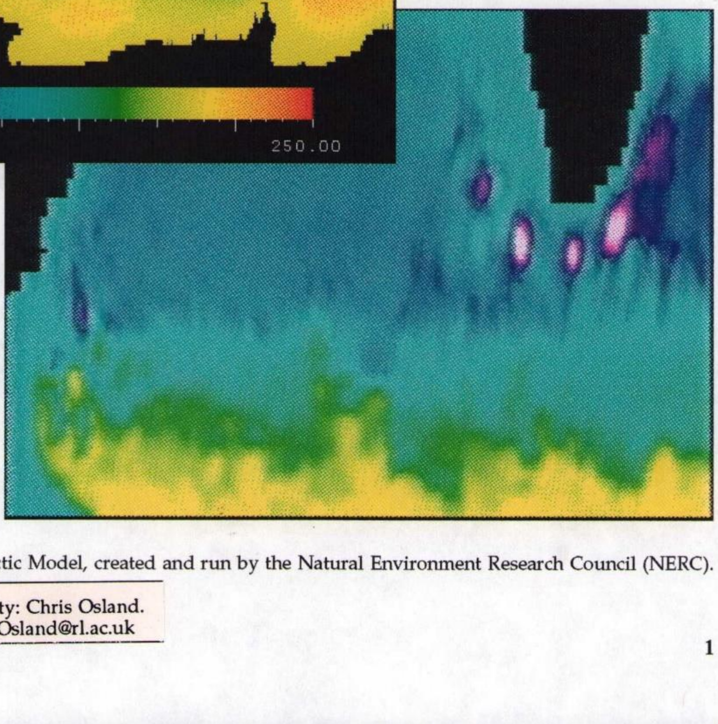
The model was concerned with the temperature, salinity and flow of the water, and involved the evaluation of parameters at up to 32 depths. The simulation covered a period of 16 years, requiring about 9,000 hours of processing (roughly one year of computer time) on a Cray X-MP supercomputer. It produced enormous quantities of data.

To obtain direct visual insight into some aspects of the model, a number of animated sequences on videotape were produced, including 'close up' views of areas of special interest such as the South Atlantic and Drake's Passage. The animations showed clearly, among other things, that there was a gradual movement of eddies of warmer water around the coast of South Africa from East to West with the Agulhas current and up into the Atlantic Ocean.

The final version of the tape totalled about 40 minutes of video, and extracts were shown at the international geophysics conference in Vienna in 1991.



Full view of Southern Ocean



Flow round South Africa

'FRAM' : The Fine Resolution Antarctic Model, created and run by the Natural Environment Research Council (NERC).

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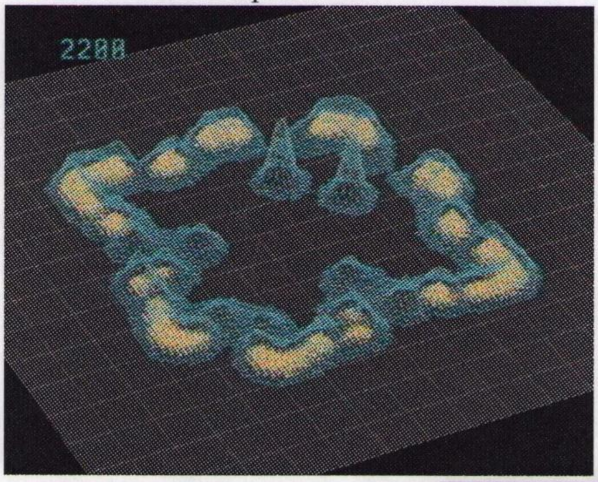
POPULATION MODELLING

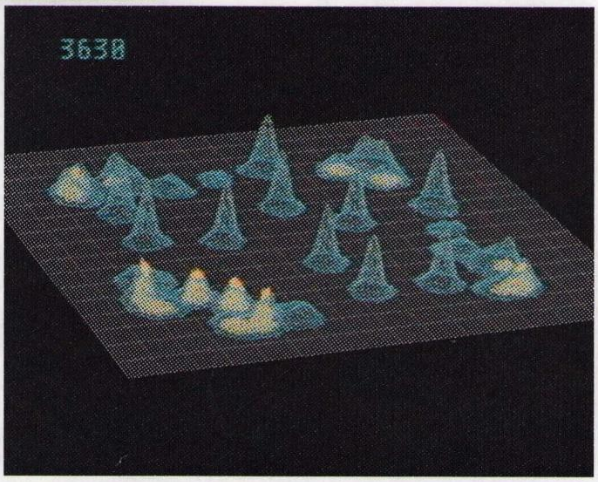
The model underlying this exercise is one that may be appropriate for a variety of Economic or Financial simulations, including the behaviour of markets.

In this case, the simulation envisages a population of rabbits coexisting with foxes in a grass-covered environment, with no external interference. The assumptions are that rabbits eat only grass; grass re-grows at a finite rate; foxes eat only rabbits; both species have limited mobility; and the reproduction rate of each species depends on its numbers at any given time. The fox population is shown in yellow, the rabbit population in blue.

The actual equation used, and the initial conditions, determine in detail what happens when the model is set 'in motion'. But this type of model is applicable in principle to any system that might be expected to behave as a finite state automaton.

The advantage of video animation here is that it provides the clearest possible means of visualising what is going on and allows the whole sequence or any part of it to be re-run as often as required.





Equation by P M Allen and M Lesser. Simulation run at NASA Goddard Center by J Corliss and M Lesser.

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SURGERY

As a pre-operation aid for neurosurgeons, Guy's Hospital in London wanted to be able to rotate a three-dimensional image of the brain and skull of a patient, viewing it from different angles.

They produced three separate scans: a CT scan showing the skull, and two MRI scans showing blood vessels and the outline of a tumour that was to be operated on. Computer staff at UMDS then combined the three scans with great precision to form a composite image, displaying the skull predominantly in white, the blood vessels in red and the tumour in green.

Three sets of video sequences were produced at the Atlas Video Facility from their data. Each sequence showed the whole image or a section through it moving gently back and forward through a small angle to emphasize the 3-D effect, or in some cases being cut away in imitation of the surgical procedures.

A full view

A sectional view

'UMDS' : United Medical and Dental Schools of Guy's and St. Thomas's Hospitals.

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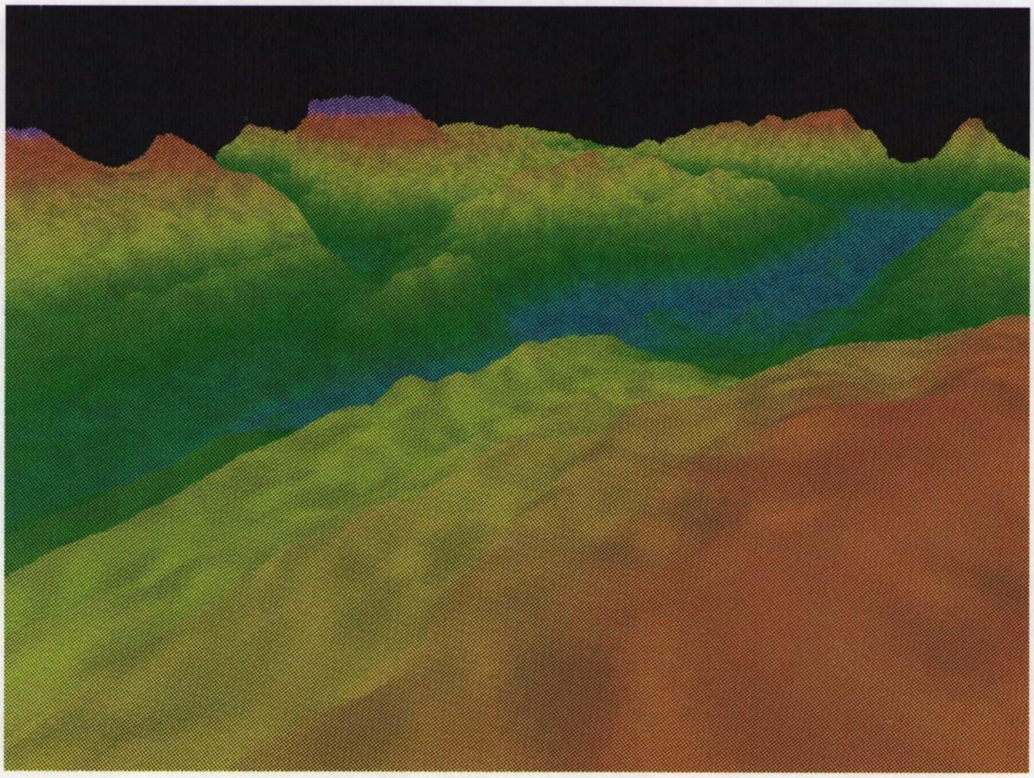
UNDER-WATER EXPLORATION

In this project, the profile of the ocean floor was to be mapped over an area of 100 km by 100km in the Indian Ocean, where there is a junction of three tectonic plates.

The data consisted of depth measurements collected by acoustic sensors in a towed underwater vehicle. The measurements were subsequently processed on a supercomputer to produce 2-D colour-coded images and finally a set of 3-D perspective views seen from over 700 points along an imaginary flight path.

When this succession of still pictures is used to create an animated sequence, the viewer is given the illusion of taking a flight over the terrain, with peaks and valleys visible as if through a cockpit window. The resulting video lasts almost half a minute, and gives a vivid impression of the profile of the ocean floor over a large area.

The 'imaginary voyage' or 'virtual reality' approach can probably be adapted for more detailed under-water or under-ground surveying. The basic idea is to show the viewer what is there by direct visual means, in an environment in which normal filming techniques are not possible.



Animation commissioned by NERC. Data supplied by the IOS Deacon Laboratory.

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