

Planet Earth

Blue Planet

- 1 02:02:12:28 CAPTIONING IS MADE POSSIBLE BY THE ANNENBERG/CPB PROJECT
- 2 02:02:16:27 IN THE VAST REACHES OF SPACE, THERE ARE PERHAPS 100 BILLION GALAXIES, WITHIN THE SPIRAL ARMS OF OUR OWN MILKY WAY, 400 BILLION STARS.
- 3 02:02:29:27 SPINNING ROUND OUR SUN ARE HARD AND FROZEN PLANETS, WORLDS OF SWIRLING, POISONOUS GAS AND WORLDS WHOSE ROCKY SURFACES ARE BARREN AND DEAD.
- 4 02:02:41:13 LIFE BECOMES POSSIBLE WITH PRECIOUS LIQUID WATER, AND IT IS ABUNDANT ON JUST ONE PLANET, THE BLUE PLANET CALLED EARTH.
- 5 02:02:56:13 PERHAPS IT SHOULD BE CALLED PLANET OCEAN, FOR LESS THAN 1/3 OF ITS SURFACE IS ABOVE WATER.
- 6 02:03:05:05 BENEATH ITS CHARTED WAVES IS AN AMAZING WORLD OF CONSTANT MOTION, SHIMMERING LIGHT, AND LIQUID DARKNESS, HOME TO CREATURES GREAT AND SMALL.
- 7 02:03:21:27 IN ITS DEPTHS ARE THINGS NEVER BEFORE SEEN, NEVER IMAGINED.
- 8 02:03:27:27 TO STUDY THE OCEANS OF PLANET EARTH, SCIENCE MUST VENTURE BEYOND THE SHORE AND BENEATH THE WAVES.
- 9 02:03:36:27 NEW TECHNOLOGIES TAKE RESEARCHERS TO DEEP FRONTIERS AND HIGH INTO SPACE TO GAZE UPON THE GLOBAL OCEAN.
- 10 02:03:46:28 WITH ELECTRONIC EYES, THEY EXPLORE DISTANT REALMS.
- 11 02:03:50:13 SCIENTISTS AND THEIR MACHINES OF EXPLORATION HAVE OPENED A WORLD OF FASCINATING CONNECTIONS.

- 12 02:03:58:12 SATELLITES IN SPACE CAPTURE THE SEAS IN NEW DIMENSIONS AND COLOR THE FLOW OF A POWERFUL CURRENT SAILORS TRY TO CROSS.
- 13 02:04:09:15 RESEARCHERS PROBE THE OCEAN'S INTERIOR WITHOUT EVER GOING THERE.
- 14 02:04:16:12 A TROPICAL REEF IN PANAMA IS LINKED TO A DEVASTATING DROUGHT IN INDIA.
- 15 02:04:25:13 AND A DIVE TO THE SEAFLOOR BECOMES A JOURNEY BACK IN TIME TO FRIGID BLACKNESS.
- 16 02:04:33:12 WHERE LIFE SHOULD NOT EXIST, STRANGE CREATURES DEFIANTLY SURVIVE.
- 17 02:04:37:27 IN AN OCEAN ANCIENT AND DEEP IS A WORLD NEWLY DISCOVERED, A PLACE OF WONDER THAT COULD ONLY EXIST HERE ON THE BLUE PLANET CALLED EARTH.
- 18 02:05:26:22 Annenberg Media
- 19 02:05:30:06 §
- 20 02:05:37:28 IBM IS PROUD TO SUPPORT THE SPIRIT OF SCIENTIFIC DISCOVERY THAT MADE THIS SERIES POSSIBLE.
- 21 02:05:43:26 *IGNITION SEQUENCE. STARTED .*
- 22 02:05:45:11 *ALL ENGINES ARE STARTED .*
- 23 02:05:47:13 *WE HAVE IGNITION .*
- 24 02:05:48:27 *2, 1, 0... WE HAVE A LIFTOFF .*
- 25 02:05:52:01 *WE HAVE A LIFTOFF .*
- 26 02:05:53:28 *IT'S LIGHTING THE AREA LIKE DAYLIGHT -- THE SPACE SHUTTLE CHALLENGER ASCENDS FROM FLORIDA'S CAPE CANAVERAL.*
- 27 02:06:01:14 IN MINUTES, IT WILL BE HIGH ABOVE THE PLANET, SAILING THE SEAS OF OUTER SPACE.
- 28 02:06:09:01 *OK, YOU'RE LAUNCHED -- CHALLENGER CARRIES RESEARCHERS INTO ORBIT IN AN UNPRECEDENTED ERA OF DISCOVERY.*

- 29 02:06:16:12 *WE'VE BEEN OBSERVING OCEANS ON THE FLIGHT .*
- 30 02:06:20:07 PAUL SCULLY-POWERS, THE FIRST OCEANOGRAPHER TO WITNESS THE VIEW FROM ORBIT, JOINS THE ASTRONAUTS AND MISSION SPECIALISTS.
- 31 02:06:29:13 HE OBSERVES AND PHOTOGRAPHS LARGE MASSES OF SPINNING WATER CALLED EDDY FIELDS.
- 32 02:06:35:12 THEY SHOW UP IN THE LOW-ANGLE SUNLIGHT AS GOLDEN FILIGREE ON THE OCEAN'S SURFACE, 190 MILES BELOW.
- 33 02:06:44:12 EDDIES ARE USUALLY FOUND CLOSE TO MAJOR CURRENTS.
- 34 02:06:48:12 ONLY RECENTLY DISCOVERED IN THE OPEN OCEANS, THESE EDDIES AREN'T FULLY UNDERSTOOD.
- 35 02:06:54:12 THEY MAY COIL AND UNCOIL LIKE GIANT SPRINGS, STORING AND RELEASING HUGE AMOUNTS OF ENERGY.
- 36 02:07:02:00 ABOARD THE SHUTTLE, SCULLY-POWERS MAKES THE FIRST OCEANOGRAPHIC REPORT FROM SPACE.
- 37 02:07:07:20 *THE NATIONAL CREWS HAVE BROUGHT BACK PHOTOS OF THE OCEAN FROM SPACE WHICH CAPTURE SMALL AREAS, BUT WHEN YOU COME UP HERE, YOU SEE THOSE SMALL AREAS AND THEIR DYNAMICS ARE INTERRELATED .*
- 38 02:07:24:12 *FOR EXAMPLE, THE MEDITERRANEAN IS ONE VAST EDDY FIELD .*
- 39 02:07:29:05 *FROM THIS ALTITUDE, YOU CAN LOOK DOWN THE MEDITERRANEAN AND SEE THE INTERCONNECTIONS .*
- 40 02:07:35:13 *PROBABLY THE BEST WAY OF DESCRIBING IT IS INTEGRATING THE PIECES OF KNOWLEDGE WE'VE HAD INTO ONE BIG PICTURE OF THE OCEANS .*
- 41 02:07:46:27 FOR EARTHBOUND OCEANOGRAPHERS, A PICTURE OF THE GLOBAL OCEAN IS A GREAT MILESTONE.
- 42 02:07:53:13 THE INTERPLAY OF ITS MANY PARTS IS NOW VIEWED FROM A TOTALLY NEW PERSPECTIVE.

- 43 02:08:00:14 AT THE SURFACE, THERE ARE FEW CLUES TO WHAT IS HAPPENING BENEATH THE WAVES, BUT RECENT DISCOVERIES HAVE REVEALED A LINK BETWEEN WEATHER AND THE MOVEMENT OF THE SEAS.
- 44 02:08:14:28 AS LONG AGO AS THE 16th CENTURY, LEONARDO DA VINCI COMPARED THE BEHAVIOR OF EARTH'S ATMOSPHERE TO WATER IN MOTION.
- 45 02:08:24:11 "MOVEMENTS OF THE WIND "RESEMBLE THOSE OF WATER.
- 46 02:08:28:13 "AIR MOVES LIKE A RIVER, "CARRYING THE CLOUDS WITH IT, "JUST AS RUNNING WATER CARRIES ALL THINGS THAT FLOAT UPON IT." NOW, CENTURIES LATER, EVENTS IN THE SEAS ARE THOUGHT TO BE STRIKINGLY SIMILAR TO THOSE IN THE ATMOSPHERE.
- 47 02:08:59:13 THEORIES DESCRIBE LIQUID STORMS THE SIZE OF HURRICANES AND OCEANIC TORNADOES CHURNING THE DEEP.
- 48 02:09:08:28 THE LIQUID OCEAN IS DENSE AND MOVES MORE SLOWLY THAN THE AIRY ATMOSPHERE, BUT ITS WATERS ARE IN CONSTANT MOTION.
- 49 02:09:18:28 THERE IS WEATHER IN THE SEA.
- 50 02:09:21:27 A LANDLOCKED MOUNTAINTOP OVERLOOKING BOULDER, COLORADO, IS THE SITE OF INNOVATIVE STUDIES, THE NATIONAL CENTER FOR ATMOSPHERIC RESEARCH.
- 51 02:09:35:13 HERE, COMPUTERS AMONG THE MOST POWERFUL IN THE WORLD SIMULATE THE COMPLEX BEHAVIOR OF THE EARTH'S ATMOSPHERE AND OCEANS.
- 52 02:09:45:00 IT LOOKS LIKE WE SCANNED THROUGH THIS TOO QUICKLY TO MY EYE.
- 53 02:09:50:27 OCEANOGRAPHER BILL HOLLAND COLLABORATES WITH METEOROLOGIST RICHARD GROTHJAHN ON AN UNUSUAL EXPERIMENT.
- 54 02:09:57:12 SCIENTISTS HAVE USED THE COMPUTER TO CREATE TWO-DIMENSIONAL MODELS, BUT THEY WANT TO SEE THE OCEAN AS IT IS, IN THREE DIMENSIONS.

- 55 02:10:08:13 IT WOULD BE AWFULLY NICE TO MAKE A THREE-DIMENSIONAL VERSION.
- 56 02:10:13:15 AN OCEANIC SCIENTIST USES A COMPUTER PROGRAM DEVELOPED TO MODEL THE ATMOSPHERE.
- 57 02:10:19:10 HOLLAND EXAMINES A CUBE OF THE GULF STREAM AS IF LIFTED OUT OF THE SEA.
- 58 02:10:26:26 AS A JET STREAM MOVES ACROSS THE SKY, THE BODY OF THE WARM CURRENT RIDES OVER THE SURROUNDING WATER.
- 59 02:10:35:25 SWIRLING WATER PEELS OFF THE STREAM.
- 60 02:10:38:25 THESE ARE THE EDDIES.
- 61 02:10:40:26 AS THEY SPIN AND CORKSCREW DOWNWARD, SOME PLUNGE THOUSANDS OF FEET TO THE SEAFLOOR.
- 62 02:10:48:11 THE COMPUTER-CREATED VIEW OF THE GULF STREAM IS UNIQUE, BUT THE MOVEMENT OF ITS CURRENT IS NOT.
- 63 02:10:57:13 IT IS BUT ONE OF SEVERAL OCEAN-BORN PHENOMENA THAT ARE LIKE THE WEATHER ON LAND.
- 64 02:11:04:27 AQUATIC VERSIONS OF WEATHER CROSS THE OCEAN IN INTERNAL WAVES.
- 65 02:11:09:23 BENTHIC STORMS AND HURRICANES SCOUR THE DEEP.
- 66 02:11:15:10 A SPINNING EDDY IN THE SEA IS STRANGELY LIKE A TORNADO IN THE ATMOSPHERE.
- 67 02:11:33:26 THE POWER OF THE COMPUTER ENABLES US TO SEE THE DEPTHS OF THE OCEAN AS NEVER BEFORE AND HAS UNVEILED AN INTERIOR MORE TURBULENT AND MOBILE THAN EVER IMAGINED.
- 68 02:11:48:17 LIKE PLAITED RIBBONS FLUTTERING IN THE BREEZE, THE GULF STREAM ARCS ACROSS THE NORTH ATLANTIC.
- 69 02:11:55:25 IT CARRIES NEARLY 100 TIMES THE WATER OF ALL THE WORLD'S RIVERS COMBINED.

- 70 02:12:02:12 THE GULF STREAM IS PROBABLY THE MOST STUDIED PIECE OF OCEAN IN THE WORLD.
- 71 02:12:09:13 THE STORY OF ITS DISCOVERY IS TIED TO COLONIAL AMERICA.
- 72 02:12:14:10 THE GULF STREAM'S FIRST CHART WAS MADE BY POSTMASTER GENERAL BENJAMIN FRANKLIN TO HELP SPEED MAIL FROM ENGLAND.
- 73 02:12:22:28 IT TRACED THE CURRENT'S PATH UP NORTH AMERICA AND ACROSS THE ATLANTIC.
- 74 02:12:28:27 FRANKLIN EXPLAINED HOW WESTWARD SAILING SHIPS SHOULD AVOID THE CURRENT, WHILE THOSE TRAVELING EASTWARD COULD BENEFIT FROM IT.
- 75 02:12:37:28 HIS MAP WAS REMARKABLY ACCURATE, BUT IT WOULD TAKE OVER 200 YEARS BEFORE ANOTHER CHART CAPTURED ITS TRUE NATURE.
- 76 02:12:47:22 UNIVERSITY OF MIAMI RESEARCHERS PRODUCE IMAGES OF THE GULF STREAM MORE DETAILED THAN FRANKLIN COULD HAVE IMAGINED.
- 77 02:12:55:27 USING COMPLEX COMPUTER PROGRAMS, OTIS BROWN AND BOB EVANS RECORDED THE STREAM'S COURSE OVER SEVERAL MONTHS.
- 78 02:13:06:14 THEIR INFORMATION IS GATHERED IN SPACE.
- 79 02:13:09:13 SENSORS ON ORBITING SATELLITES READ THE SURFACE TEMPERATURES OF THE WATER FAR BELOW.
- 80 02:13:15:28 THE WARM WATERS OF THE GULF STREAM ARE MARKED YELLOW, MEANDERING ALONGSIDE THE COOLER BLUE WATERS OF THE NORTH ATLANTIC.
- 81 02:13:25:26 SPINNING LIKE A TOP, WATER BREAKS OFF, FORMING EDDIES NORTH AND SOUTH OF THE STREAM.
- 82 02:13:33:13 THE GULF STREAM IS A WARM RIVER WITH CONSTANTLY CHANGING BANKS.
- 83 02:13:38:28 THE PUSH OF ITS CURRENT AND SPIN OF ITS EDDIES CAN HELP OR HINDER ALL WHO TRY TO CROSS IT.

- 84 02:13:48:27 EVERY TWO YEARS, CRUISING YACHTS RACE TO BERMUDA FROM THE CAPE COD TOWN OF MARION, MASSACHUSETTS.
- 85 02:13:57:07 HERE WE GO.
- 86 02:13:59:16 WE'RE CRAWLING UP ON THEM.
- 87 02:14:02:02 8 KNOTS TO BERMUDA.
- 88 02:14:03:28 WE'LL BE THERE EARLY.
- 89 02:14:05:26 IT IS ONE BOAT'S MAIDEN VOYAGE.
- 90 02:14:08:24 THE *REPLIQUE*'S CAPTAIN AND CREW NEED ALL THEIR SKILL AND KNOWLEDGE OF THE STREAM TO GET TO BERMUDA FIRST.
- 91 02:14:17:27 THE BOATS BEGIN A FOUR-DAY ORDEAL TAKING THEM ACROSS SOME OF THE MOST DIFFICULT WATER IN OPEN OCEAN RACING.
- 92 02:14:29:12 AT THE WORLD WEATHER CENTER, A CLOSE WATCH IS KEPT ON THE GULF STREAM.
- 93 02:14:36:14 JENNIFER CLARK OF THE NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION RECEIVES SATELLITE MAPS AND PLOTS THE STREAM'S MOVEMENTS.
- 94 02:14:44:28 SHE DRAWS THE RACE COURSE AND ADDS SPECIAL INFORMATION FOR THE RACING FLEET IN HER REGULAR REPORTS.
- 95 02:14:53:12 THESE BULLETINS ARE IMPORTANT TO ALL SHIPS, ESPECIALLY TO CAPTAINS OF BOATS BOUND FOR BERMUDA.
- 96 02:15:01:00 THE STREAM CONTAINS A DEEP LOOP THAT DOUBLES BACK ON ITSELF.
- 97 02:15:06:14 A BOAT MANEUVERING ON THE CURRENT'S DOWNRIVER SIDE GETS AN EXTRA KICK TOWARD ITS DESTINATION.
- 98 02:15:14:11 THOUGH SHE IS HUNDREDS OF MILES AWAY, HER MAPS AND RADIO BULLETINS ARE THE RACERS' ONLY HELP.

- 99 02:15:30:28 IN THIS RACE, RULES OF SPORTSMANSHIP PROHIBIT USE OF ELECTRONIC NAVIGATION.
- 100 02:15:36:07 THE YACHTSMEN CALCULATE THEIR POSITION USING RADIO REPORTS AND THE SEXTANT, THAT CENTURIES-OLD TOOL OF MARINERS.
- 101 02:15:44:05 STILL MANY MILES FROM THE STREAM, EACH CAPTAIN MUST DECIDE HIS STRATEGY AND CHOOSE HIS COURSE.
- 102 02:15:51:28 AND THERE'S OUR PLOT.
- 103 02:15:54:11 WE'RE COMING INTO THE EDDY.
- 104 02:15:56:27 WE'LL GET THE REVERSE SIDE AND GET PUSHED.
- 105 02:16:01:02 WE COULD MISS IT.
- 106 02:16:04:04 THE CAPTAIN AND NAVIGATOR GAMBLE.
- 107 02:16:06:24 THEY RIDE THE STREAM AS LONG AS THEY CAN, PERHAPS CATCHING AN ADDITIONAL PUSH FROM AN EDDY'S SPIN.
- 108 02:16:15:28 OTHERS WILL TRY A DIFFERENT STRATEGY, TAKING THE SHORTEST COURSE ACROSS THE CURRENT.
- 109 02:16:22:02 LOOK AT THOSE CLOUDS NEAR THE SUN.
- 110 02:16:25:12 TELL-TALE CLOUDS ARE A SIGN THAT THEY ARE NEAR THE "RIVER IN THE SEA." TEMPERATURE READINGS CONFIRM THIS.
- 111 02:16:34:26 WE'RE ABOUT 25 1/2 DEGREES CELSIUS.
- 112 02:16:37:22 THAT'S IT.
- 113 02:16:39:26 THAT'S THE GULF STREAM.
- 114 02:16:42:28 IT'S WORTH IT JUST FOR THAT.
- 115 02:16:46:03 IN THE STREAM, THE CREW OF THE *REPLIQUE* IS CONFIDENT THE PUSH OF 3 KNOTS WILL GET THEM TO BERMUDA FIRST.
- 116 02:16:55:28 § WAY, WAY UP SHE RISES EARLY IN THE MORNING §§ THE GULF STREAM AND ITS EDDIES ARE EVER CHANGING, AND NOT ALL CHANGES APPEAR ON THE

- SATELLITE MAPS.
- 117 02:17:07:29 JOE, HAS THAT 2356Z SATELLITE PICTURE COME IN?
- 118 02:17:11:26 YES.
- 119 02:17:13:00 A WARM CORE EDDY NORTH OF THE STREAM IS VISIBLE FROM SPACE.
- 120 02:17:18:16 SOUTH OF THE STREAM, COLD RINGS BREAK OFF AND SLOWLY SINK.
- 121 02:17:24:03 ONCE THEY SINK, THEY ARE INVISIBLE TO THE SATELLITE.
- 122 02:17:29:07 *GULF STREAM COORDINATES, NORTH WALL 100 MILES EAST..*
- 123 02:17:33:17 THOUGH THE WIND STILL BLOWS AND THE PROW SEEMS TO CUT THE WAVES, IT IS AN ILLUSION.
- 124 02:17:42:07 SOMETHING UNSEEN SLOWS THE *REPLIQUE'S* PROGRESS.
- 125 02:17:46:27 FROM THIS POSITION HERE, WE'RE AT LEAST 20 MILES BACK.
- 126 02:17:51:28 MY EARLIER SITE MUST HAVE BEEN CORRECT.
- 127 02:17:55:13 SOMETHING IS PUSHING US BACKWARDS.
- 128 02:17:57:27 < I DON'T KNOW.
- 129 02:17:59:26 I DON'T REALLY KNOW.
- 130 02:18:02:05 THERE ARE POWERFUL CURRENTS OUT HERE THAT CAN'T BE TRACKED.
- 131 02:18:07:04 AREN'T THEY STREAM-INDUCED?
- 132 02:18:09:04 THE STREAM IS A RIVER IN THE OCEAN.
- 133 02:18:12:13 THEY'RE ALL RELATED TO THE STREAM.
- 134 02:18:15:13 WHAT IT COULD BE IS BELOW THE SURFACE THERE'S A COLD EDDY, AND THE SURFACE TEMPERATURES WOULDN'T RECORD IT.
- 135 02:18:24:13 IF IT'S DOWN 5 FEET, IT COULD SET US BACK.

- 136 02:18:28:28 YOU'RE SAYING WE NEED A TWO-FOOT-DRAFT BOAT?
- 137 02:18:34:12 THE CREW'S FRUSTRATION MOUNTS AS THEIR CHANCES OF WINNING DECLINE.
- 138 02:18:40:11 OCEANOGRAPHERS ARE IN THE SAME CATEGORY WITH WEATHER FORECASTERS AND STOCK ANALYSTS.
- 139 02:18:51:06 *THUNDERSTORMS DUE TONIGHT* .
- 140 02:18:53:12 THE *REPLIQUE* BREAKS FREE OF THE COLD RING EDDY.
- 141 02:18:58:07 THEY ARE BEYOND THE GULF STREAM AND THE RADIO BULLETIN REPORTS AN APPROACHING SQUALL.
- 142 02:19:05:09 FIGHTING THROUGH THE STORM, THE *REPLIQUE* ROARS DOWN THE FINAL LEG TO BERMUDA.
- 143 02:19:13:12 THE RESULT OF THEIR WAGER WILL BE KNOWN IN A FEW HOURS.
- 144 02:19:20:13 IN THE MORNING LIGHT, *REPLIQUE* MOTORS INTO THE HAMILTON HARBOR.
- 145 02:19:25:13 THE GULF STREAM GAVE THEM A STRONG PUSH, BUT OTHER BOATS ARE THERE BEFORE THEM.
- 146 02:19:33:13 THEY ARE 15th ACROSS THE LINE, BUT THEY ARRIVED SAFELY.
- 147 02:19:37:28 HARRY BUSCH FINDS THAT THE WRONG SIDE OF THE COLD EDDY WAS ENCOUNTERED BY EVERYONE WHO TRIED TO STAY IN THE STREAM.
- 148 02:19:49:17 IT WAS A COLD EDDY THAT'S BENEATH THE SURFACE, AND IT'S IMPOSSIBLE THROUGH THE MEANS WE HAVE AVAILABLE TO US TO ASCERTAIN WHETHER YOU'RE THERE, NEAR IT, IN IT, UNTIL YOU REALIZE HOW MUCH GROUND YOU LOSE.
- 149 02:20:07:17 THE SKIPPER OF THE *PIRATE* WON THE RACE, BUT HE WENT 110 MILES WEST.
- 150 02:20:13:26 THERE WERE SEVERAL WAYS TO LOSE ON IT, SO WE WENT NORTH AND CROSSED THE STREAM, PICKED

- UP ABOUT 35 MILES, PERHAPS, FROM THE STREAM.
- 151 02:20:25:24 WE DIDN'T MANEUVER TO STAY IN THE STREAM.
- 152 02:20:29:26 WE WANTED TO GET ON OUT TO THE WEST, AND IT SEEMED TO WORK.
- 153 02:20:36:24 A GENTLEMAN'S RACE ENDS, SYMBOLIC OF OUR KNOWLEDGE OF THE GULF STREAM.
- 154 02:20:42:24 WITH SATELLITE AND COMPUTER, THE CURRENT, IN CEASELESS MOTION, HAS BEEN CAPTURED IN ASTOUNDING IMAGES.
- 155 02:20:50:25 IT IS AS UNPREDICTABLE AS THE OUTCOME OF A YACHT RACE.
- 156 02:20:56:09 THE GULF STREAM IS BUT ONE MAJOR CURRENT SYSTEM IN THE WORLD'S OCEANS CREATED BY PREVAILING WINDS AND THE EARTH'S ROTATION.
- 157 02:21:06:27 THE BRAZIL, THE KUROSHIO, THE PERU, THE AUSTRALIA -- MARINERS HAVE LONG USED THESE GREAT CURRENTS TO NAVIGATE AROUND THE WORLD.
- 158 02:21:16:25 BUT THERE ARE OTHER CURRENTS, DRIVEN BY TEMPERATURE, DEEP IN THE INTERIOR OF THE OCEANS.
- 159 02:21:24:11 ANTARCTICA IS THE HUB OF A WHEEL CONNECTING ALL THE OCEANS OF THE WORLD.
- 160 02:21:31:01 COMPUTER ANIMATION RECORDS THEM TURNING AROUND THE ICY CONTINENT IN ONE GIANT CIRCUIT.
- 161 02:21:37:15 THE CIRCUMPOLAR CURRENT IS THE PUMP THAT DRIVES ALL THE COLD SOUTHERN OCEAN CURRENTS.
- 162 02:21:47:20 IN THE POLAR REGIONS OF THE EARTH LIES THE KEY TO THE CIRCULATION OF WATER BELOW THE SURFACE.
- 163 02:21:58:11 SCIENTISTS MEASURE RADIOACTIVE MATERIAL IN THE WATER TO TRACE THE PATH OF THE CURRENTS.
- 164 02:22:04:12 HEAVY AND DENSE, THE COLD WATER SINKS.

- 165 02:22:08:13 THESE DEEP CURRENTS CAN CREEP ALONG THE BOTTOM FOR CENTURIES.
- 166 02:22:13:12 THE TRIP ACROSS SOME OCEAN BASINS TAKES AS LONG AS 1,000 YEARS.
- 167 02:22:19:12 EVENTUALLY, INTERNAL CURRENTS RESURFACE AS UPWELLINGS.
- 168 02:22:22:13 THE COLD WATERS BRING NUTRIENTS FROM THE DEEP THAT MAKE LIFE POSSIBLE IN WHAT WOULD OTHERWISE BE A STAGNANT, LIQUID DESERT.
- 169 02:22:38:28 THE FRIGID WATERS OF ANTARCTICA MIGHT BE THOUGHT A WASTELAND, BUT IT IS THE COLD WATER CURRENTS ESPECIALLY PLENTIFUL.
- 170 02:22:47:18 THAE HERE, AS THROUGHOUT THE OCEAN, ALL LIFE IS LINKED BY THE FOOD CHAIN, THAT INTRICATE GEOMETRY OF EAT AND BE EATEN.
- 171 02:23:25:12 FROM THE MAJESTIC WHALES TO LITTLEST FISH, IT TIES THE DESTINY OF ONE CREATURE TO ANOTHER.
- 172 02:23:33:13 ULTIMATELY, IT IS A SCHEME OF HARMONY IN A REALM OF BREATH TAKING BEAUTY.
- 173 02:23:53:13 AT THE BASE OF THE FOOD CHAIN, DETERMINING THE SURVIVAL OF ALL CREATURES, ARE PLANTS TOO TINY FOR THE UNAIDED EYE TO SEE.
- 174 02:24:03:28 DELICATELY COLORED PLANKTON, THEY ARE THE GRASSES OF THE SEA.
- 175 02:24:09:29 THEY PERFORM THE MIRACLE OF PHOTOSYNTHESIS, UTILIZING SUNLIGHT TO TRANSFORM CARBON DIOXIDE AND WATER INTO FREE OXYGEN AND CARBOHYDRATES, THE FUNDAMENTAL CURRENCY OF ALL ANIMAL LIFE.
- 176 02:24:23:17 BOTH MICROSCOPIC CREATURES AND GREAT LEVIATHANS ARE TOTALLY DEPENDENT ON THESE PLANTS.
- 177 02:24:28:22 IN RECENT TECHNOLOGY, PLANKTON ARE STUDIED NOT THROUGH A MICROSCOPE, BUT BY SATELLITES IN SPACE.

- 178 02:24:37:18 SENSORS THAT MEASURE CHLOROPHYLL ACTUALLY RECORD THE AMOUNT OF PLANKTON IN THE WATER.
- 179 02:24:45:28 GROUND STATIONS RECEIVE AND PROCESS THE INFORMATION BEAMED TO EARTH.
- 180 02:24:50:26 ONE SUCH LABORATORY IS AT NASA'S GODDARD SPACE FLIGHT CENTER IN MARYLAND.
- 181 02:24:59:13 CONCENTRATIONS ARE HIGHER IN THE WINTER.
- 182 02:25:02:15 A NASA TEAM WORKING WITH SATELLITE IMAGES PREPARED BY THE UNIVERSITY OF MIAMI IS JOINED BY BIOLOGICAL OCEANOGRAPHER JIM McCARTHY OF HARVARD UNIVERSITY.
- 183 02:25:13:18 TOGETHER, THEY HAVE PRODUCED REMARKABLE MAPS OF THE ATLANTIC SEABOARD, IN COLORS THAT REFLECT THE CONCENTRATION OF PLANKTON.
- 184 02:25:22:18 THE HIGHEST ABUNDANCE OF LIFE IS IN RED.
- 185 02:25:26:18 FURTHER OUT TO SEA, WHERE THERE ARE FEWER PLANKTON, IT IS BLUE.
- 186 02:25:33:01 SOUTH OF THE STREAM, A COLD RING, A SMALL YELLOW SPIRAL OF LIFE TRAPPED IN A DESERT OF BLUE WARM WATER.
- 187 02:25:43:17 NORTH OF THE STREAM, A WARM CORE RING HOLDS LITTLE LIFE.
- 188 02:25:48:28 ONE OF THE MOST EXCITING DEVELOPMENTS IN OCEAN SCIENCES HAS BEEN MEASURING THE DISTRIBUTION OF OCEAN PROPERTIES FROM SATELLITES.
- 189 02:25:59:02 THIS IS DONE ROUTINELY FOR TEMPERATURE, REVEALING PATTERNS OF CURRENTS AND EDDY FIELDS THAT SPIN OFF THEM.
- 190 02:26:07:19 BUT RECENTLY, WE HAVE BEEN ABLE TO LOOK AT LARGE AREAS OF THE OCEAN AND SEE THE DISTRIBUTION OF PLANKTON.
- 191 02:26:18:03 WE KNOW THE DISTRIBUTION OF ORGANISMS IS RELATED TO OCEAN CURRENTS.

- 192 02:26:23:17 CURRENTS AFFECT WHERE ORGANISMS ARE, AND CURRENTS SUPPLY THE NUTRIENTS THAT PERMIT ORGANISMS TO GROW.
- 193 02:26:31:07 THROUGH THE GRASSES OF THE SEA PASSES HALF THE OXYGEN BREATHED BY ANIMALS OF EARTH.
- 194 02:26:39:11 THE FATE OF LIFE ON LAND AND IN THE SEA IS BOUND TO THESE MICROSCOPIC PLANTS.
- 195 02:26:53:23 SOME TUNA MIGRATE 200 MILES A DAY.
- 196 02:26:57:26 IN A YEAR, THEY CAN CIRCLE THE PACIFIC OCEAN.
- 197 02:27:02:05 WHEREVER OCEAN CURRENTS CARRY THE PLANKTON, TUNA WILL FOLLOW.
- 198 02:27:13:03 TODAY, THE FISHERMAN IS RECEIVING HELP FROM A TECHNOLOGY THAT NEVER GOES TO SEA.
- 199 02:27:20:01 MIKE LAURS, OF THE SOUTHWEST FISHERIES CENTER IN SAN DIEGO, GIVES FISHERMEN A GOOD IDEA OF WHERE THEY MIGHT FIND TUNA BEFORE THEY LEAVE PORT.
- 200 02:27:32:17 HE USES PLANKTON MAPS MADE FROM SATELLITE DATA.
- 201 02:27:36:17 THIS IS AN OCEAN IMAGE, MEASURED BY SATELLITE.
- 202 02:27:41:02 IT SHOWS AREAS OF THE OCEAN THAT ARE RICH, AND AREAS OFFSHORE THAT ARE MORE CLEAR.
- 203 02:27:48:17 TUNA ARE VISUAL FEEDERS AND CONSEQUENTLY NEED CLEAR WATER TO DETECT THEIR FOOD.
- 204 02:27:54:27 THEY AGGREGATE ALONG BOUNDARIES BETWEEN THE CLEAR WATER AND THE MORE TURBID WATER.
- 205 02:28:01:14 THIS INFORMATION IS IMPORTANT TO FISHERMEN.
- 206 02:28:07:13 SATELLITE AND COMPUTER HAVE FASHIONED A MAP OF CURRENTS AND LIFE INTERTWINED.
- 207 02:28:15:07 IN ANCIENT TIMES, A POET ASKED, "WHO CAN FATHOM THE DEPTHS OF THE WINE-DARK SEA?" NOW WE HAVE GAINED A NEW GLIMPSE OF THOSE DARK WATERS THAT STRETCH FAR BEYOND LAND'S END.

- 208 02:28:31:28 WE CAN READ THE SIGNATURE OF LIFE WRITTEN IN THE OCEANS OF THIS BLUE PLANET.
- 209 02:28:46:07 THE CYCLES OF WEATHER ON EARTH ARE LINKED TO THE SEAS.
- 210 02:28:51:27 MANY LAND ENVIRONMENTS OWE THEIR PREDICTABLE WEATHER TO THE REGULAR TEMPERATURE AND FLOW OF OCEAN CURRENTS.
- 211 02:28:59:27 BUT WHEN THE CONSTANCY OF THE OCEAN IS DISTURBED, THE SEAS CAN PRODUCE DISASTER.
- 212 02:29:06:29 IN THE WINTER OF 1982, A SERIES OF CATASTROPHES STRUCK WIDESPREAD PARTS OF THE WORLD.
- 213 02:29:14:12 RAGING SURF BATTERED THE CALIFORNIA COAST.
- 214 02:29:17:17 FOR THE FIRST TIME IN 75 YEARS, HURRICANES ROARED DOWN ON TAHITI.
- 215 02:29:23:13 IN FIVE MONTHS, THE ISLAND WAS LASHED BY STORMS SIX TIMES.
- 216 02:29:31:27 A SEVERE DROUGHT STRUCK SOUTHEAST AUSTRALIA, PRODUCING GIGANTIC DUST STORMS.
- 217 02:29:39:27 IN THEIR WAKE, THE NATION'S WORST BUSH FIRES IN HISTORY MARCHED ACROSS THE LAND.
- 218 02:30:00:18 IN AFRICA, THE WINTER RAINS DID NOT COME.
- 219 02:30:07:17 THERE WAS NO RELIEF FOR THE DRY, PARCHED GROUND.
- 220 02:30:11:29 HALF A WORLD AWAY, A RECORD SNOWFALL IN UTAH PRODUCED UNPRECEDENTED SPRING FLOODS.
- 221 02:30:18:05 STREETS BECAME RIVERS OF MUD.
- 222 02:30:21:25 REPORTS WERE RELAYED FROM AFRICA TO ASIA TO THE AMERICAS.
- 223 02:30:28:00 THE DAMAGE COST \$40 BILLION.
- 224 02:30:30:29 A CLUE THAT MIGHT LINK THESE EVENTS IS TO BE FOUND OFF THE COAST OF PANAMA.
- 225 02:30:39:21 FOR 15 YEARS, THE CORAL REEFS OF UVA AND SICA

- ISLANDS HAVE BEEN STUDIED BY SCIENTISTS FROM THE SMITHSONIAN TROPICAL RESEARCH INSTITUTE.
- 226 02:30:50:26 PETER GLYNN AND HIS COLLEAGUES HAVE NOW REFOCUSED THEIR STUDIES TO DETERMINE THE CAUSE A DEADLY MYSTERY ON THE REEF.
- 227 02:31:03:22 THESE REEFS ARE A MICROCOSM OF LIFE ON EARTH.
- 228 02:31:11:26 THOUSANDS OF SPECIES LIVING TOGETHER, ALL OF THEM DEPENDENT ON A TYPE OF PLANKTON THAT LIVE IN THE CORAL.
- 229 02:31:22:10 BUT EARLY IN 1983, DISASTER STRUCK HERE AS WELL.
- 230 02:31:27:15 DURING THE SAME PERIOD WHEN WEATHER WENT WILD ON LAND, SYMBIOTIC PLANTS THAT LIVE INSIDE THE TISSUE OF CORAL DIED AND STREAMED OFF.
- 231 02:31:39:00 IN PLACES, THE REEF IS BEGINNING TO RECOVER, BUT GREAT PARTS STILL REMAIN DEVASTATED.
- 232 02:31:46:01 STUDYING ITS REBIRTH, GLYNN IS LOOKING FOR THE CAUSE OF THE CORAL'S DEATH.
- 233 02:31:53:14 HE FIRST SUSPECTED THAT THE DESTRUCTION WAS TRIGGERED BY MANMADE POLLUTION.
- 234 02:31:59:16 ONCE THE DIE-OFF HAD BEGUN, THE CROWN-OF-THORNS STARFISH MOVED IN TO FURTHER DECIMATE THE CORAL.
- 235 02:32:08:17 THE GUARDIAN SHRIMP THAT NORMALLY PROTECT THE REEF COULD NOT STOP THEM.
- 236 02:32:13:28 BUT THERE WAS LITTLE EVIDENCE OF POLLUTION.
- 237 02:32:17:12 SOMETHING ELSE HAD ATTACKED THE HARDY REEF, PERHAPS AN ABRUPT TEMPERATURE CHANGE.
- 238 02:32:23:13 A TEMPERATURE CHANGE COULD BE CONNECTED TO EL NINO, A WARMING TREND OFF PERU KNOWN TO RAISE THE TEMPERATURE ABOVE THE TOLERANCE FOR LIFE.
- 239 02:32:35:18 AFTER MEASURING THE TEMPERATURE OF THE SURROUNDING WATER, THE THEORY SEEMED

WORTH TESTING.

- 240 02:32:42:22 HERE IS A TANK WHERE THE WATER TEMPERATURES ARE ABOUT NORMAL.
- 241 02:32:48:12 YOU CAN SEE THAT THIS CORAL IS GOLDEN BROWN.
- 242 02:32:53:12 IT HAS PLANTS THAT LIVE IN THE TISSUES SYMBIOTICALLY, AND THIS IS THE NORMAL SITUATION WITH NORMAL SEAWATER TEMPERATURES.
- 243 02:33:04:00 NOW, IN 1983, THE SEAWATER TEMPERATURES WERE HIGHER THAN NORMAL FOR TWO TO THREE MONTHS.
- 244 02:33:12:08 WE HAVE DUPLICATED THE WARMING CONDITIONS.
- 245 02:33:15:08 YOU CAN SEE THAT THE BROWN COLOR LEFT THE CORAL SKELETON.
- 246 02:33:20:22 WE STILL HAVE A LITTLE NORMAL CORAL ON TOP BUT BLEACHING AND LOSS OF THE ALGAE BELOW.
- 247 02:33:29:12 WE ARE PROBABLY DUPLICATING THE CORAL BLEACHING AND DEATH THAT WE ACTUALLY OBSERVED IN THE EASTERN PACIFIC OCEAN DURING 1983.
- 248 02:33:39:13 GLYNN AND HIS TEAM RETURN TO THE REEF.
- 249 02:33:43:12 CORAL GROWS OUTWARD LIKE TREES.
- 250 02:33:45:26 ONLY THE SURFACE IS ALIVE.
- 251 02:33:48:13 BENEATH IT IS LAYER UPON LAYER OF EARLIER GENERATIONS.
- 252 02:33:52:28 IN THE CORAL HEADS, SOME 400 YEARS OLD, MAY BE A RECORD OF PAST CATASTROPHES.
- 253 02:34:00:13 GLYNN NOW BELIEVES THAT EL NINO IS THE CAUSE OF THE DEVASTATION.
- 254 02:34:06:15 IF SO, THE SAMPLES SHOULD MATCH PAST WARMING EVENTS.
- 255 02:34:11:00 THE PAST'S PATTERN MAY PREDICT WHEN EL NINO WILL NEXT COME TO THE REEF.
- 256 02:34:18:12 EL NINO, "THE CHILD," SO NAMED BECAUSE THE

- WARMING EVENT IS NEAR CHRISTMAS TIME.
- 257 02:34:25:13 THOUGH RECORDED FOR NEARLY 200 YEARS, ITS CYCLE IS HIGHLY IRREGULAR.
- 258 02:34:31:06 INSTRUMENTS ABOARD A SATELLITE CAN READ THE CHANGING SURFACE TEMPERATURE OF THE OCEAN, INCLUDING WATERS OFF SOUTH AMERICA.
- 259 02:34:40:28 OFF PERU, THERE IS A RICH UPWELLING OF COLD WATER.
- 260 02:34:45:27 BUT EVERY FEW YEARS, AT CHRISTMAS TIME, A LAYER OF WARM WATER THICKENS IN THE EASTERN PACIFIC, CUTTING OFF THE WATER IN WHICH PLANKTON LIVE.
- 261 02:34:58:11 THEY DIE, AND THE ENTIRE CYCLE OF LIFE BREAKS DOWN.
- 262 02:35:03:08 A SATELLITE STUDY OF EL NINO HAS BEEN CONDUCTED AT THE SCRIPPS INSTITUTION OF OCEANOGRAPHY.
- 263 02:35:11:14 ROBERT BERNSTEIN, PLOTTING THE SURFACE TEMPERATURE OF THE OCEAN, HAS PIECED TOGETHER A MAP FROM 1982 AND 1983.
- 264 02:35:20:28 HIS STUDY COVERS THE ENTIRE PACIFIC OCEAN.
- 265 02:35:28:27 ON THE MONITOR ARE TWO MAPS OF THE PACIFIC.
- 266 02:35:33:13 NORMAL CONDITIONS FOR DECEMBER ARE ABOVE, THE EL NINO YEAR BELOW.
- 267 02:35:38:28 TEMPERATURE IS SHOWN BY COLOR -- BLUE AND GREEN THE COOLEST, ORANGE AND RED THE WARMEST.
- 268 02:35:46:12 THE UPWELLING IS COOL BLUE WATER EXTENDING OUTWARD FROM THE COAST OF SOUTH AMERICA.
- 269 02:35:53:02 BUT IN 1983, IT IS CAPPED AND SNUFFED OUT, AS THE WATER TEMPERATURE RISES AS MUCH AS 15 DEGREES FAHRENHEIT.
- 270 02:36:02:28 THESE UNUSUAL CONDITIONS ARE NOT CONFINED TO SOUTH AMERICA.

- 271 02:36:07:15 FAR TO THE WEST, THERE HAVE ALSO BEEN DRAMATIC CHANGES.
- 272 02:36:12:13 SOME DISTURBANCE HAS OCCURRED BETWEEN THE SEA AND THE AIR IN THE WESTERN PACIFIC.
- 273 02:36:19:12 WEATHER IN THE OCEAN AND THE ATMOSPHERE HAS SHIFTED EASTWARD BY A FULL HEMISPHERE.
- 274 02:36:26:11 THE DISTURBANCE IS REFLECTED IN THE ATMOSPHERE.
- 275 02:36:29:28 SATELLITE PHOTOS ABOVE THE PACIFIC SHOW NORMAL CLOUD PATTERNS OF TRADE WINDS BREAKING INTO DISARRAY.
- 276 02:36:37:28 SCIENTISTS REALIZE THAT THESE FLUCTUATIONS ARE LARGER THAN A WARMING TREND OFF SOUTH AMERICA.
- 277 02:36:44:13 THESE OSCILLATIONS IN THE SOUTHERN OCEAN ARE CONNECTED TO THE MONSOONS IN ASIA AND PLAY HAVOC WITH THE WEATHER OF NEARLY 70% OF THE WORLD.
- 278 02:36:56:27 IN LATE 1984, AN INTERNATIONAL SYMPOSIUM IS CONVENED IN PARIS.
- 279 02:37:02:09 FROM AROUND THE WORLD, SCIENTISTS COME TOGETHER TO SORT THROUGH THE GLOBAL IMPLICATIONS OF THE DISCOVERY.
- 280 02:37:09:28 THAT'S A MAJOR PROJECT.
- 281 02:37:11:29 AUSTRALIA HAD SOME VERY SEVERE DROUGHTS, IN PARTICULAR, IN PLACES WHICH NORMALLY DON'T HAVE DROUGHT.
- 282 02:37:19:17 IN THE PHILIPPINES, EL NINO HAD A DEVASTATING EFFECT RECENTLY WHEN TWO TYPHOONS PASSED THROUGH THE COUNTRY WITHIN A PERIOD OF 10 DAYS.
- 283 02:37:31:03 THAT DEVASTATED THE COUNTRY AND COST MILLIONS OF DOLLARS.
- 284 02:37:36:08 ALL THE MAJOR DROUGHTS AND SOME FAMINES IN INDIA OCCURRED DURING EL NINO YEARS.

- 285 02:37:45:26 A DECADE OF RESEARCH BEGINS TO EXPLORE THE INTRICATE CONNECTIONS BETWEEN THE OCEAN AND THE ATMOSPHERE.
- 286 02:37:54:07 THE GOAL, TO HOW LEARN AND WHEN AIR AND SEA GO OUT OF BALANCE AND TO PREDICT WHEN ANOTHER MASSIVE EL NINO MAY STRIKE.
- 287 02:38:08:29 THE STUDY IS NAMED T.O.G.A., TROPICAL OCEANS AND GLOBAL ATMOSPHERE.
- 288 02:38:13:13 THE RESEARCH VESSEL *DISCOVERER* EMBARKS ON THE FIRST VOYAGE IN A DECADE OF STUDY INVOLVING OVER 50 COUNTRIES, HUNDREDS OF VESSELS, AND THOUSANDS OF RESEARCHERS.
- 289 02:38:25:27 BECAUSE OF ITS HUGE SIZE, OCEANOGRAPHIC INFORMATION ON THE PACIFIC IS FAR FROM ADEQUATE.
- 290 02:38:32:28 T.O.G.A. PROMISES TO ADD DRAMATICALLY TO THE KNOWLEDGE SCIENTISTS NOW HAVE OF THE GLOBE'S LARGEST OCEAN.
- 291 02:38:41:11 DATA RECORDING BUOYS THAT RADIO INFORMATION TO LAND WILL BE STATIONED ACROSS THE PACIFIC.
- 292 02:38:48:13 THE WEATHER OF THE ATMOSPHERE CHANGES DAILY, BUT THE OCEAN HAS A MEMORY.
- 293 02:38:55:03 ITS WEATHER MAY CONTINUE OVER MONTHS OR YEARS.
- 294 02:38:59:07 RESEARCHERS WILL INVESTIGATE HOW ONE AFFECTS THE OTHER.
- 295 02:39:04:15 A BUOY IS LAUNCHED, BEGINNING THE MOST COMPREHENSIVE STUDY OF HOW THE OCEANS AND ATMOSPHERE INTERACT.
- 296 02:39:12:27 FLOATING SENTINELS IN THE PACIFIC MAY SHED LIGHT ON EVENTS THAT AFFECT THE LIVES OF MILLIONS, AND SCIENTISTS MAY DISCOVER THAT OCEAN AND ATMOSPHERE ARE ONE CONTINUOUS SYSTEM, FROM THE TOP OF THE SKY TO THE FLOOR OF THE DEEP SEA.
- 297 02:39:35:28 IN LEGEND, ALEXANDER THE GREAT WAS LOWERED

INTO THE DEPTHS.

- 298 02:39:40:27 INSIDE HIS CRYSTAL SPHERE, HE BECAME THE FIRST TRAVELER TO OBSERVE THE WONDROUS AND STRANGE CREATURES THAT INHABIT THE OCEAN.
- 299 02:39:50:27 INVENTOR OTIS BARTON AND ZOOLOGIST WILLIAM BEEBE REPEATED THE TRIP THIS CENTURY.
- 300 02:39:56:12 THEIR BATHYSPHERE WAS MADE NOT OF CRYSTAL, BUT STEEL.
- 301 02:40:01:23 FOR MORE THAN 1/2 MILE DEEP, THE EXPLORERS DESCRIBED FANTASTIC FISH LIVING AT THE EDGE OF PERPETUAL DARKNESS.
- 302 02:40:10:01 UNABLE TO PHOTOGRAPH WHAT THEY SAW, THEY RELAYED THEIR DESCRIPTIONS TO AN ARTIST ON DECK.
- 303 02:40:17:14 THE PAINTINGS APPEARED IN THE PAGES OF THE *NATIONAL GEOGRAPHIC* MAGAZINE, LIFE FORMS SEEN FOR THE FIRST TIME.
- 304 02:40:27:15 FANGED AND LUMINESCENT, THEY, TOO, SEEMED LIKE CREATURES BORN IN LEGEND.
- 305 02:40:39:24 TODAY, SHIPS OF INNERSPACE ALLOW SCIENTISTS TO PROBE DEEPER YET INTO THE NETHER WORLD OF THE MID-OCEAN.
- 306 02:40:54:25 RICHARD HARBISON, OF WOODS HOLE OCEANOGRAPHIC INSTITUTION, PREPARES FOR A DIVE IN THE *JOHNSON-SEALINK*.
- 307 02:41:03:13 ABOARD THIS 20th-CENTURY VERSION OF ALEXANDER'S CRYSTAL SPHERE, HE ENTERS THE ENVIRONMENT OF ANIMALS THAT LIVE IN THE MIDWATER OF THE OCEAN.
- 308 02:41:14:04 THE MIDWATER ENVIRONMENT IS THE LARGEST ON EARTH.
- 309 02:41:18:25 2/3 OF THE EARTH IS COVERED WITH WATER AT AN AVERAGE DEPTH OF OVER 2 MILES.
- 310 02:41:26:26 IT'S A DIFFERENT ENVIRONMENT FROM THE ONE WE KNOW.

- 311 02:41:31:10 BELOW A DEPTH OF ABOUT 400 METERS, THERE'S NO LIGHT.
- 312 02:41:36:26 THE TEMPERATURE IS RELATIVELY CONSTANT.
- 313 02:41:39:12 FOR AN ANIMAL LIVING IN THIS ENVIRONMENT, THERE'S ESSENTIALLY NO BOUNDARIES BETWEEN THE SURFACE AND THE BOTTOM.
- 314 02:41:47:25 IT'S THE LEAST EXPLORED ENVIRONMENT ON EARTH.
- 315 02:41:51:09 WITH NO ONE ELSE TO TAKE A SOUVENIR SNAPSHOT, HARBISON TURNS THE CAMERA ON HIMSELF, COMMEMORATING THE 1,000th DIVE OF THE *JOHNSON-SEALINK*.
- 316 02:42:02:12 THERE ARE ANIMALS HERE RECOGNIZABLE AND FAMILIAR, BUT LIKE HARBISON, THEY ARE INTRUDERS FROM ABOVE, BRIEFLY VISITING THIS REALM.
- 317 02:42:18:27 MORE ASTOUNDING THAN BEEBE'S PAINTINGS, THE INHABITANTS OF THIS VAST DARKNESS ARE CREATURES OF DELICATE, TRANSLUCENT BEAUTY.
- 318 02:42:27:13 SOME GROW TO 20 FEET IN LENGTH.
- 319 02:42:30:27 MOST ARE NO LARGER THAN A HUMAN HAND.
- 320 02:42:36:27 PERFECTLY ADAPTED TO PRESSURE OF ALMOST HALF A TON PER SQUARE INCH, MANY WILL DISINTEGRATE IF BROUGHT TO THE SURFACE.
- 321 02:42:46:28 ONLY HERE CAN THEY BE OBSERVED.
- 322 02:43:03:00 A CTINOPHORE DRIFTS FOR THE CAMERA, ITS FOOD-GATHERING TENTACLES DRAWN INTO ITS BODY.
- 323 02:43:09:25 IT HAS NEVER BEEN SEEN BEFORE.
- 324 02:43:13:08 LOBES SPREAD.
- 325 02:43:15:27 HE'S COMING BACK INTO SHAPE QUITE NICELY, WHICH IS GOOD.
- 326 02:43:22:18 A MEDUSA, AN ETHEREAL DEEP-SEA JELLYFISH.
- 327 02:43:29:02 A SIPHONOPHORE IS REDISCOVERED.
- 328 02:43:32:11 IT HAS NOT BEEN RECORDED SINCE IT WAS FIRST

- FOUND, MORE THAN 100 YEARS AGO.
- 329 02:43:43:07 MOST ARE CREATURES NEW TO SCIENCE.
- 330 02:43:46:07 OUT OF 30 SPECIMENS COLLECTED, HALF ARE SEEN FOR THE VERY FIRST TIME.
- 331 02:43:52:28 IT WAS KNOWN THIS WORLD IS VAST.
- 332 02:43:56:13 IT WAS NEVER BELIEVED IT COULD BE SO FULL OF LIFE.
- 333 02:44:08:00 SOUND HAS BEEN CALLED THE LIGHT OF THE SEA.
- 334 02:44:12:08 IT'S EQUIVALENT TO VISION FOR INHABITANTS OF THE WATER.
- 335 02:44:16:28 FISH CALL, AND MARINE MAMMALS SING TO COMMUNICATE AND NAVIGATE.
- 336 02:44:21:26 SCIENTISTS THINK THAT WHALES ARE ABLE TO HEAR OTHER WHALES ACROSS ENTIRE OCEAN BASINS.
- 337 02:44:31:13 IMITATING THE CREATURES OF THE SEA, MANMADE ECHO SOUNDING WAS FIRST USED IN THE 1940s TO BEHOLD WHAT HUMAN EYES COULD NOT, THE BOTTOM OF THE OCEAN.
- 338 02:44:44:28 SOUND WAVES BOUNCED OFF THE SEAFLOOR REVEAL AN OCEAN BOTTOM FAR DIFFERENT FROM THE FLAT, MUDDY PLAIN EXPECTED.
- 339 02:44:53:26 LIKE CHINESE INK DRAWINGS, THERE EMERGED MOUNTAINS AND RIDGES, VALLEYS AND PLATEAUS.
- 340 02:45:03:15 IN THE 1960s, BRUCE HEEZEN AND MARIE THARP, OF THE LAMONT-DOHERTY GEOLOGICAL OBSERVATORY, ASSEMBLED ECHO-SOUNDING DATA FROM AROUND THE WORLD.
- 341 02:45:14:12 THEY SET ABOUT CREATING THE FIRST COMPREHENSIVE MAP OF THE WORLD'S OCEAN FLOOR.
- 342 02:45:20:27 IT WAS A MONUMENTAL TASK THAT COULD BE COMPARED TO PAST CARTOGRAPHERS WHO CONSTRUCTED THE FIRST MAPS OF THE NEW WORLD.

- 343 02:45:38:12 THEIR REVOLUTIONARY MAPS PORTRAYED A REMARKABLE GEOGRAPHY.
- 344 02:45:42:13 AMONG THE DISCOVERIES, THE WORLD'S TALLEST MOUNTAIN, NOT EVEREST, BUT THE ISLAND OF HAWAII, REACHING 35,000 FEET ABOVE THE SEAFLOOR.
- 345 02:45:52:27 PERHAPS THE MOST CURIOUS FEATURE REVEALED WAS A LONG, SINUOUS VALLEY BORDERED WITH HIGH RIDGES THAT WRAPPED ITS WAY AROUND THE GLOBE.
- 346 02:46:07:04 THE GRAND CANYON, AMONG THE VISIBLE WONDERS OF PLANET EARTH.
- 347 02:46:11:20 2 MILES BENEATH THE OCEAN'S SURFACE IS THE MID-OCEAN RIDGE, SIMILAR IN SHAPE TO THE GRAND CANYON, BUT OVER 200 TIMES AS LONG.
- 348 02:46:23:26 IT IS THE LARGEST GEOLOGICAL FEATURE ON THE PLANET.
- 349 02:46:28:28 AT THE EXXON PRODUCTION RESEARCH COMPANY IN HOUSTON, AN IMAGE-PROCESSING LABORATORY BECOMES THE STAGE WHERE DATA FROM THE SEAFLOOR IS TRANSFORMED BY COMPUTER.
- 350 02:46:40:26 BILL RYAN AND JAHN FARRE ARE CREATING WHAT MAY BECOME A COMMON WAY TO EXPLORE THE OCEAN.
- 351 02:46:49:05 WE'RE LOOKING AT THE RISE IN NORTH EQUATORIAL PACIFIC, WHERE SEAFLOOR IS ACTUALLY BEING FORMED TODAY.
- 352 02:46:57:02 ESSENTIALLY WE'RE USING SOUND FOR EYES.
- 353 02:47:00:04 WE'RE LOOKING AT PIECES OF THE SEAFLOOR 3 BY 5 MILES.
- 354 02:47:05:14 THIS PORTRAIT OF THE EAST PACIFIC RISE OFF MEXICO IS BASED ON THE MAPS OF OCEAN BOTTOM MADE BY SONAR.
- 355 02:47:15:11 USING TWO DIFFERENT SETS OF ADVANCED SONAR INFORMATION, THE COMPUTER CREATES A SINGLE THREE-DIMENSIONAL IMAGE.

- 356 02:47:25:27 SOUND TRANSFORMED TO LIGHT OUTLINES A SMALL, EXTINCT VOLCANO.
- 357 02:47:30:12 IT STANDS ABOUT 60 FEET HIGH.
- 358 02:47:33:12 TO ITS RIGHT IS THE RIFT VALLEY.
- 359 02:47:38:28 THAT'S PERFECT RIGHT THERE.
- 360 02:47:40:28 THE COMPUTER BECOMES A CAMERA POSITIONED AT WILL.
- 361 02:47:44:27 ELECTRONICALLY IT CAPTURES THE PANORAMA OF A PITCH-DARK WORLD 2 MILES BENEATH THE SURFACE.
- 362 02:47:51:26 LET'S GET ABOUT 300 METERS ABOVE THE SEAFLOOR AND VERTICAL EXAGGERATION OF...LET'S TRY 10.
- 363 02:47:59:25 HERE WE ARE.
- 364 02:48:02:10 WE'RE JUST GOING TO LEAVE THE SEA SURFACE AND GRADUALLY DESCEND DOWN AND FLY ACROSS THAT VOLCANO THERE, WITH THE RIFT VALLEY IN THE BACKGROUND.
- 365 02:48:15:27 THE FIRST EVER TO TAKE THIS TRIP, WE FLY OVER THE VOLCANO, BANK TO THE SOUTH, AND DESCEND INTO THE VALLEY.
- 366 02:48:31:28 THOUSANDS OF FEET BENEATH THE SURFACE, NEW OCEAN CRUST IS BEING FORMED.
- 367 02:48:37:27 THE RIFT VALLEY IS LOCATED WHERE THE EARTH'S TECTONIC PLATES PULL APART.
- 368 02:48:43:23 MOLTEN ROCK FROM THE EARTH'S INTERIOR RISES THROUGH FISSURES AND CRACKS TO BECOME THE YOUNGEST PART OF OUR PLANET'S SURFACE.
- 369 02:48:58:12 CARRIED BY MOVEMENT OF THE PLATES, THIS SEAFLOOR WILL CROSS AN ENTIRE OCEAN BASIN.
- 370 02:49:05:15 OVER MILLIONS OF YEARS, IT WILL ACCUMULATE A RECORD OF ITS JOURNEY.
- 371 02:49:13:18 WEST OF GREENLAND ARE THE REMOTE ARCTIC WARS OF CANADA'S BAFFIN BAY, FREE OF ICE JUST A FEW WEEKS A YEAR.

- 372 02:49:24:06 DRILLSHIP *RESOLUTION*, TAKING ADVANTAGE OF THE WEATHER, BEGINS AN EXTRAORDINARY STUDY.
- 373 02:49:31:12 THE *RESOLUTION* IS SPECIALLY DESIGNED TO PROBE THE HISTORY BURIED BENEATH THE SEA.
- 374 02:49:43:03 FUNDED BY FIVE NATIONS, STAFFED WITH AN INTERNATIONAL TEAM OF SCIENTISTS, THE *RESOLUTION* CONTINUES THE WORK BEGUN BY THE FIRST SCIENTIFIC DRILLSHIP, *GLOMAR CHALLENGER*, IN THE 1960s.
- 375 02:50:02:07 SEDIMENTS OF THE DEEP PROVIDE A UNIQUE PORTRAIT OF OUR ANCIENT EARTH.
- 376 02:50:08:08 HERE IS EVERYTHING THAT LIVED IN THE WATER OR WASHED FROM THE LAND IN THE PAST 200 MILLION YEARS.
- 377 02:50:22:25 FROM THOUSANDS OF FEET BENEATH THE SEAFLOOR, CORES OF GEOLOGICAL TIME ARE RETURNED TO THE SURFACE.
- 378 02:50:43:24 IN THE SHIPBOARD LABORATORY, THEY ARE ANALYZED AND RECORDED BY THE MOST ADVANCED TOOLS OF SCIENCE.
- 379 02:50:52:11 ONE BY ONE, THEY YIELD THEIR SECRETS.
- 380 02:50:55:25 MAGNETIC PARTICLES HELP REVEAL THE AGE OF THE CORE AND THE OCEAN BASIN BENEATH IT.
- 381 02:51:03:22 IN LAYERS OF SEDIMENTS IS CHAPTER AFTER CHAPTER ON CLIMATES AND ICE AGES.
- 382 02:51:09:27 THEY ARE A DIARY READ BY SCIENTISTS MIKE ARTHUR AND SURAT SRIVASTAVA FOR CLUES OF WHEN THESE WATERS WERE TROPICAL AND WHEN THEY WERE COVERED BY ICE.
- 383 02:51:22:24 THE INTERGLACIAL SEDIMENTS ARE LIGHT-COLORED.
- 384 02:51:25:26 THE GLACIAL SEDIMENTS ARE DARK-COLORED.
- 385 02:51:29:01 THAT'S RIGHT.
- 386 02:51:30:10 THE ELECTRON MICROSCOPE FOCUSES ON SKELETONS OF MINUTE ANIMALS.

- 387 02:51:34:24 THAT'S WELL-PRESERVED.
- 388 02:51:36:09 THEY REVEAL A TALE OF THE TEMPERATURE AND CHEMISTRY OF AN ANCIENT SEA G AND THE ABUNDANCE OF LIFE ON AN ANCIENT EARTH.
- 389 02:51:47:10 CORES ARE STORED TO BE SENT TO LABORATORIES ON LAND FOR FURTHER STUDY.
- 390 02:51:53:26 THEY WILL BE COLLECTED FROM EVERY OCEAN.
- 391 02:51:57:00 EACH CORE IS A UNIQUE HISTORY BOOK.
- 392 02:52:00:13 THEY ARE ADDED TO THE LIBRARY OF DISCOVERY ABOUT THE DISTANT PAST OF THE BLUE PLANET.
- 393 02:52:13:29 A DEEP-DIVING SUBMERSIBLE NAMED *SEA CLIFF* RIDES ABOARD A NAVY TENDER IN THE PACIFIC.
- 394 02:52:21:00 FOLLOWING DRAMATIC DISCOVERIES MADE BY HER SISTER SHIP, *ALVIN*, *SEA CLIFF* AND OTHER DIVING VEHICLES TAKE SCIENTISTS TO EXPLORE THE SEA BOTTOM.
- 395 02:52:36:27 *SEA CLIFF* CARRIES 3 PEOPLE IN ITS 5-FOOT SPHERE.
- 396 02:52:41:16 COMING DOWN.
- 397 02:52:43:13 THE COPILOT SITS UPRIGHT.
- 398 02:52:45:13 THE PILOT AND SCIENTIST LIE PRONE, POSITIONS THEY WILL KEEP FOR THE DURATION OF THE DIVE.
- 399 02:52:53:12 IT CAN DESCEND TO 20,0 FEET, DEEPER THAN ANY OTHER RESEARCH SUBMARINE.
- 400 02:53:04:25 IT WILL BE NINE HOURS BEFORE *SEA CLIFF* SURFACES.
- 401 02:53:17:28 COPILOT, TURN SATISFACTORY.
- 402 02:53:19:28 COMMENCE BOTTOM APPROACH.
- 403 02:53:21:27 COMMENCE BOTTOM APPROACH. ROGER.
- 404 02:53:23:28 THIS IS *SEA CLIFF*.
- 405 02:53:27:02 MY DEPTH, 4,075.

- 406 02:53:28:26 THE SCIENTISTS ARE SEARCHING FOR A VENT AREA, ONE OF THE MOST EXCITING SEAFLOOR DISCOVERIES.
- 407 02:53:38:22 IN A WORLD WITHOUT LIGHT, SONAR GUIDES THEM TO THE LOCATION THEY SEEK.
- 408 02:53:54:28 AT THE BOUNDARIES OF TECTONIC PLATES ARE CRACKS CREATED BY THE PULLING AND TEARING OF GEOLOGICAL ACTIVITY.
- 409 02:54:03:28 THIS IS A DOMAIN OF UNRELENTING DARKNESS.
- 410 02:54:07:15 ONLY IMMENSE PRESSURE AND THE SALT IN THE WATER PREVENT IT FROM FREEZING.
- 411 02:54:14:12 HOT WATER GUSHES OUT OF THE SEAFLOOR.
- 412 02:54:18:07 WATER SEEPS THROUGH CRACKS IN THE BOTTOM.
- 413 02:54:22:03 HEATED BY THE EARTH'S INTERIOR, IT RETURNS THROUGH THESE VENTS.
- 414 02:54:28:28 EACH HOT SPRING IS AN OASIS OF LIFE.
- 415 02:54:32:28 STRANGE CREATURES ABOUND, TUBE WORMS MORE THAN 2 FEET LONG, WITHOUT MOUTHS OR STOMACHS.
- 416 02:54:39:27 2 MILES BENEATH THE SURFACE ARE GIANT CLAMS THE SIZE OF SALAD PLATES AND ALBINO DEEP-SEA CRABS.
- 417 02:54:52:18 AT THE HEART OF THIS ALIEN WORLD ARE BACTERIA LIVING IN SCALDING WATER, FEEDING ON SUBSTANCES NORMALLY POISONOUS TO LIFE.
- 418 02:55:02:24 MOST EXTRAORDINARY, IN THIS PITCH-BLACK WORLD, THEY CREATE ORGANIC CARBON, THE ROLE SUNLIGHT PERFORMS ON THE SURFACE.
- 419 02:55:10:29 SCIENTISTS THINK A HOT SPRING IS BORN AND DIES WITHIN A FEW HUNDRED YEARS.
- 420 02:55:17:27 HOW THESE CREATURES THEN ENDURE THE FRIGID WATER REMAINS A MYSTERY.
- 421 02:55:23:18 COMMUNITIES OF PARADOX, THEY CHALLENGE OUR

- BASIC IDEAS OF WHERE LIFE BEGINS AND HOW IT EVOLVES.
- 422 02:55:35:28 *SEA CLIFF* SURFACES, A SHIP OF THE DEEP WITH TALES FROM FAR FRONTIERS.
- 423 02:55:42:28 WITH INSTRUMENTS OF EXPLORATION, SCIENCE HAS FOUND A NEW OCEAN, RESPONSIBLE FOR MUCH OF WHAT IS REMARKABLE ABOUT PLANET EARTH.
- 424 02:55:52:28 THE DRAMA OF OUR LAND BEGINS BENEATH THE SEA.
- 425 02:55:57:28 FROM THE DEEP COMES THE FIERY STUFF OF WHICH OUR PLANET IS MADE AND REMADE.
- 426 02:56:08:04 FROM ITS CURRENTS STEMS MUCH OF EARTH'S WEATHER, THE DUET AND COUNTERPOINT OF SEA AND SKY.
- 427 02:56:17:18 THE CEASELESS FLOW OF OCEAN WATERS AND THE ATMOSPHERIC WIND ARE PARTNERS.
- 428 02:56:23:16 THEY WRAP THE GLOBE IN CONSTANT MOTION.
- 429 02:56:31:13 OUR PICTURES OF THE SEA ARE MADE BY SOUND, IMAGED BY SATELLITES, PROCESSED BY COMPUTERS, AND FINALLY WITNESSED BY HUMAN EYES IN A WAY PREVIOUSLY IMPOSSIBLE.
- 430 02:56:44:23 FOR CENTURIES, ITS SURFACE WAS OPAQUE, AND OUR KNOWLEDGE STOPPED WITH ITS SHORE.
- 431 02:56:51:27 WHAT WE DISCOVER BENEATH THE WAVES IS MORE FANTASTIC THAN EVER IMAGINED.
- 432 02:56:57:26 THE DEEP SEEMS LIKE ANOTHER PLANET, BUT IN FACT, IT IS FURTHER INTO THE HEART OF OUR OWN.
- 433 02:57:07:15 SCIENCE HAS BEGUN TO SEE EARTH AS "THE BLUE PLANET," A FRESH PERSPECTIVE THAT CHALLENGES US TO SEARCH THE SEAS ANEW.
- 434 02:57:17:11 A NEW JOURNEY HAS BEGUN, ECHOED BY THE GENIUS OF SIR ISAAC NEWTON -- "I SEEM TO HAVE BEEN "ONLY LIKE A BOY PLAYING ON THE SEASHORE, WHILE A GREAT OCEAN OF TRUTH LAY ALL UNDISCOVERED BEFORE ME." CAPTIONING PERFORMED BY THE NATIONAL CAPTIONING

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