C.C. TSCHERNING,
GEODÆTISK INSTITUT
DK-2920 CHARLOTTENLUND

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A EUROPEAN CRUSTAL DYNAMICS INFORMATION SYSTEM.

1. INTRODUCTION - A CASE STORY
2. POSSIBLE APPLICATIONS OF A CDIS
3. USERS OF A CDIS
4. SYSTEM DESIGN OF A CDIS

MAIN INSPIRATION AND BASE FOR THIS TALK FROM:

Guy M. LOHMAN & J. Thomas RENPROW: A PROPOSED CONCEPT FOR A CRUSTAL DYNAMICS INFORMATION MANAGEMENT NETWORK, JPL Publication 79-111, 1980.

OFFICE OF SPACE AND TERRESTRIAL APPLICATIONS, NASA: APPLICATIONS OF SPACE TECHNOLOGY TO CRUSTAL DYNAMICS AND EARTHQUAKE RESEARCH, NASA, 1978.

Jhon G. ROEDERER: CONSIDERATIONS IN THE DEVELOPMENT OF A NATIONAL GEOPHYSICAL DATA POLICY, EOS, Vol. 62, no. 27, pp. 569, 1981.

David R. LIDE, Jr.: CRITICAL DATA FOR CRITICAL NEEDS, SCIENCE, Vol. 212, No. 4501, pp. 1343-1349, 1981

DILLA HUNTY et al: GEOPHYSICAL DATA BASE SYSTEM CONSIDERATIONS. GEOPHYSICAL PROSPECTING, Vol. 28, pp. 495-512, 1980.

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1. INTRODUCTION:

TASK: COMPUTE GEOID / GRAVITY FIELD MODEL FOR NORDIC COUNTRIES: DK, N, S, SF.

DATA AVAILABLE OF VARIOUS TYPES:

(1) DOPPLER DERIVED (X, Y, Z) COORDINATES AND M.S.L. HEIGHTS

(2) GRAVITY ANOMALIES

(3) DEFLECTIONS OF THE VERTICAL

(4) SATELLITE ALTIMETRY

(5) POTENTIAL COEFFICIENT SETS

(6) TOPOGRAPHIC HEIGHTS, DENSITIES.

PROBLEMS:

DATA ALSO NEEDED FROM SURROUNDING AREA: (D, DDR, PL, USSR) WHO HAD THE DATA ??

EVEN IF DATA EXISTED IT COULD NOT BE MADE

(2), (6) AVAILABLE DUE TO SECURITY RESTRICTIONS.

IF DATA WERE MADE AVAILABLE THEN:

(1), (2), (3) ESSENTIAL DATA ELEMENTS LACKED: PRECISION, USED REFERENCE SYSTEM, METHOD OF COMPUTATION

(2), (4), DATA FORMAT REQUIRED CHANGE: CODED INFORMATION, LACK OF DELIMITERS, NUMBER OF SIGNIFICANT DIGITS NOT INDICATED.

ALL DATA CONTAINED ERRORS: MISPUNCHED NUMBERS, WRONG REFERENCE SYSTEM, - NOT ADJUSTED TO COMMON ORIGIN, SAME VALUES FROM DIFFERENT SOURCES DISAGREED.

PROBLEMS INCREASE IF WE NEED TO COMBINE DATA FROM VARIOUS FIELDS OF RESEARCH:

GEODESY, GEOMAGNETISM, HYDROLOGY, METEOROLOGY, VOLCANOLOGY, SEISMOLOGY, EXPLORATION GEOPHYSICS, ASTROPHYSICS, EARTH DYNAMICS ....

WHERE DO WE FIND DATA ?

HOW DO WE ACCESS THE DATA ?

WHAT IS THE "QUALITY" OF THE DATA ?

HAS SOMEBODY ELSE USED THE DATA ?

ESPECIALLY FOR GEODYNAMIC STUDIES MUST DATA OF DIFFERENT KINDS BE "CORRELATED"

EXAMPLE: THE INFLUENCE OF ATMOSPHERIC AND GROUND WATER LEVEL VARIATIONS ON A GRAVITY MEASUREMENT.

WE NEED A KIND OF

EUROPEAN CRYSTAL DYNAMICS

INFORMATION SYSTEM

WITH LINKS TO SIMILAR SYSTEM IN OTHER AREAS OF THE WORLD, AND CONTAINING DATA OF "GLOBAL" TYPE OF INTEREST FOR EUROPEAN SCIENTISTS.

2. SOME POSSIBLE APPLICATIONS OF A CDIS.

A CDIS SHOULD MAKE IT POSSIBLE TO (1) KNOW THE EXISTENCE AND LOCATION OF DATA, (2) DOCUMENT DATA, (3) IF NECESSARY ARCHIVE RAW OR PROCESSED DATA, (4) AID TRANSCRIPTION OR REFORMATTING OF DATA, HEREBY SUPPORTING THE FOLLOWING AREAS:

AREA	DATA TYPES/OBSERVATIONS	"GOAL"
TECHNOPHYSICS & SEISMOLOGY:		
CRYSTAL MOVEMENTS	SEISMIC, LEVELLING, GRAVITY, GEODETIC, VLBI, LASER,	DETERMINE MOTIONS AND DEFORMATIONS OF "PLATES".
EARTHQUAKE PREDICTION.	RELEVELLING, GEODIMETER TRAVER, TILTMETERS, STRAINMETERS, PRECISE POSITIONING BY SPACE TECHNIQUES, MAGNETIC, GEOCHEMICAL, ELECTRICAL, SEISMIC ACTIVITY, GRAVITY, EARTH TIDES,	HAZARD ASSESSMENT
VOLCANO PREDICTION	MICRO-GRAVITY, GROUND WATER LEVEL, MAGNETIC, HEAT FLOW, GROUND TEMPERATURE, SEISMIC ACTIVITY, CHEMICAL CHANGES DEFORMATION SURVEY	PREDICTION OF ACTIVITY AND ERUPTION
POSITIONING/LOCATION:		
SURVEYING & MAPPING	"GEODETIC", DOPPLER, GPS, VLBI, GRAVITY VECTOR, + POTENTIAL,	ESTABLISH REFERENCE POINTS, SURVEY, MAP-PRODUCTION.
MONITORING SUBSIDENCE AND PUBLIC HAZARDS	"GEODETIC", GPS, PHOTOGRAMMETRY, REMOTE SENSING	MONITORING ENGINEERING STRUCTURES: DAMS, PIPELINES, SEWAGE SYSTEMS, DRAINAGE, LAND SUBSIDENCE AFTER OIL, GAS, GROUND WATER REMOVAL.
RESOURCE EXPLORATION AND EXPLOITATION:	DOPPLER, GPS, "GEODETIC"	LOCATION OF PLATFORMS, GEOPHYSICAL SURVEYS, MONITORING ICE FLOW
MILITARY	— SAME —	— FRIENDS AND ENEMY LOCATION — +++...
EARTH DYNAMICS:	TIME, EARTH ROTATION, POLAR MOTION, ⟷	VARIATION OF THESE QUANTITIES
SATELLITE + SPACECRAFT TRACKING	VLBI, LASER, DOPPLER, GPS	ORBIT DETERMINATION
ASTRONOMICS	VLBI, HYDROGENE	STELLAR STRUCTURES.....

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3. POTENTIAL USERS OF A CDIM, (in Europe)

EUROPEAN ORGANISATIONS:

ESA, ESF, A FUTURE 'EUROPEAN GEODYNAMIC ORGANISATION' EGO.

NATIONAL GOVERNMENT ORGANISATIONS

NATIONAL GEODETIC/MAPPING/CADASTRAL ORGANISATIONS LIKE IGN (B,F), ORDNANCE SURVEY (UK), NGO (N), IGM (I,S), DGFI (D) ETC.

NATIONAL SPACE ORGANISATIONS (CNES (F)).

NATIONAL GEOLOGICAL SURVEYS

NATIONAL DEFENCE ORGANISATIONS.

NATIONAL RESEARCH — " —

UNIVERSITY DEPARTMENTS

GEODETIC, GEOPHYSICAL, ASTRONOMICAL DEP.

INDUSTRY

SURVEYING FIRMS

EXPLORATION CO.

INTERNATIONAL USERS

FAGS SUB-ORGANISATIONS

WORLD DATA CENTERS.

GENERAL PUBLIC

SOMEBODY, WHO WANTS TO BUY A HOUSE IN CALABRIA.

4. SYSTEM DESIGN OF A CDIS

4.0. BASIC FACTS: TELECOMMUNICATION BECOMES VERY EFFECTIVE AND INEXPENSIVE

SUBDISCIPLINES [SEISMOLOGY] HAS ALLREADY DEVELOPED INFORMATION SYSTEMS

MANY NATIONAL DATA BASES EKIST

FUNDS ARE SCARCE, DIGITAL DATA COLLECTION COMMON EVERYWHERE

LOMAN & RENFROW OF JPL HAS PROPOSED THE ESTABLISHMENT OF A "CDIS" BASED ON THESE FACTS.

THE PROPOSAL COULD EASILY BE IMPLEMENTED IN EUROPE !!

4.1: INFORMATION SYSTEM CONSIDERATIONS:

CONTROLLING PERSONNEL:
GEOPHYSICISTS → DATA COLLECTION, VALIDATION, PROCESSING, DISPLAY
INFORMATION SYSTEM SPECIALISTS → SYSTEM DESIGN, STORAGE, DATA MODELS, COMMUNICATION.

TIMELINESS:
DATA MUST BE INCORPORATED AS FAST AS POSSIBLE.
-DIFFICULT-

DISTRIBUTED/CENTRALIZED COMPUTING:
MAIN EMPHASIS ON DISTRIBUTED COMPUTING.

INTERACTION MODE:
INTERACTIVE IN ORDER TO SURVEY DATA
BATCH FOR RETRIEVAL OF LARGE DATASETS.

VALIDATION:
STANDARDS MUST BE DEFINED AND ENFORCED.

DOCUMENTATION:
THE SYSTEM MUST BE ABLE TO PROVIDE INFORMATION ABOUT
E.G. MODE OF REDUCTION, DATA COLLECTION METHOD ETC.

PROCESSING REQUIREMENTS:
TIME SERIES ANALYSIS, ADJUSTMENT, SPECTRAL ANALYSIS, ETC.
GRAPHICS DISPLAY

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RAW AND/OR PROCESSED DATA:
BOTH KINDS NEEDED.

DATA DENSITY [TIME/SPACE]:
NO LIMITATIONS MUST EXIST.

RETRIEVAL KEYS:
TIME & LOCATION & TYPE.

STORAGE MEDIA:
DISC'S AND TAPE'S

ENTRY AND USE OF ANCILLARY DATA:
MUST BE POSSIBLE, REQUIRES REFORMATTING/REPROCESSING CAPABILITY.

COMPATABILITY OF DATA:
MORE STANDARDS NEEDED/SHOULD BE USED FOR COLLECTION, VALIDATION, EXCHANGE;

QUANTITY OF DATA:
SYSTEM MUST BE PREPARED TO HANDLE VERY LARGE DATA VOLUMES (E.G. WITH ONE LARGE COMPUTER WITHIN A NETWORK OF COMPUTERS).

INTERCOMMUNICATION OF DATA BASES:
EXISTING DATA BASES SHOULD FORM THE BASE OF A CDIS. EXISTING DATA NETWORKS SHOULD BE UTILIZED.

4.2. USER REQUIREMENTS.

GENERAL & INFORMATION DISTRIBUTION:

- CONTROL BY GEOPHYSICISTS : POLICIES, PROCEDURES
- FLEXIBILITY FOR GROWTH : CDIS MUST BE ABLE TO ACCEPT AND MANIPULATE VARYING DATA TYPES, FORMATS, WITH VARIOUS RETRIEVAL KEYS AND VARYING TEMPORAL AND SPATIAL OBSERVATION DENSITY.
  SCOPE AND FUNCTIONS MUST BE EXPANDABLE
- CONTAIN CATALOG OF EXTANT DATA : WORLDWIDE, PERMITTING BROWSING AND COMPLEX INFORMATION REQUESTS.
  GEODETIC INTEGRATED WITH GEOPHYSICAL DATA.
- DATA EXCHANGE & TRANSCRIPTION : RESPONSE TO MOST REQUESTS IN A COUPLE OF DAYS. CDIS MUST BE CAPABLE OF TRANSCRIBING DATA FROM TO PAPER/ PUNCH CARDS/ 7/9 TRACK TAPE /MICROFICHE ...
- DATA FROM NEW TECHNOLOGIES MUST BE INTEGRATED.
  DATUM SHIFTS - TRANSFORMATIONS
- DATA COLLECTION STANDARDS : MUST BE ESTABLISHED, TO ENSURE COMPATIBILITY & COMPARABILITY.

INFORMATION STORAGE REQUIREMENTS:

- DATA/INFORMATION ARCHIVING : AT THE SITE, WHERE EACH DATASET IS MOST USED !
- DOCUMENTATION : DETAILED DOCUMENTATION MUST BE AVAILABLE : DATA COLLECTING AGENCY, "PLATFORM", CHARACTERISTICS, EQUIPMENT USED, ACCURACIES, RESTRICTIONS IN USE, TRACK MUST BE KEPT OF CHANGES, VALIDATIONS, AVERAGING, FILTERING ETC.
- FORMATS : CHARACTER FORM, FORMATTED, WITH DELIMITERS.
- STORAGE MEDIA : MAGNETIC TAPES / DISCS.
- DATA REFINEMENT, RAW OBSERVATIONAL DATA SHOULD BE KEPT.

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INFORMATION RETRIEVAL REQUIREMENTS:

- RETRIEVAL KEY'S: MINIMUM: SPACE + TIME. BUT ALSO SENSOR TYPE, AGENCY, PRINCIPAL INVESTIGATOR.
- CROSS-REFERENCING: TO BIBLIOGRAPHIC REFERENCES WHICH CITE DATA. - HEREBY POSSIBLE TO TRACK UTILIZATION OF DATA - METHODS ANALYZING THE DATA.
- ACCESS MODE: INTERACTIVE ACCESS TO CATALOG BATCH ACCESS TO DATASETS.

4.3. PROPOSED SYSTEM CONCEPT.

COMMUNICATION "NETWORK" WHICH WILL EXPEDITE THE EXCHANGE OF GEOPHYSICAL INFORMATION, USEFULL IN CRYSTAL DYNAMICS STUDIES, AMONG GEOPHYSICAL DATA CENTERS IN EUROPE.

NOT A NEW 'SUPER' DATA CENTER, BUT BASED ON EXISTING DATABASES AND THE NEW TECHNOLOGIES FOR INTERCONNECTING DISTRIBUTED DATABASES.

NETWORK SHOULD GROW AND EVOLVE AS USER DEMANDS AND DATA EXCHANGE EXPANDS.

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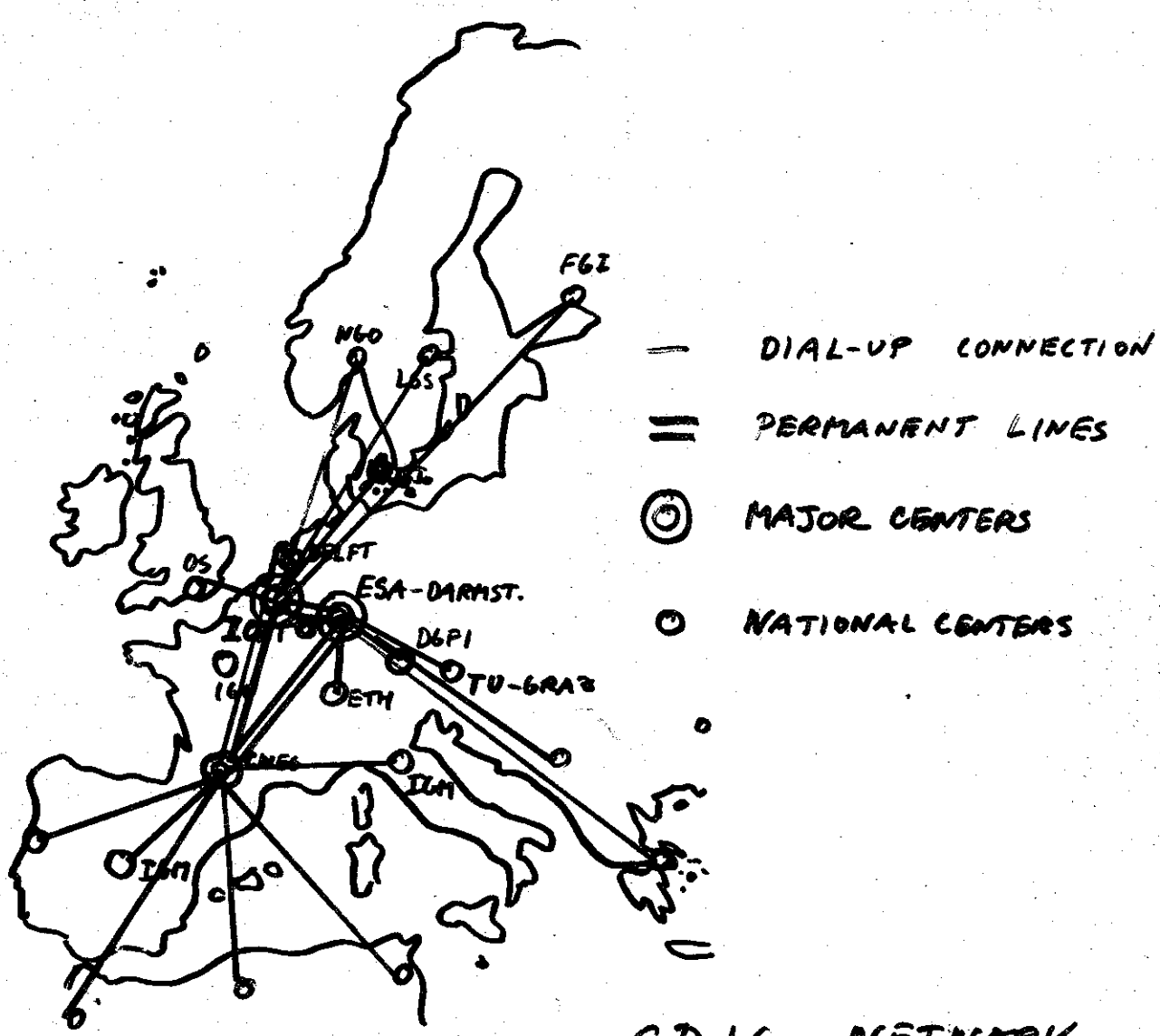

CDIS - NETWORK.

IMPLEMENTATION SCHEDULE :

PHASE I: CREATION OF A COMPUTERIZED CATALOG AT ONE OF THE MAJOR CENTERS, POINTING AT GEODETIC, SEISMIC, GRAVITY FIELD, .. INFORMATION.
ESTABLISHMENT OF PROTOCOLS / STANDARDS.

PHASE II: FUTHER DEVELOPMENT OF CATALOG, BIBLIOGRAPHICAL CATALOG. CDIS RESPONSIBLE FOR DISSEMINATION OF DATA.

PHASE III: SUPPORT DATA COLLECTION, EXCHANGE, VALIDATION & FILTERING OF MOST IMPORTANT DATA TYPES.

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5. CONCLUSION:

I THINK A CDIS MAY BE ESTABLISHED, I.E. FUNDED WITHOUT BIG DIFFICULTIES. - MONEY SPEND ARE EASILY RETRIEVED.

WE NEED A EUROPEAN (+NATIONAL) GEOPHYSICAL/CRYSTAL DYNAMIC DATA POLICY. - ESTABLISHMENT OF A CDIS WILL FORCE US NOT JOST TO TALK, BUT TO DO SOMETHING.

ENVISAGE 1990:

WE HAVE A NUMBER OF GPS RECEIVERS IN EACH 1° SQUARE IN EUROPE. - THEY GIVE ±0.02 m RELATIVE POSITIONS EACH 10 MINUTES.

ANOMALOUS POSITION CHANGES MUST BE CORRELATED WITH KNOWN CRUSTAL STRUCTURE, EARTH TIDE MESUREMENTS ETC. -

THIS KIND OF TASK COULD BE DONE BY A CDIS.