# Remote Sensing.....in the beginning and later....

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# What do we consider as the beginning of EO from space?

I suggest: 1972

Why?

before 1972:

-earth observation was exlusively by aerial pictures\*

-first meteorological satellite: 1-st April 1960- TIROS1

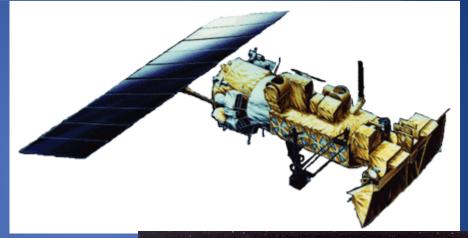
-EO from satellite from space (Corona-KOSMOZ), military, no public access\*

\*Analogue systems

What happend in 1972? -Launch of ERTS-1, Landsat 1: 23-07-1972 -Launch of NOAA-2 AVHRR: 15-10-1972

	ERTS-1 Landsat 1	NOAA-2 AVHRR
-resolution	79 meter	1 km
-bands	4: G, R, NIR	4: R, NIR, SWIR, TIR
-prize	8000 US\$	Only for MET Off









# 79 meter resolution



# 1 km resolution



# And that came to us....."remote sensing people"

We were used to work with aerial pictures:

- -resolution: 10-50 cm
- -panchromatic or colour, sometimes CIR, B&W IR
- -in stereo, by definition
- -analouge interpretation and mapping methods
  - +stereographic mapping for the topography

+the use of interpretation kyes and PMU mapping

	NW9 \$F132 67 -0057 51-16-30N 116-47-55W 765		SI.	Ground					
			No.	Features	Tone	Texture	Shape/ size	Pattern	Association
			1	Salt affected soil	Dull white	Rough	Irregular	Dispersed	Weed /grass
alltri			2	Waterlogged area with weeds		Smooth	Irregular	Dispersed	Salt tolerant weed
Rellard	AN AN		3	Normal soil	White gray, white tone	Smooth	Irregular	Regular	Irrigated land
			4	Plantation /orchards	Bright red, red and dark red	Smooth	Fixed	Regular	Near road side
			5	Sand dunes	Bright white tone	Medium to coarse	Uniform	Contiguous	Shrub/arid plantation
5	-7400		6	Settlement (Habitation)	Cyan, gray pinkish mixed tone	Mottled	Irregular	Clustered	Pond
		J. C.	7	Feeder (Rajasthan canal)	Dark black- bluish line	Smooth	Regular	Linear	Plantation & Un-mettle road
			8	Railway line	Dark black with reddish mixed tone	Smooth	Regular	Linear	
	FS125 1/ 188 F/4.8 FF2.8 FC+2/3 SP-1/	Standard 0078	9	Metalled road	Black tone	Smooth	Regular	Linear	

And that came to us...."remote sensing people" We were used to work with aerial pictures: -resolution: 10-50 cm -panchromatic or colour, sometimes CIR -in stereo, by definition -analouge interpretation and mapping methods

And we got: -80 meter resolution -monoscopic images -BUT MULTISPECTRALITY



separation between the photogrammetry and the image interpretation research

# What to do with these new "possibilities"?

The "old" known techniques were applied to this new imagery, including: Do not forget, this imagery came under the form of negative film emulsions to the lab's. image processing techniques:

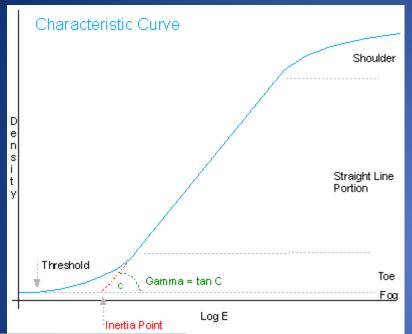
-image enhancement, band by by band by the use of high  $\gamma$ -fims

- -images enlargments, by photographic enlargments
- -colour composites by diazo thechniques
- -density analysis by a densitometer on the film

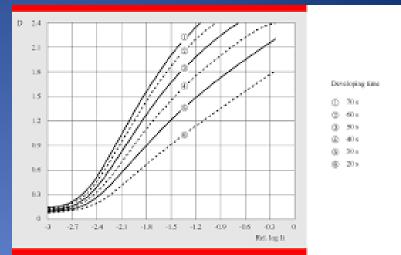
image interpretation methods: -PMU-mapping

-interpretation keys

# image enhancement, band by by band by the use of high γ-fims

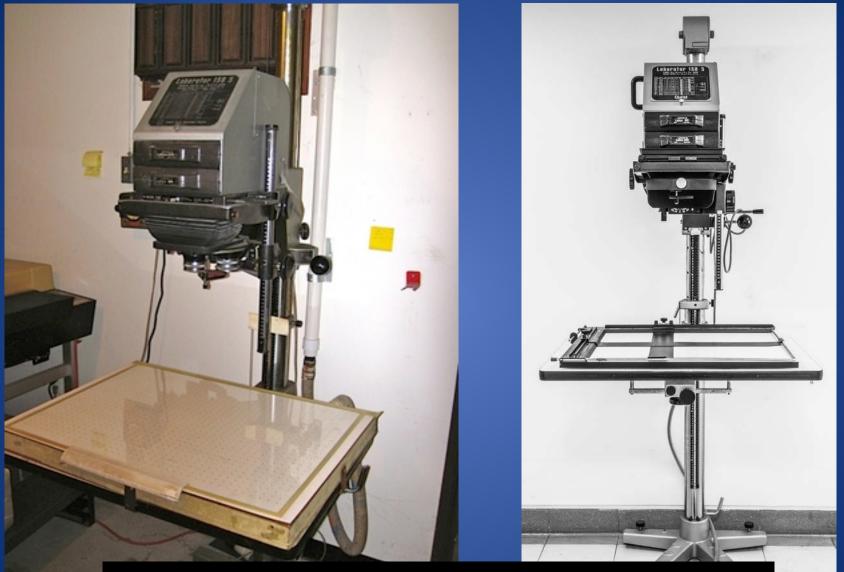






# Estimated time for 1 enhancement of one band: 1h 1h30min

# image enlargements by photographic enlargments



Estimated time for 1 enlargement of one band: 1h 1h30min

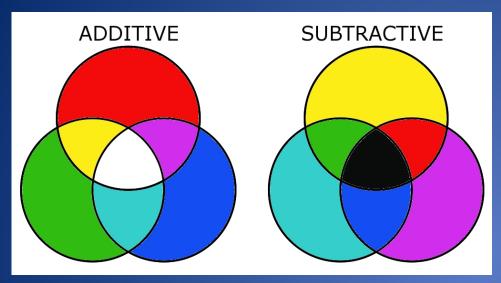
# colour composites by diazo thechniques

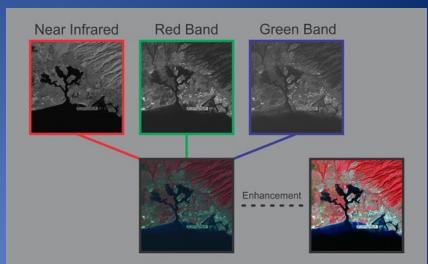


# Developed in amonia vapour !!!!!!



# colour composites by diazo thechniques





## The only possibility were FCC



Estimated time for 1 FCC based on 3 bands: 3-4 days Problems: -colour balance between the 3 bands -much experimental work

# density analysis by a densitometer on the film



# interpretation keys and PMU mapping

SI.	Ground	Interpretation keys					
No.	Features	Tone	Texture	Shape/ size	Pattern	Association	
1	Salt affected soil	Dull white	Rough	Irregular	Dispersed	Weed /grass	
2	Waterlogged area with weeds	Blackish red mixed tone	Smooth	Irregular	Dispersed	Salt tolerant weed	
3	Normal soil	White gray, white tone	Smooth	Irregular	Regular	Irrigated land	
4	Plantation /orchards	Bright red, red and dark red	Smooth	Fixed	Regular	Near road side	
5	Sand dunes	Bright white tone	Medium to coarse	Uniform	Contiguous	Shrub/arid plantation	
6	Settlement (Habitation)	Cyan, gray pinkish mixed tone	Mottled	Irregular	Clustered	Pond	
7	Feeder (Rajasthan canal)	Dark black- bluish line	Smooth	Regular	Linear	Plantation & Un-mettle road	
8	Railway line	Dark black with reddish mixed tone	Smooth	Regular	Linear		
9	Metalled road	Black tone	Smooth	Regular	Linear		

# The (early) 80's



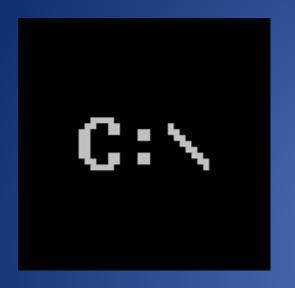
-The introducion of digital image processing

-Landsat 4: 14-th of July 1982 -7 bands (+SWIR, TIR) -30 meter resolution

-SPOT-1: 22-nd of February 1986 -20 meter resolution is XS -10 meter resolution in P -stereo capacity from space



# The introduction of digital image processing





Current date is Tue 1-01-1980 Enter new date: Current time is 21:35:24.18 Enter new time:

The IBM Personal Computer DOS Version 2.00 (C)Copyright IBM Corp 1981, 1982, 1983

#### A>dir

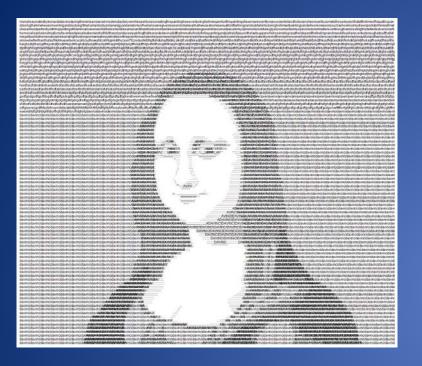
Volume in drive A has no label Directory of A:\

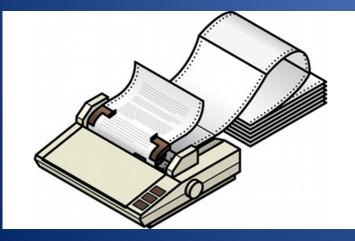
COMMAND	COM	17664	3-08-83	12:00p
FORMAT	COM	6016	3-08-83	12:00p
CHKDSK	COM	6400	3-08-83	12:00p
SYS	COM	1408	3-08-83	12:00p
DEBUG	COM	11904	3-08-83	12:00p
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**IBM 286** 

# The introducion of digital image processing



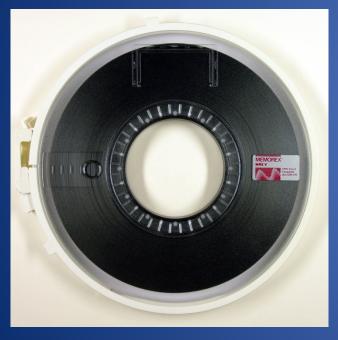




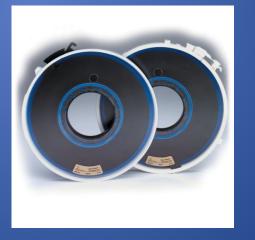
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## The introducion of digital image processing

# -colour display in 4 colours, later 16 colours -image size: 256 \* 256 pixels 512 \* 512 pixels



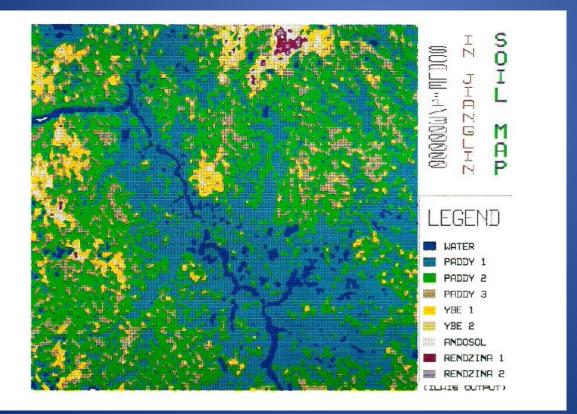
the sub-scenes had to be cut from the fullscenes, stored on CCT's, loaded on a main frame computer and cut from there. E.g. 1 CCT per Landsat 4 –band.



-Image processing: image slicing, lineair stretch

## The introducion of digital image processing

-an image classification of an image of 512 \* 512 pixels took +/- 24h (max.likelihood)
-limited number of classes
-limited lay out possibilities



# O.K., the image display improved, more colours, some faster processing with the IBM 386

But: all the ancillary data where in analogue format and these data needed to be digitised mannualy

- -contour lines to build a DEM
- -polygone lines for geology, soil, land use
- -points and tables for climatology, soil properties , like chemical composition, salinty etc...









#### Duration: some times days, weeks

Flur

# Now a days: all these ancillary data is in digital form available, often for free or at limited prices.

e.g.:

-DEM's: ASTER and SRTM, Regional DEM'sNational Geographic Institute's

-climatic data: NOAA, EUROMET...

-geology, soils, vegetation, LULC etc: USGS, different national and regional offices

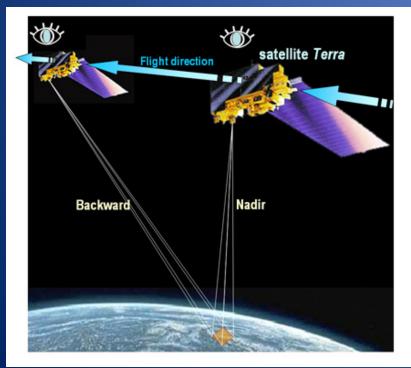
# The "big" chance: end of the 90's

-For the first time VHR-images for civilian purposes

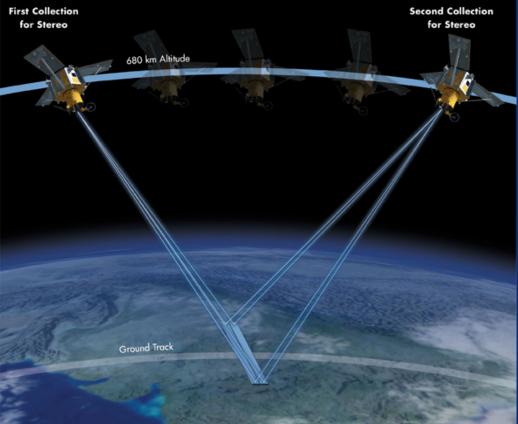
launch IKONOS-2: 26 September 1999
 -1m resulution in P
 -Stereo capacities!!! From space
launch Terra-Aster: 18 December 1999

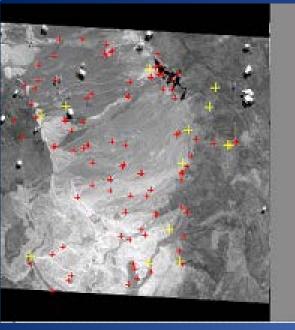
-Photogrammetry becomes digital and is re-entering the "remote sensing community" again due to the finer resolution and the stereo capacities from space images

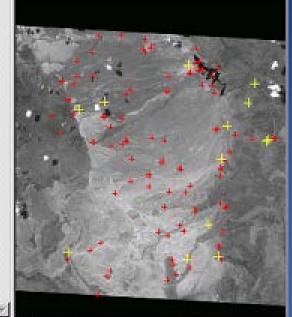




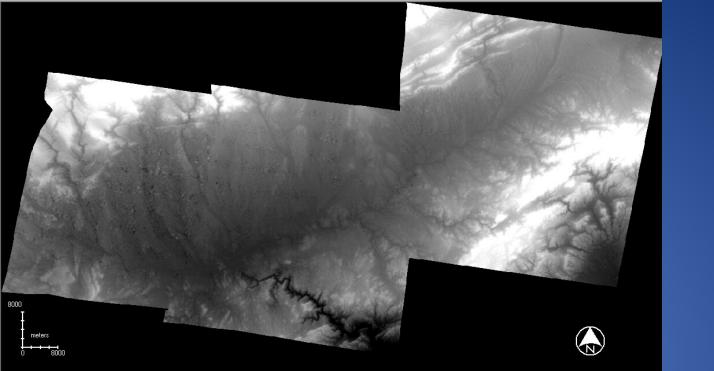
#### Stereo-recording from Space

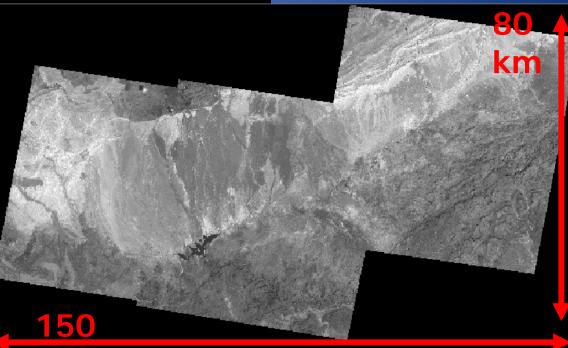


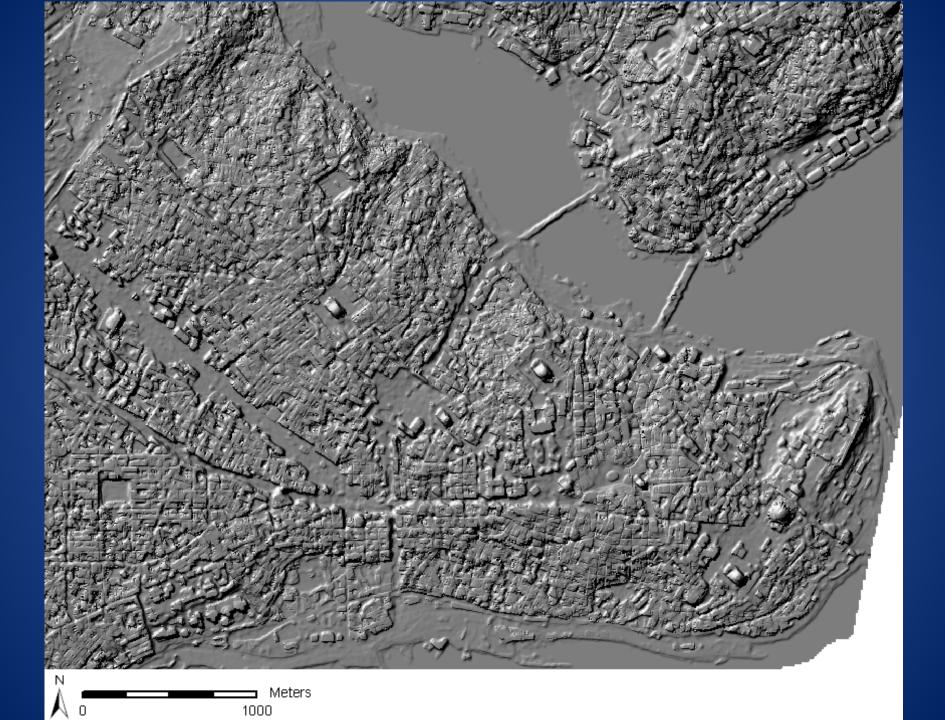


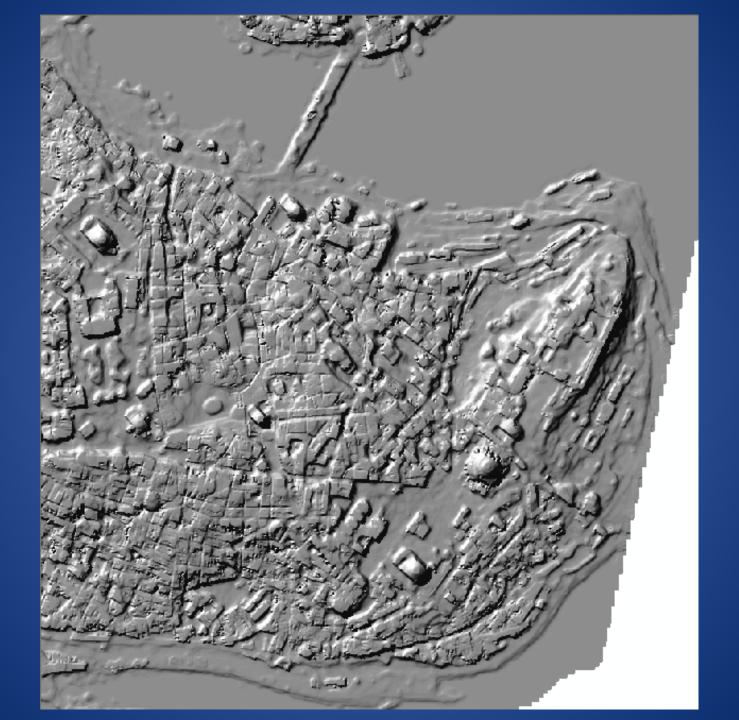


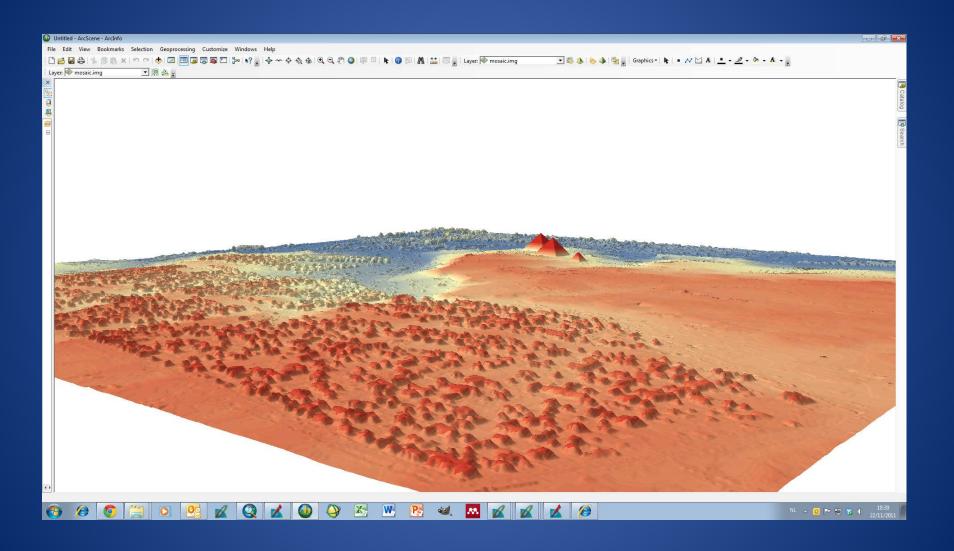






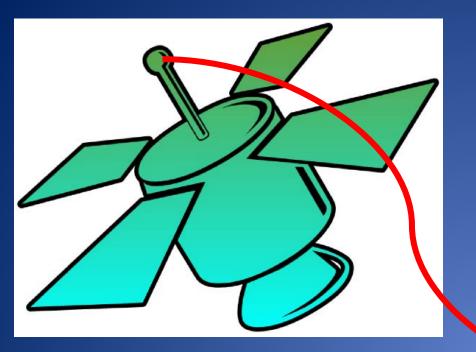






And so...after more than 40 years ...we end up with a fine resolution and stereo-viewing

but with
-multispectrality
-wide range of resolutions (ground, temporal, radiometrical)
-digital processing



# Thank you for your attention.... And let's stay in contact

