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## Satellite Remote Sensing for Geomedical Purposes

- Satellite Remote Sensing can support geomedical research with a substantial amount of geographical and environmental information which is important for the study and assessment of environmental impact to health.
  - This presentation gives a shortened brief overview about a previous feasibility study dealing with the possibilities to correlate environmental phenomena with diseases.
1. The world is full of turbulences and phenomenas which cause illness and distribute pathogens. The image shows the water vapor layer in the upper atmosphere.
  2. The idea for the study was born during an observation flight in winter time with a light aircraft when a small airpolluting factory was noticed, which emits normal waste gases which concentrated some days later due to a changed weather situation (inversion) over the factory.
  3. Other revisits, again some days respectively weeks later, showed the snow melting pattern under the previous waste gas cloud, which was caused by a fall out of soot, dust and resulting differences of light reflection by the snow, compared to the clean areas further away. Surface temperature rise of the impacted area lead to an earlier melting of the snow. This again was followed by an earlier greening of the surrounding meadows in spring time.
  4. On many days of the year, specially between autumn and spring time southern winds (Föhn) are prevailing. In this situation the waste gases of the factory are blown over a well known tourist village.
  5. It was assumed that similar situations could be observed in a larger scale from satellite. For this a test area in Upper Austria was selected, where heavy industries are concentrated. The area is well known for inversions with long lasting smog situations.
  6. Investigations in satellite image archives where successful. Several images could be found which showed similar phenomena.

The region to be investigated after a fresh snow fall. The city is located at the Danube river in a small basin. In the north the area is surrounded by the so called **Bohemian Mass** a cristallin mountain areas with heights up to 900 and 1000 meters. Parallel to the Danube stretches from west to east the flat pre-alpine area slightly hilly, with small river beds, full of agricultural land, and a small city chain following the River Traun towards the south west. The black dots are forests. In the south the Alps are rising.

7. The same area during a several days old inversion. The central emission sources can be seen through the inversion cloud over the city area. The cloud distribution pattern is a regular one and can be observed very frequently.

After a change of the weather situation the snow melting pattern under the inversion cloud can be seen – it corresponds clearly with it.

8. With this images the idea was born to correlate the environmental respectively the smog situation with diseases. To study influenzas temperatures and humidity might be of interest. This information can be extracted from the thermal infrared band of the satellite data.
9. A first trial was made with death reasons of the inhabitants of this district. The number of cases had to be restricted to one year only, but was done for about 10 death causes. The study showed some interesting results - three of them are shown here:
10. Skin cancer correlates with the smog cloud. It has not been investigated what the reasons might be. For instance it could be one reason that the citizens are spending too much time on Italian beeches or in skiing areas without good sun protection.
11. A similar pattern shows up for lung cancer. - Smokers or industrial and city dust (including traffic exhaust gases)?
12. No correlation can be found for heart deaths. As a result of this pre-feasibility study more research will be done in the near future, together with medical investigators, which collected information over at least 10 years on living people, and which will be now correlated with satellite data information and environmental ground measurements.

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