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ENV-540 Image processing for earth observation

MODIS sensor : description and applications to fire monitoring

Applications

- Clouds study (distribution, size, water vapor content & temperature)
- Monitoring of fires and oils spills (thanks to near real-time data)
- Land use change ...

Challenges

- Sensitive to cloud cover for surface study (as optical sensor)
- Orbital drift to lower altitudes

Sensor characteristics

- MODIS = *Moderate Resolution Imaging Spectroradiometer*
- 2 satellites : Aqua and Terra
- Spectral bands : 36 of wavelength 0.4 µm to 14.4 µm
- Viewing swath : 2,330-km-wide
- Revisit time : 1 to 2 days
- Orbit : 705 km altitude and 98° inclination
- Resolution : 250 m (2 bands), 500 m (5 bands) or 1 km (29 bands - fire detection)

Why MODIS is relevant for fire detection and monitoring ?

- 2 products: active fire & burned areas at 1-km resolution
- 4 daily MODIS fire observations at mid-latitudes
- 4 & 11 µm bands distinguish flaming from smoldering (~ 1000 m²)
- Useful for fire management & global monitoring of fire impacts on ecosystems, atmosphere & climate

$$|T_{Fire} - T_{LandCoverAround}| > Threshold \Rightarrow Fire$$ ✓

A relevant example: Dramatic burning on Kangaroo Island

This image from 12/01/2020 is created from Bands 7-2-1 of the Moderate Resolution Imaging Spectroradiometer (MODIS) instrument aboard the Aqua satellite. The dark red areas of the 12 January image indicates that almost a third of the island burned in that 9-day period.

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References **1.***https://modis.gsfc.nasa.gov/* **2.***https://terra.nasa.gov/about/terra-instruments/modis* **3.** *https://modis.gsfc.nasa.gov/data/dataprod/mod14.php* **4.***https://modis-fire.umd.edu/files/MODIS_C6_C6.1_Fire_User_Guide_1.0.pdf* **5.***https://www.usfa.fema.gov/wui/data/wildfire-report-series/modis-detected-fires-report/modis.html* **6.***https://forest-fire.emergency.copernicus.eu/about-effis/technical-background/active-fire-detection* **7.***https://worldview.earthdata.nasa.gov/*