Each year, malaria kills 1 to 2 million people. Children in Africa are most vulnerable, where a child dies from malaria every minute. This life-threatening disease is caused by parasites that are transmitted to people by infected mosquitoes. Controlling the spread of mosquitoes is the most effective way of reducing the transmission of the disease. Since mosquitoes begin life as aquatic larvae and adults rarely travel more than two kilometres from their breeding site in their 2 to 3 weeks of life, human proximity to water poses a risk of exposure to malaria. Environmental factors such as rainfall patterns, temperature and humidity affect the number and breeding cycle of the mosquitoes, and epidemics can occur when these conditions suddenly favour transmission in areas where people are not protected against malaria.

GMES satellite data help model the prevalence and spread of malaria and the dynamics of disease outbreaks.

Timely and adequate data are an essential requisite for evidence-based planning towards malaria eradication. GMES satellite data support the modelling of the prevalence of malaria and the dynamics of outbreaks by providing information on the environmental conditions that tend to elevate mosquito numbers. Detailed maps of land surface temperature (from radiometers), surface water and vegetation cover (from optical sensors) as well as digital elevation models of water bodies (from radars) can be used in numerical models and statistical analyses. Models, combining hydro-meteorological data with information on malaria cases and local population collected by Ministries of Health in different countries, help identify areas at risk and forecast possible outbreaks. This provides authorities with the information they need to embark upon recovery actions and issue warnings. Satellites, with their synoptic and routine views, are essential for monitoring large areas to identify spatial patterns and relevant climatic trends for mosquito development, especially for areas where meteorological data taken on the ground are scarce.

The map shows the prevalence of malaria in West Africa (percentage of expected population testing positive for malaria over a given location). The map was produced using numerical models that analyse malaria data with environmental factors such as climate, altitude, vegetation cover, agro-ecological zones which are also derived from satellite maps.

Source: MARA ARMA
**CURRENT ACTIVITIES**

GMES projects support African efforts to halve malaria mortality by:

- monitoring areas at risk from space
- refining the parameters used to identify optimal local breeding conditions for mosquitoes
- implementing Earth observation capacities within malaria vector control and management programmes

**HOW ELSE CAN GMES CONtribute?**

The GMES Sentinel-1, -2 & -3 missions can support anti-malaria control measures by:

- ensuring the continuity of C-band SAR data by, for example, mapping water bodies (Sentinel-1)
- routinely delivering global high-resolution optical images, for example, mapping detailed land-use and land-use change (Sentinel-2)
- providing timely, medium-resolution optical measurements to monitor, for example, land cover, photosynthetic activity and land surface temperature (Sentinel-3)

**NEXT STEPS**

- Improve the development of Earth observation methodologies to monitor areas at risk of malaria
- Integrate Earth observation techniques in the malaria control programmes
- Enhance Earth observation capacity in malaria control and management

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The temperature of the surface of the land can be measured best from space with satellites that provide thermal-infrared data.

For more than 10 years, the Advanced Along-Track Scanning Radiometer (AATSR) on Envisat provided thermal measurements over the oceans and land. An even more accurate sensor of this kind, the Sea and Land Surface Temperature Radiometer (SLSTR), will be carried on the GMES Sentinel-3 mission. The SLSTR is designed to measure ocean and land-surface temperature. It has nine spectral bands, an accuracy of 0.2 K and a ground spatial resolution of 1 km.

The first Sentinel-3 satellite is expected to launch in 2014, followed by a twin satellite to optimise coverage for the GMES services.

The image shows the daytime land surface temperature over Africa for April 2006, based on Envisat AATSR data. Land surface temperature acts directly both on the breeding cycle of mosquito vectors as well as the development of the Plasmodium parasite within the vectors. Thus, surface temperature is thought to be directly related to increased risk for malaria.

Source: Processed by Dr. D. Ghent, University of Leicester, UK

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**Sentinel-3**

**ESA’s flying thermometer**