**innovative cloud monitoring and forecasting**

CloudCAM is based on a field-mounted camera system, providing high resolution cloud imagery which is then processed to detect individual clouds. Fulcrum3D’s [CloudCAM analysis software](http://www.fulcrum3d.com/solar/cloudcam-analysis/) to identify, categorize, track and predict cloud movement. From this the cloud forecasts, solar forecasts and power forecasts can be generated.

**CloudCAM sensor hardware***CloudCAM* is a weatherproof all-sky camera system with a fixed fish-eye lens which provides 360/180 degree sky coverage.  The system incorporates a Kipp & Zonen SMP11 pyranometer for local irradiance measurements, as well as other weather monitoring sensors (temperature, humidity etc.), power supply and remote communications.Images are captured in full colour at a high sampling rate (~6s per image) to ensure small changes in cloud locations and shape are detected.

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| [http://www.fulcrum3d.com/wp-content/uploads/2016/02/CloudCAM-CC1-Image2.png?x87728](http://www.fulcrum3d.com/index.php/wp-content/uploads/2016/02/CloudCAM-CC1-Image2.png?x87728) | CloudCAM Sensor Head 120x80 |
| Typical CloudCAM all-sky image  (Uterne Solar Power Station, courtesy Epuron) | CloudCAM sensor head showing pyranometer, humitter and camera |

**cloud detection, tracking and analysis**

The CloudCAM software identifies individual clouds and, from a series of consecutive images, assesses the historical cloud movement (including change in shape), and predicts cloud locations ahead of time. Importantly, the system can deal with the most challenging cloud events including:

* spontaneous cloud formation
* cloud shrinkage and disappearance
* multi-level cloud, including clouds moving in different directions
* cloud disappearance and emergence e.g. behind other clouds or other objects

**cloud detection**

Fulcrum3D’s cloud detection software automatically corrects for lens distortion, and reduces lens effects such as direct, flare and other anomalies. A horizon screen can be incorporated to reduce false detections. Individual clouds are detected and separately identified for subsequent tracking.

**cloud tracking and prediction**

Fulcrum3D’s cloud tracking and prediction individually tracks each cloud and from the historical data predicts future cloud locations using various image processing techniques.  The quality of the prediction is based on  how well the analysis algorithms understand the historical movement. The “confidence” values produced as part of the analysis indicate the level of understanding of the historic movement, and from this, the level of confidence in the forecasts.

**cloud shading and impact analysis**Once current and future cloud locations are known, cloud shadow maps can be generated which indicate the areas of the ground shaded at any point in time. This in turn can be used to estimate solar irradiance and solar power  production. Fulcrum3D is currently refining its cloud characterisation module to further improve its estimates of solar irradiance at any given location.