Water - today and tomorrow

Inland water management

DHI

DHI develops and provides forecasting systems used worldwide and based on state of the art technology and years of experience. The technology is proven and the experience is unprecedented.

DHI is an independent, international consulting and research organisation represented worldwide. Our objectives are to advance technological development and competence in the fields of water, environment and health. We provide a wide range of solutions within consultancy, policy services and leading edge technologies. DHI works with governmental agencies and authorities, universities, contractors, consultants and a wide range of industries.

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Water shapes our future

Society depends on water. From industry to the smallest household - from countryside to the city - water is essential. It is also a resource with a direct impact on the bottom line.

The need for water is ever increasing. Not just in quantity. It must also be of sufficient quality. The demands and constraints necessitate that the best possible management of the resources is exercised. Hence, the need to accurately monitor, assess and forecast the availability, condition and use of water resources is now more vital than ever, not least as water increasingly becomes a valuable commodity. A fact, which is further accentuated by the effects of climate change.

Forecasts are essential for planning and operational purposes. They can be tailored to provide a wide range of parameters – qualitatively as well as quantitatively. By combining online data with adaptive models, which describe the physical and chemical processes, relevant parameters can be forecasted several days ahead.

Such forecasts have a wide range of uses when it comes to water - from hydropower to water quality and from flooding to water supply. They are universal tools with specialised applications, designed to provide precisely the information needed - and when needed.

Water forecasts are used for managing:

- Water supply
- Wastewater
- Hydropower
- Cooling water
- Energy production
- Industrial production
- Flooding
- Irrigation
- Fishing and aquaculture
- Recreational activates

Predicting the future with water forecasts

Power production and trading

Most power plants rely on water for cooling. The large quantities necessitate that regulatory constraints are imposed on the use of the water so as not to negatively affect the ecosystem receiving the heated water. To protect the ecosystem the water temperature or the temperature differential between inlet and discharge must be within certain limits.

These restrictions have a direct impact on the power production.

The water temperature cannot readily be changed – but it can be predicted, hours and days ahead with high accuracy. As can the water level. This enables the power production capacity to be adjusted to comply with the available capacity.

The ability to accurately predict the production is therefore essential for optimising the revenue and consequently a strong assest for power traders.

"We have, by introducing DHI technology at four of our largest wastewater treatment plants, been able to reduce yearly operational costs by 250,000 Euro and at the same time reduce effluent concentrations".

Municipality of Aarhus, Denmark.

Dam and reservoir operation

To generate as much power as possible from hydroelectric facilities, managers must be able to estimate the most efficient use of water on a daily, weekly, monthly and yearly basis. If those estimates are based on incomplete information, production may be inefficient or out of phase with demand. Managing and using the water is a balance. In anticipation of increased runoff, reservoir water could be released to reduce potential flooding, but if the release was unnecessary the water is lost.

Integrated forecasting systems have already proven to support more efficient water management and increased exploitation of the resources available.

Industrial use of water

Industry often uses large quantities of water in their production processes. It depends on water, just like agriculture and domestic households. Industrial reliance on water makes it essential to preserve it in every aspect possible and make sure that pollution is kept at acceptable levels.

Forecasting systems have a wide range of applications. The systems are used to predict availability of water in order to match and plan production capacity, the amount of water, which can be discharged within the regulatory constraints, and all other aspects with water as the depending factor.

Spills

Spills from industry and other producing sources – accidental or intentional – are inevitable and will often require a quick response to assert the spatial and temporal development. Forecasting technology is in this context ideal to plan, evaluate and implement the necessary initiatives. Spills reaching rivers, lakes or seeping into the ground can be tracked and the development projected, enabling authorities and industries to act accordingly.

Toxic spills can have devastating consequences and the ability to proactively react is therefore imperative. This is where forecasting enters. The same technology and methodology may be used to pinpoint the source of the spill by backtracking.

Mining requires vast amounts of water for the various processes, where often highly toxic substances are used. The residuals or tailings have to be treated or deposited safely, and in case of leakages mitigative efforts must be implemented. This is what forecasting enables.

Flooding

The number of flood disasters and damages worldwide has increased significantly in recent years. While this may partly be due to changes in the climate, the increasing urbanisation and land development also plays a role.

Losses cannot be avoided when major floods occur. But flood preparedness and contingency planning can help reduce flood damage and the number of lives lost.

Flood warning, or forecasting systems in particular, provide an opportunity to reduce the impact of flood events by adapting mitigative measures. Forecasting is therefore a key component in reducing costs.

Irrigation

Water forecasts provide the basis for managing and distributing the accessible water resources. The agricultural sector is particularly vulnerable as the yield depends on supply stability and predictability. Yield can be increased and water consumption reduced by using tactical irrigation based on forecasting and online data sources of governing parameters.

Bathing water

Swimming is a pleasure and a healthy activity when the water complies with the health standards. Low occurrence of algae and bacteria such as e-coli is paramount. It is the clean water which attracts the guests and the tourists. Several days ahead accurate forecasts of the temporal and spatial development of algae blooms and bacteria can be provided online. These forecasts may include source loads such as overspilling sewer outlets in the vicinity. This allows the bather to get a clear indication of the conditions. There is no reason to be in doubt or take unnecessary health risks.

Aquaculture

Aquaculture is the fastest growing food producing sector with an annual increase of 7-8%. Today the annual production of fish and crustaceans in freshwater exceeds 50 billion US $.

The production strongly relies on a good supply of high quality water, and with a steadily growing production the stability and predictability of water supplies become even more important. This is where forecasting systems provide their value.

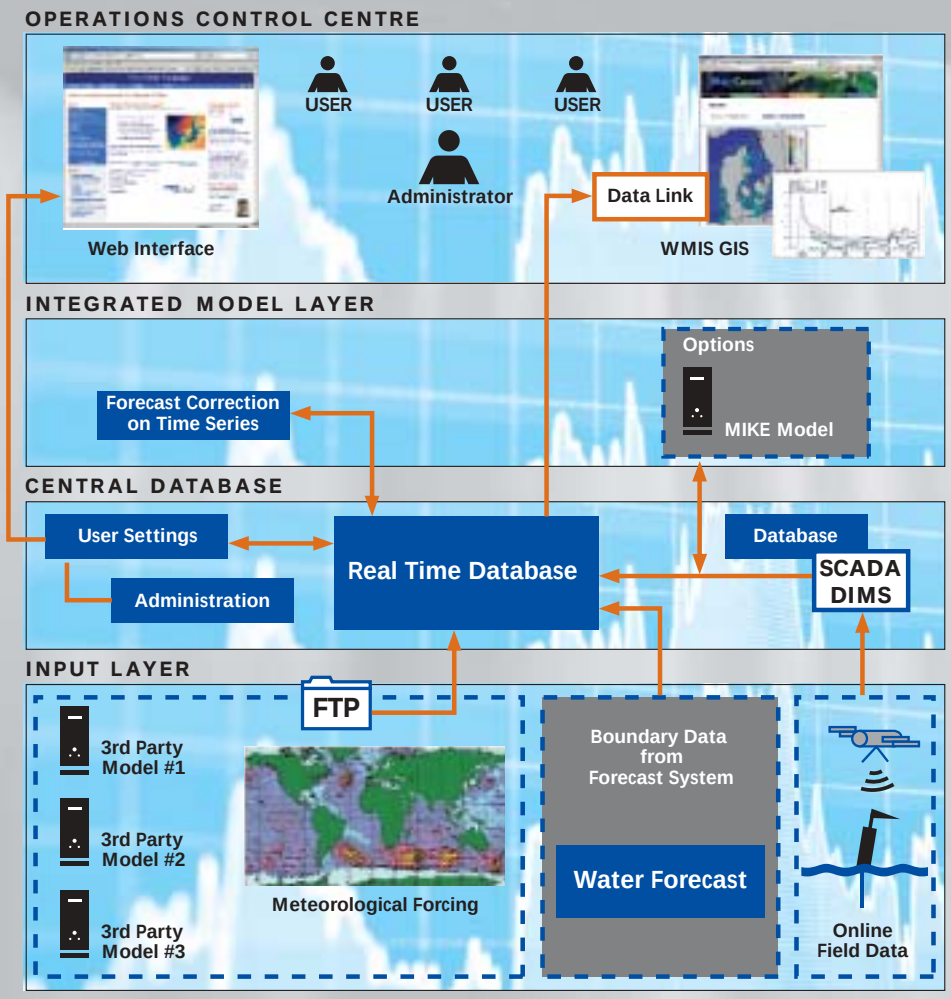
Urban water supply

The availability of clean tap water has major public health benefits. Rapidly growing urbanisation increases the demand for clean water. The widespread use of surface water dictates that not least the water quality is monitored. Using forecasts is the proactive reaction to addressing issues interfering with the quality or indeed shortage. Forecasts are instrumental for sound water safety planning.

Forecasting techniques

Forecasting relies on models, which describe the phenomena of nature and the reaction to changing conditions such as the weather or water usage.

A change in the weather will have implications, and this is where forecasting comes in. By coupling hydrodynamic, biological and chemical models with meteorological models and online data, forecasts of what is likely to occur in the near future can be made. This enables uncertainty and risks to be quantified into early warnings and responsive measures. By feeding the system with online data, the forecasts are continuously updated.



Typical elements in a DHI forecasting system.

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