PROSPECTS OF APPLICATION OF HIGH-PRECISION NAVIGATION IN THE IRRIGATED AGRICULTURE

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Content

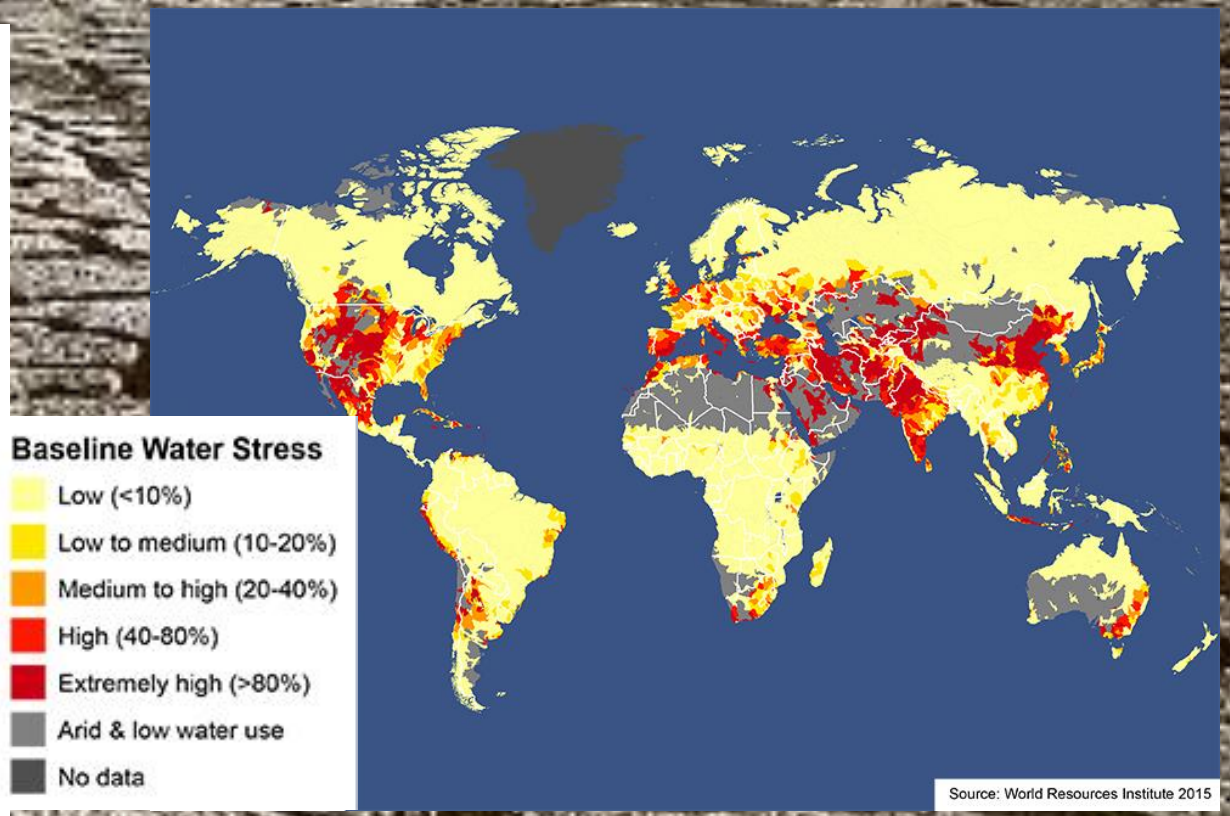
- Motivation
- World Water Scarcity and Impact of Climate Change
- Irrigation in The World Today
- Water Use Efficiency of Traditional Irrigation and Coordinate & Prescribed Irrigation
- Use of RS & GNSS Data in Coordinate & Prescribed Irrigation

Motivation

- ✓ Changes in climate, economic development, urbanization, and population growth will impact water availability around the world.
- ✓ Growing threats from a climate change and blue water scarcity
- ✓ Private and public sectors are forced to efficient water use for all branches of economy including irrigated agriculture
- ✓ Comprehensive irrigation based on new data & technologies strategies supports water saving, yield growing and long-term sustainability

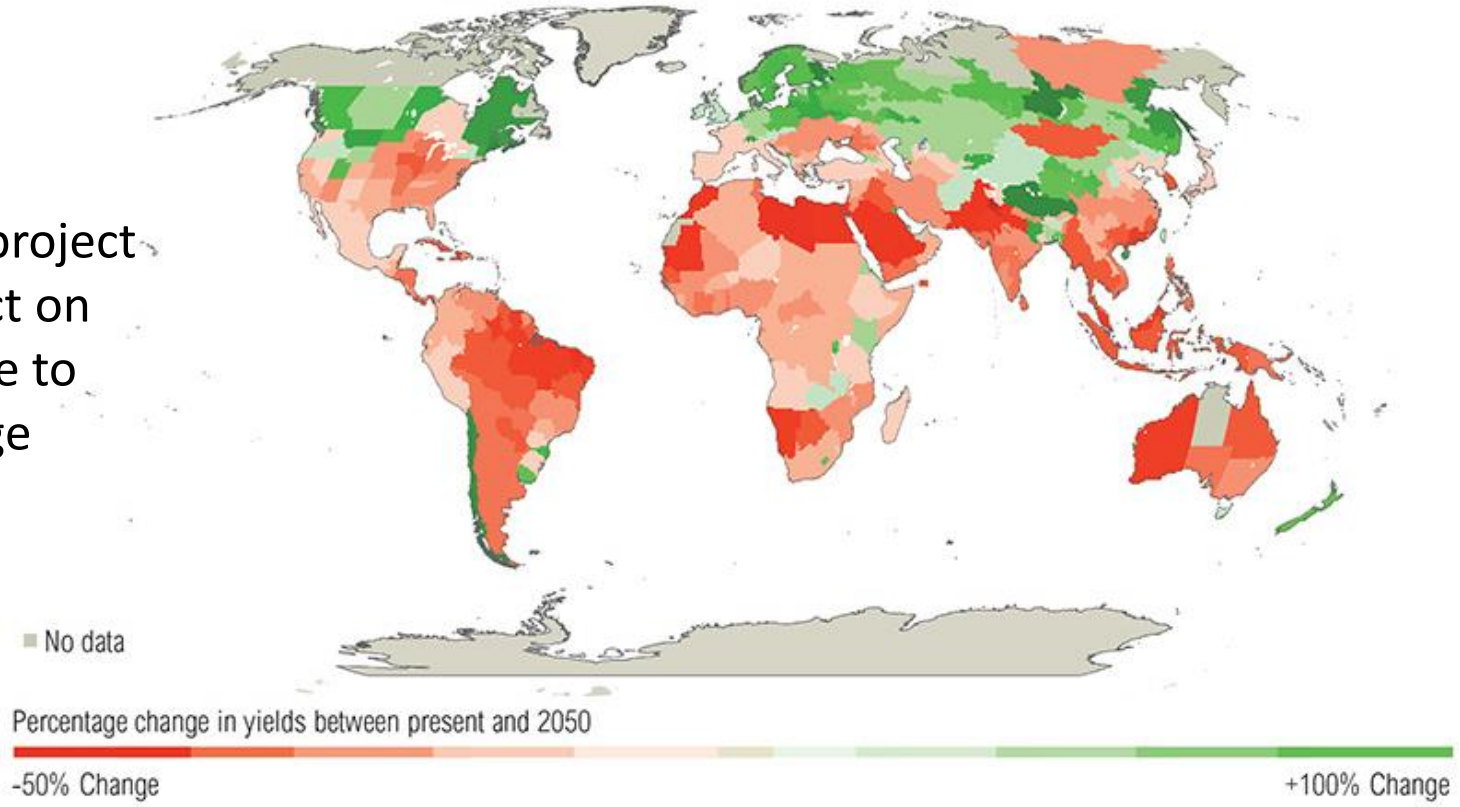
World Water Stress

The lack of sufficient available water resources to meet water needs within a region affects every continent and around 2.8 billion people around the world



Climate Change Impact on Crop Yields by 2025

Most studies project adverse impact on crop yields due to climate change



Irrigation in The World Today

Over the last 50 years :

- ✓ extend of irrigated land has more than doubled from 139 to 301 million hectares
- ✓ proportion of total cultivated land that is irrigated land doubled from 10 to 20 per cent
- ✓ water withdrawals for irrigation almost doubled from 1,900 km^3 to 3,970 km^3

300 million hectares of irrigated land (20% of cultivated land) provides :

- ✓ 40% of total agricultural production
- ✓ 60% of cereal crop production

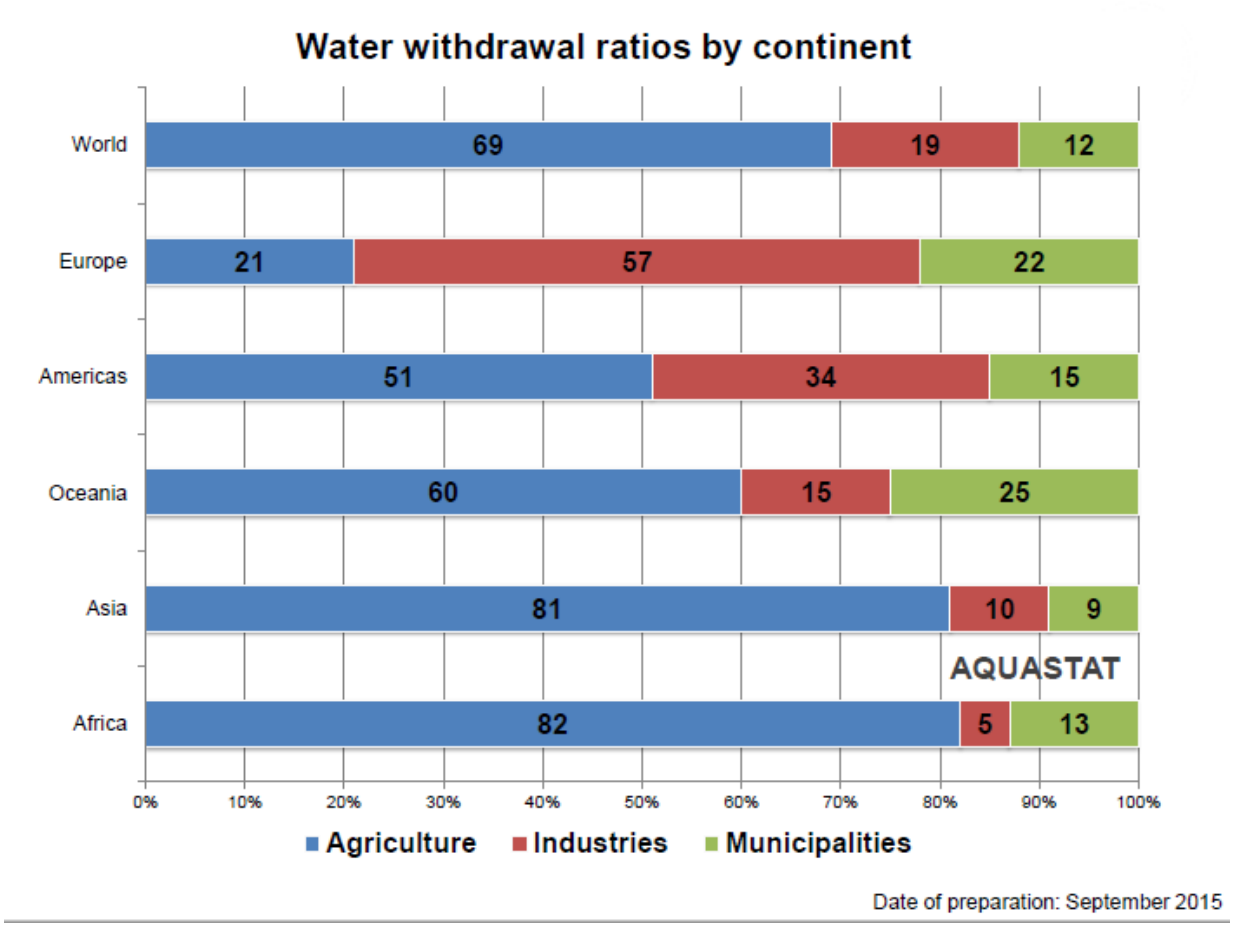
Irrigation Water Withdrawal

Irrigation is about :

✓70% of all freshwater withdrawal

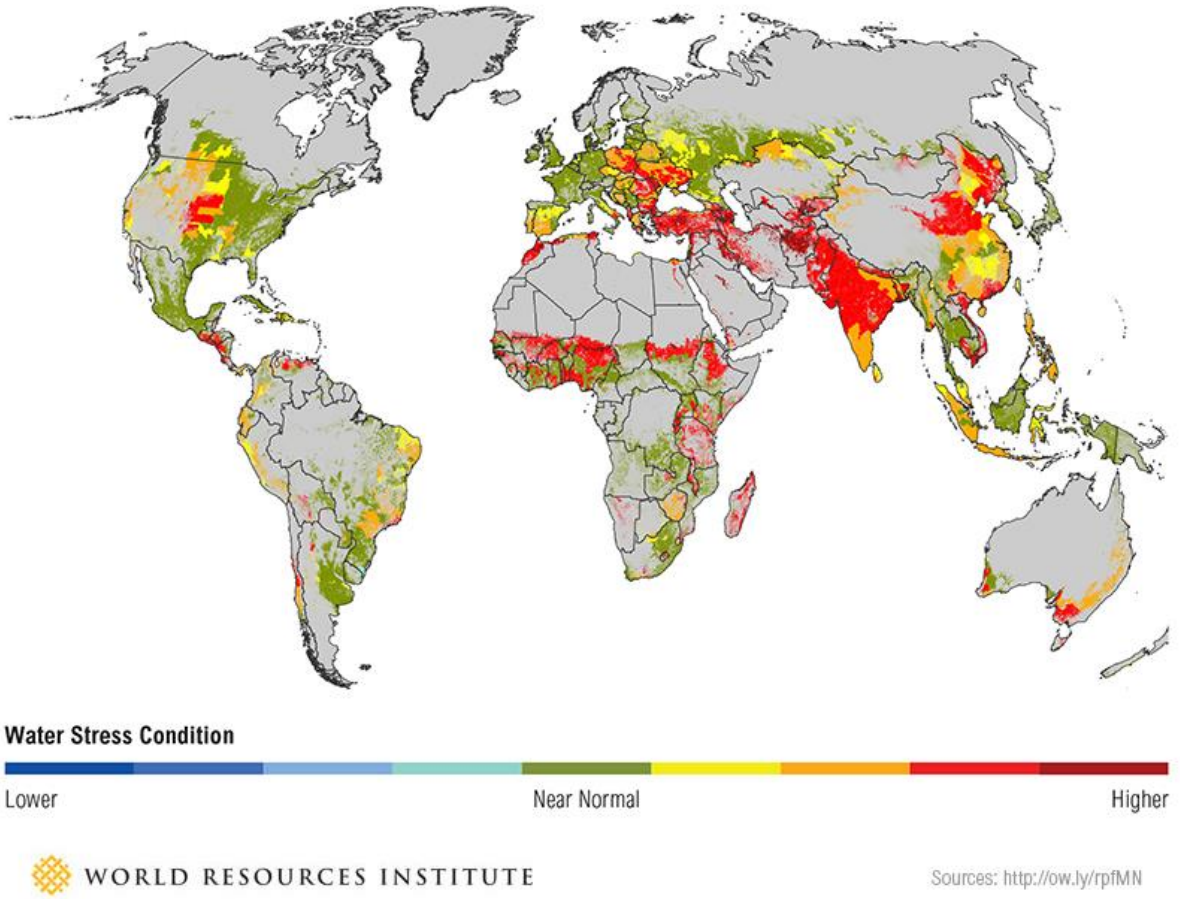
✓ 80% in low income countries

✓ 40 % in high income countries

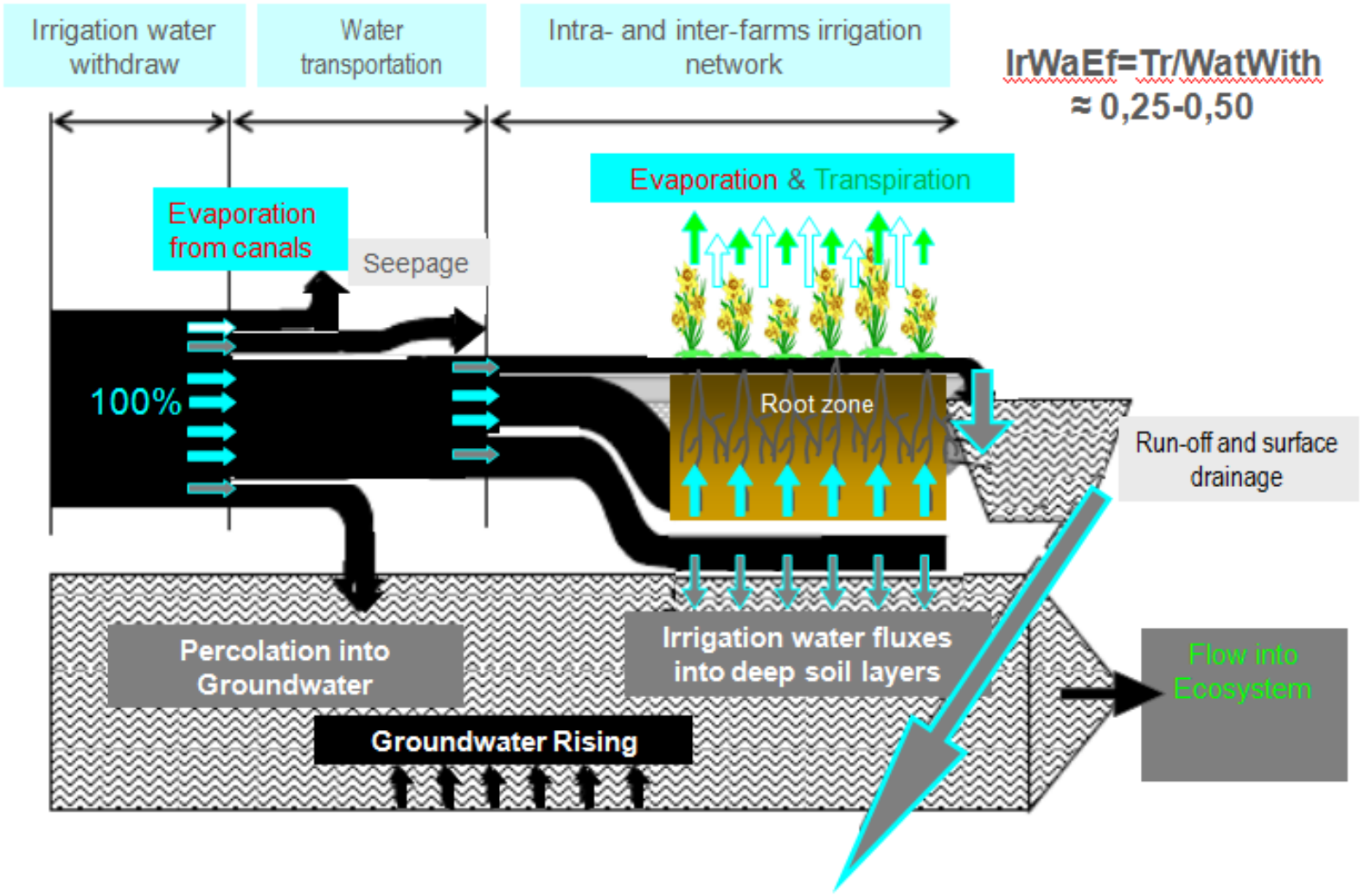


Water Stress Projection by 2025

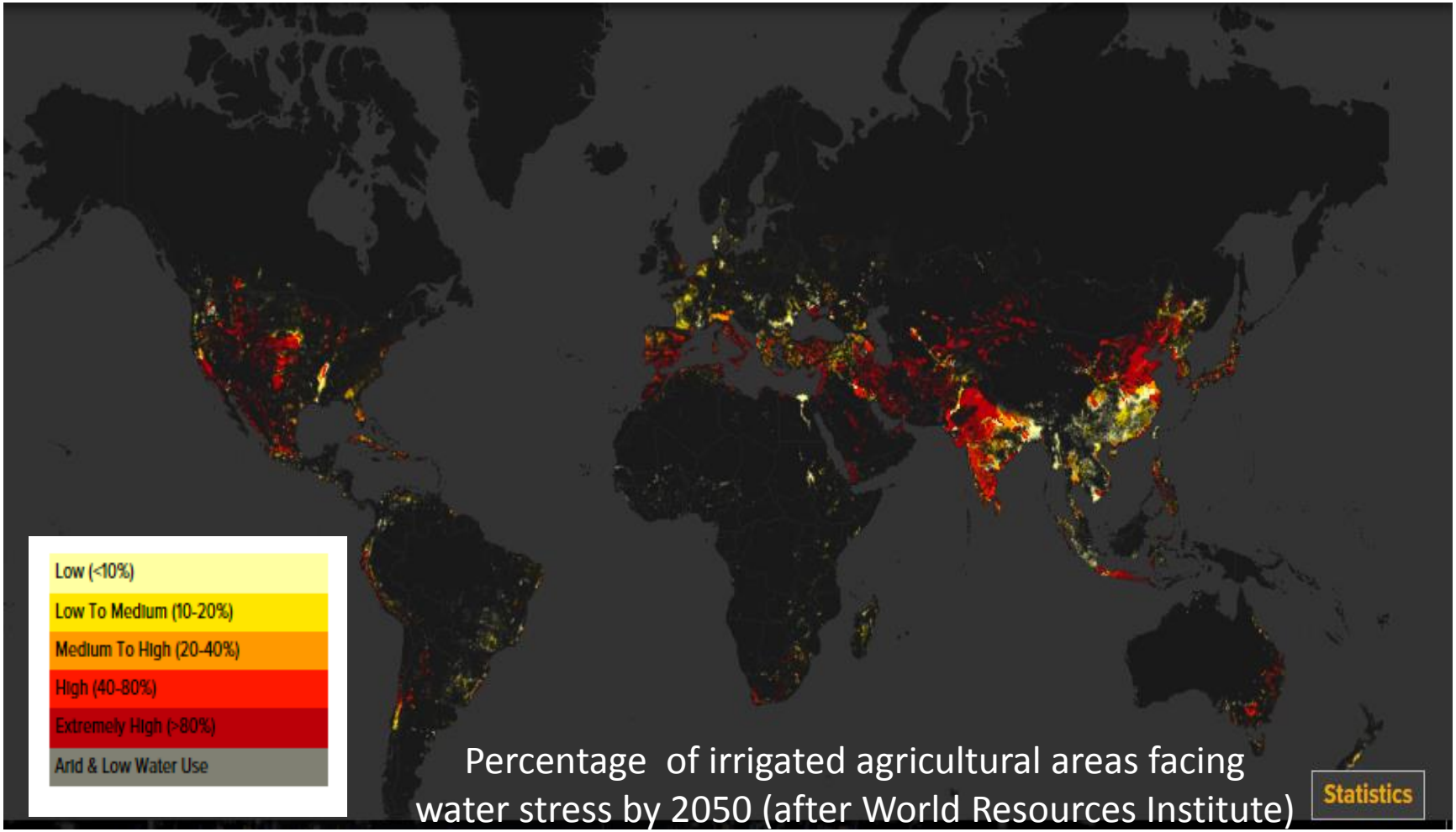
Growing water use and rising temperatures are expected to further increase water scarcity and water stress in many agricultural areas by 2025



Water Efficiency of Traditional Irrigation



Projected Water Stress at Agricultural Areas by 2050



Percentage of irrigated agricultural areas facing water stress by 2050 (after World Resources Institute)

Conventions

- Coordinate Irrigation involves the treatment of field variation by «differential in space irrigation water application» as opposed to the classical «uniform irrigation» treatment that underlies traditional irrigation management
- Prescription Irrigation utilize real-time information regarding the processes that might be limiting water productivity on a spatial scale in the field

Goals for Coordinate and Prescribed Irrigation

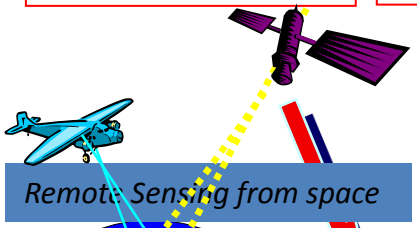
- Growing yield of irrigated crops
- Water savings
- Energy savings
- Growing water productivity
- Minimize adverse impacts on water and land resources
- Sustain irrigated agriculture

Strategies Based on RS & GNSS

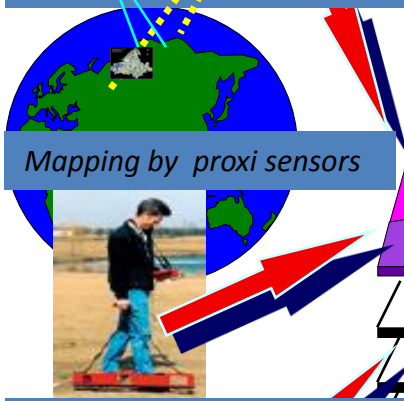
1. Improve efficient irrigation technologies using coordinate and prescription irrigations (GNSS & RS)
2. Improve mapping of crop water needs within management zones of coordinate irrigation (GNSS & RS)
3. Improve short time weather forecasting (RS)
4. Improve hydrological modeling/monitoring (RS)

Coordinate and Prescribed Irrigation based on Data & Knowledge

Data Gathering | Data Analyzing | Modeling | Planning & Decision Making | Realization



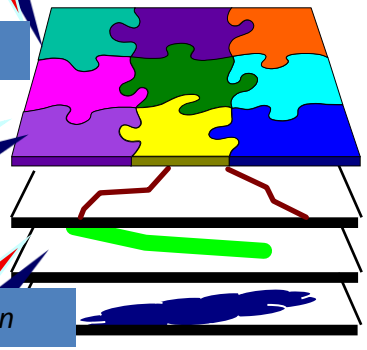
Remote Sensing from space

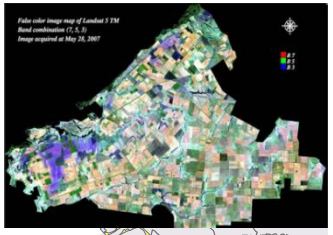


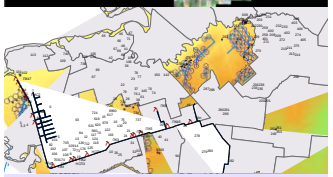
Mapping by proxi sensors

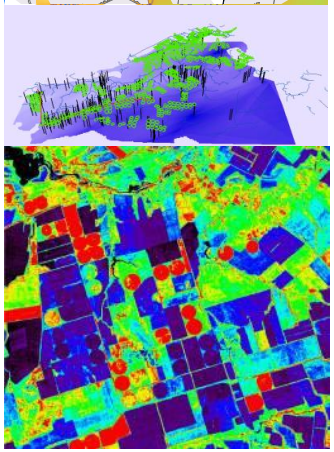
Coordinated data collection

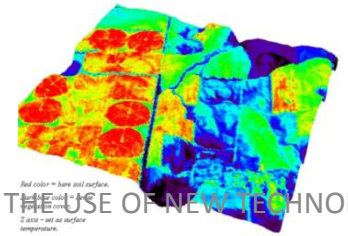
Underground monitoring

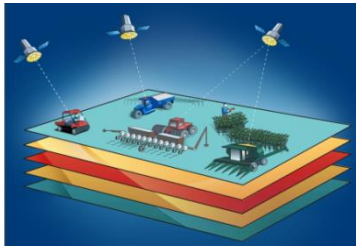


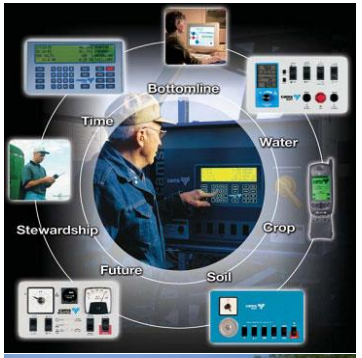


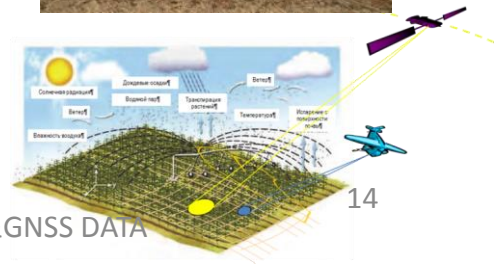




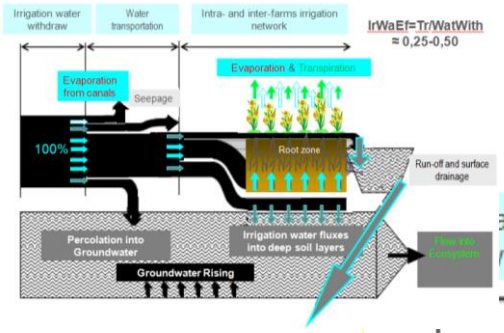


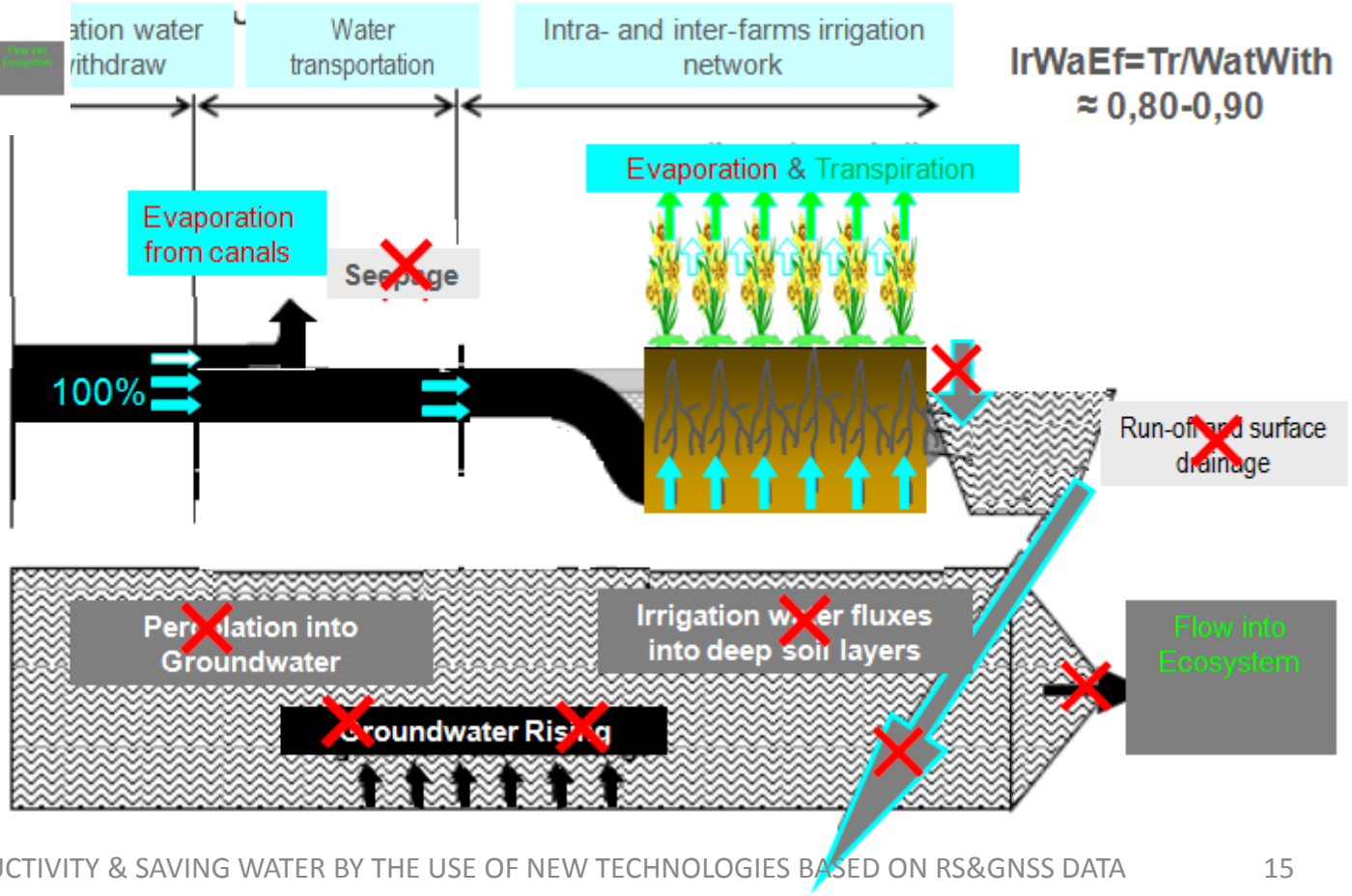




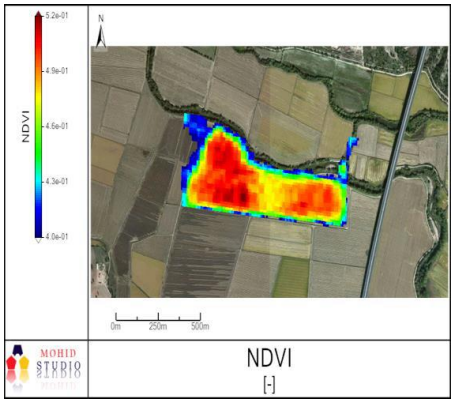


Water Efficiency of Coordinate & Prescribed Irrigation



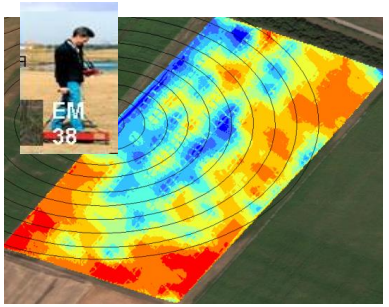


Use of RS & GNSS Data in Coordinate & Prescribed Irrigation



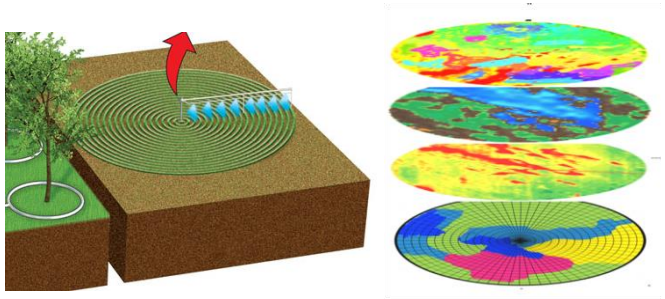
Crop Monitoring

- Crop mapping
- Crop physiologycal parameters
- Crop Water Stress



Soil Monitoring

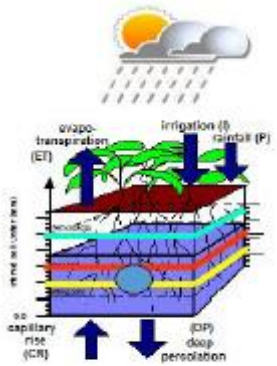
- Mapping of root zone water content

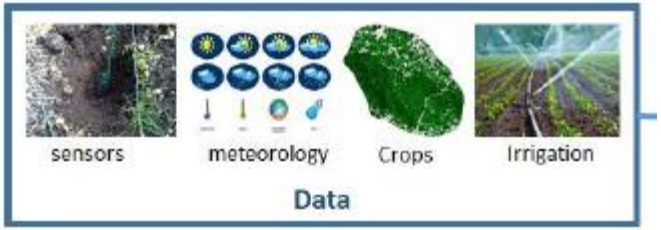


Irrigation Realization

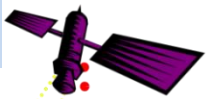
- Irrigation technological map
- Sprinkler position localization

Case Study – Privolghskaya Irrigation System

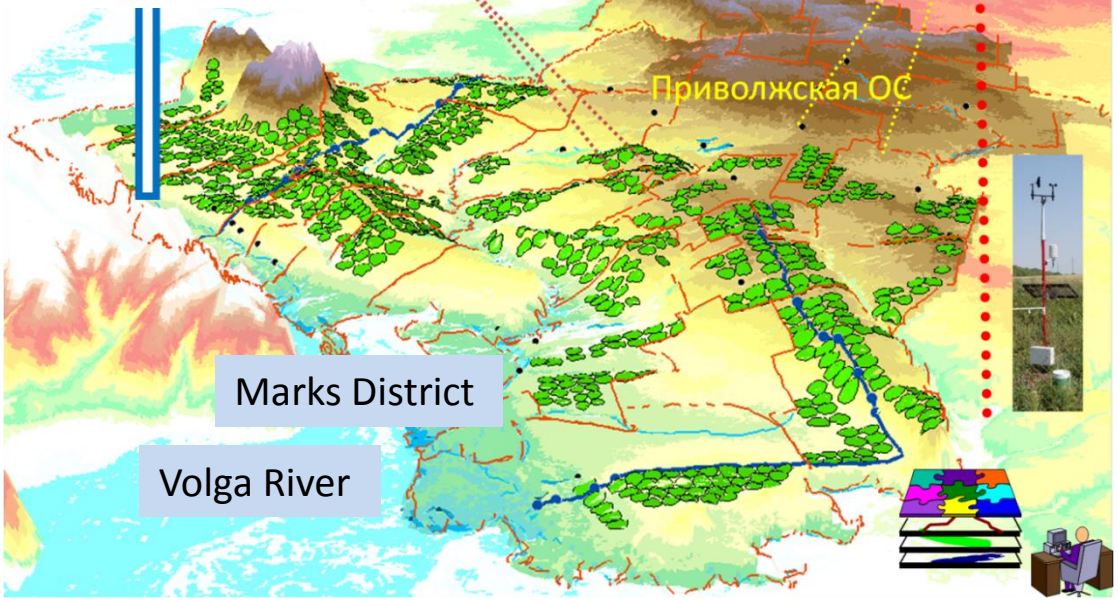




Privolghskaya Irrigation System



Modelling
- Water balance
- Crops growing



✓Irrigated area: 25 000 ha
✓Crops: Alfalfa, Soyabean, Corn

Conclusions

After some test at plot and field scale of Coordinate & Prescribed Irrigation it's expected that use of these technologies based on RS & GNSS data could :

- ✓ Rise yield of irrigated crops for about 15-30%
- ✓ Increase water efficiency for about 20-40%
- ✓ Diminish irrigation water losses in 2-3 times
- ✓ Save energy for water pumping for about 10-15%
- ✓ Cease adverse impacts on water and land resources
- ✓ Sustain irrigated agriculture


Thank you for your attention!