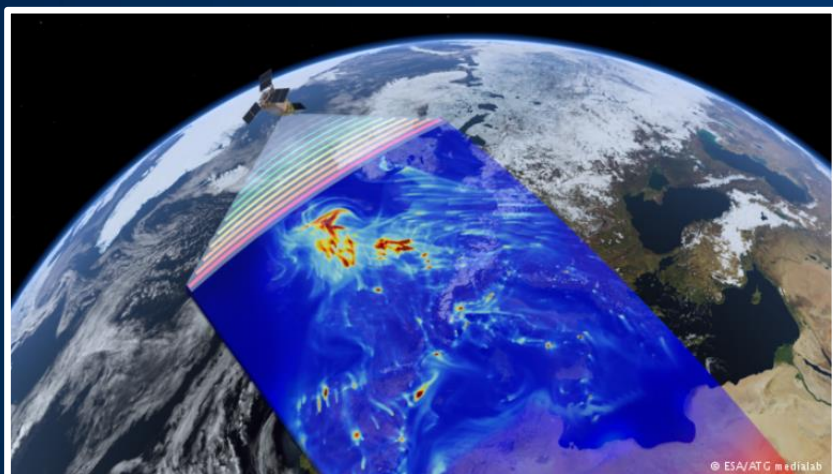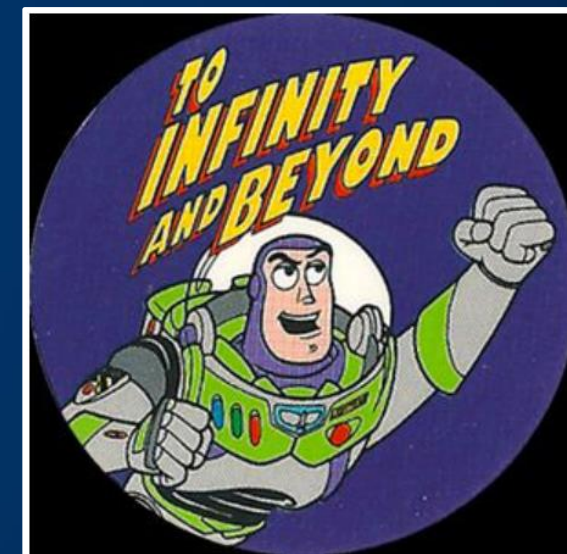# Water Management from space in NL
## The SAT-WATER program

NSO-EURISY
14 feb 2023

Dr. Hans J.C. van Leeuwen, STOWA
Programleader SAT-WATER
&
WaterBoards & Dutch Ministries, Het Waterschapshuis

**stowa** **50 JAAR** **DE KRACHT VAN KENNIS**

**Agenda:**

➢ *Introduction: The Sat-Water Program for the Dutch WaterBoards*

➢ SAT-WATER Program: blue print for operational Information for national policies?

➢ SAT-WATER Program & Cooperation in European context

Vragen & Discussie: na elke deel sessie ruimte voor paar minuten!

**Nu en in de toekomst**

Information production Watermanagement Satellite Applications = SATWATER Program

*Slogan: "Van Wetenschap naar Waterschap" or "From Science to WaterManagement*

Landingsbaan/Launch: "from innovation to implementation"

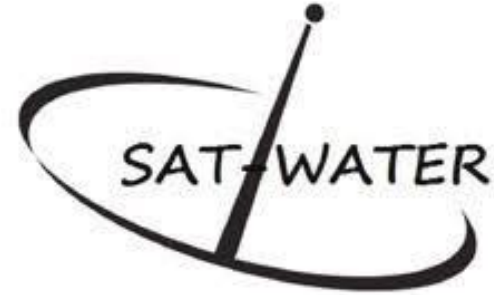Users: Waterboards, Ministries, DrinkingWatercompanies, etc

- ➢ Information acquisition (Satellite & Field)
- ➢ Knowledge, Algorithms, Field experience
- ➢ Processing & integration (Data Science)
- ➢ Implementation of Application (Open data & SW)
- ➢ Validation (Technical & Use/Organization)
- ➢ Organization  (acceptation, Business case, & Procurement Process)
- ➢ Hybrisation with working process (CoP)
- ➢ Acceptance and Scaling up (more use)
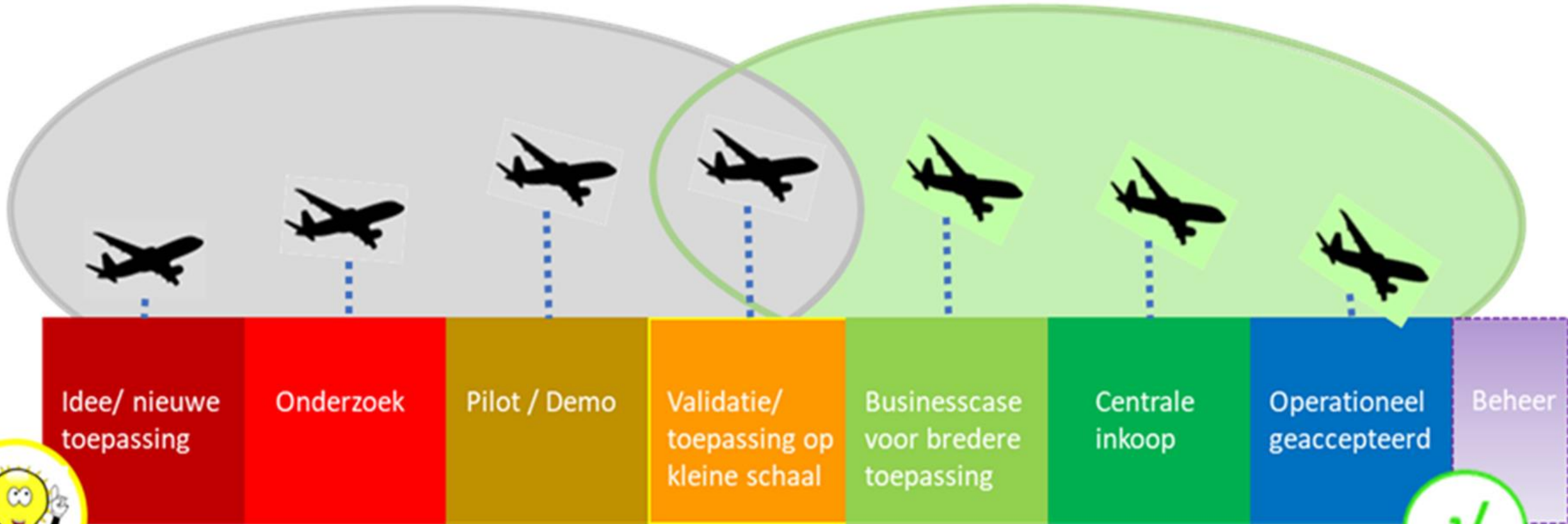- ➢ Management &  Maintenance/continuity (Archive)

hetWaterschapshuis

SAT-WATER

**Samenwerking STOWA en Het Waterschapshuis**

# Van Wetenschap Naar Waterschap
# From Science to WaterManagement

| Landings Baan/ Launch | step | Soil-Water Balance( OWASIS | Verdamping Evapotransp iration | Soil (profile) Moisture | Rural Subsidence | (peat)dike Drought Monitoring | Water Quality | Digital Canal inspection | Depth Canal | NL Veranderdetectie Mutation Rural objects | National Irrigation Indicator |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Phase | step | | | | | | HDSR | WDOD | | | |
| Idea | 1 | | | | | | | | | | |
| Research | 2 | | | | | | | | | SBIR fase 1 | |
| Pilot/demo | 3 | ESA /STOWA/SBIR | STOWA/SBIR | SBIR | SBIR | STOWA | ESA | | | SBIR fase 1/2 | |
| Validation (technical/ organisation) | 4 | SBIR OWASIS | SBIR SATDATA 2.0 | SBIR soil moisture | SBIR Rural Subsidence i-ZAK/BODIS STOWA | SBIR waterschap / STOWA | CYMONS | | | SBIR fase 2 | Embedding national Water Instrumentation NHI |
| Business Case & Central Procurement & acceptance | 5 | | BC SATDATA 3.0 | BC bodemvocht | Validation & acceptance | Validation | Validation | BC skipped | | BC verander detectie | |
| Operational Information | 6 | OWASIS | SATDATA 3.0 | | | | | Disruptive | | | |
| CoP/Support | 7 | | | | | | | | | | |

**Technical and user/organisation validation process scheme**

Client feedback & product improvement process

TECHNICAL VALIDATION

ORGANISATION VALIDATION

RS Value-Adders & Service Companies

Dutch Water Authorities e.o.

R&D Model improvement

RS & GIS Processing

Techn. validation

Company Tech.procedures improvement

HPn

HP1

HP2

HP3

Spatial Analysis Geo-Statistics

Point to Plane

Field Inspection Proces

Technical to Functional Transition → enhance Working Environment

Client validation

Organisation Acceptance & embedding

Temporal Analysis

Event to Process

Monitoring (now & fore casting)

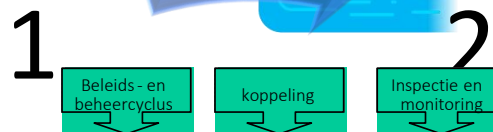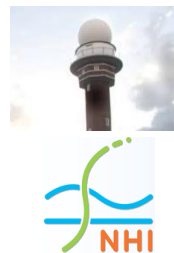Chain development process (quality assessment)
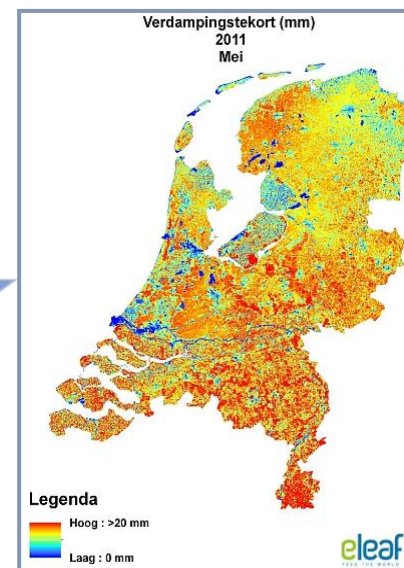
# Satellite information input to Models/DSS !!
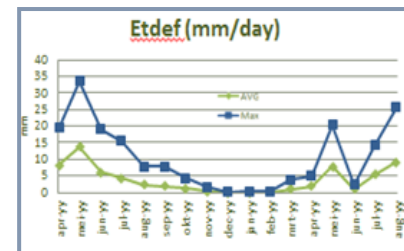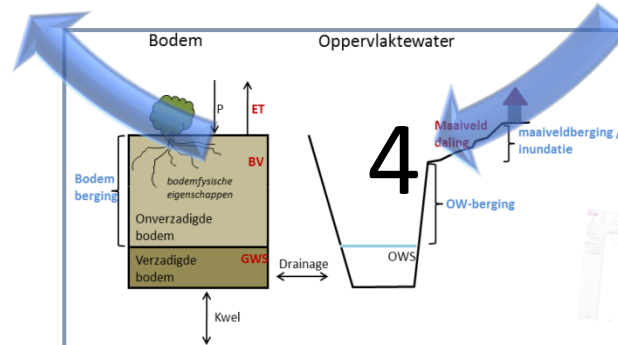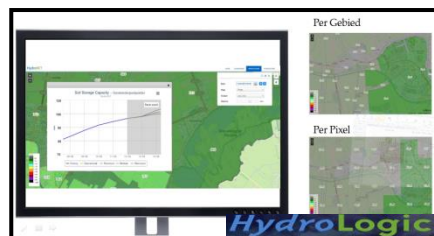


OWASIS 2.0
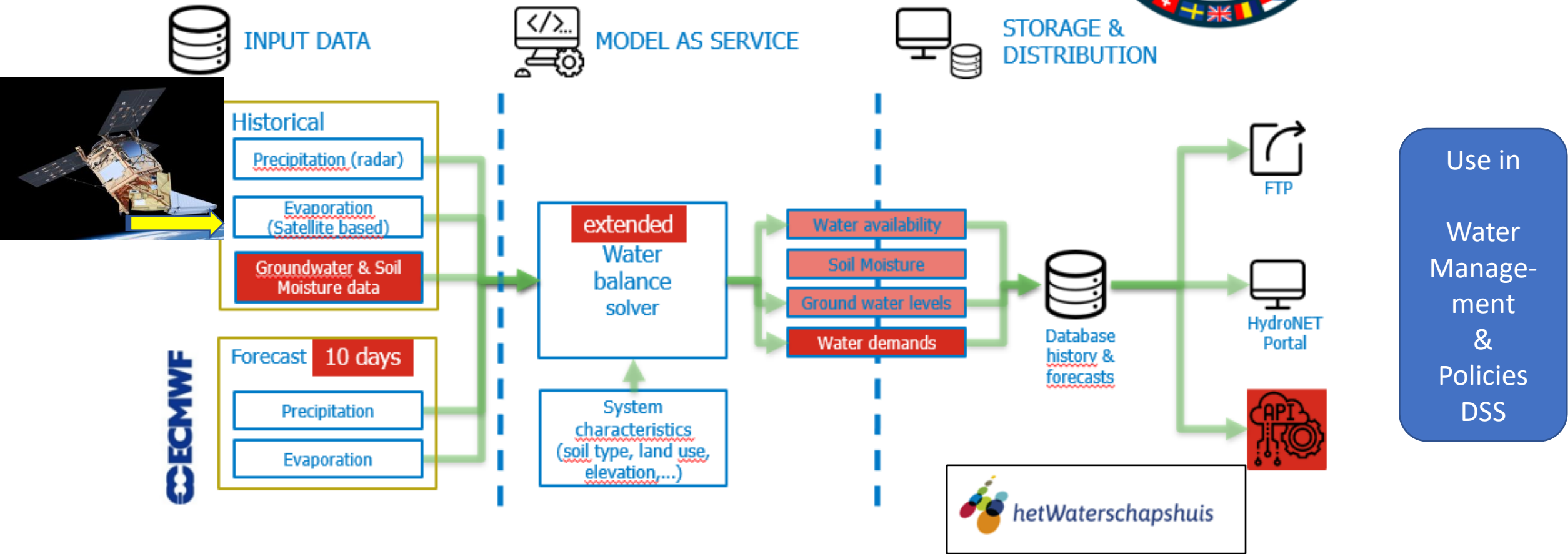
# Input to integral systems (BIGDATA & AI)
# Smart Governance on water management



Water Management Authorities

1. **Governance: smarter & better cooperation**
2. **Meteo & Info Network &**
3. **RS monitoring &**
4. **Modelling, AI**
5. **Smart management by better information**

1

2

NHI

Beleids - en beheercyclus

koppeling

Inspectie en monitoring

Organisation Water Management Policy

Verdampingstekort (mm)
2011
Mei

Legenda

Hoog : >20 mm

Laag : 0 mm

eleaf

3

5

Organisatie

Relaties

Operationele Sturing

Bodem          Oppervlaktewater

P    ET

Maaiveld daling

maaiveldberging / inundatie

Bodem berging

bodemfysische eigenschappen

BV

Onverzadigde bodem

Verzadigde bodem

GWS

OW-berging

Drainage

OWS

Kwel

4

Etdef (mm/day)

HydroLogic

**Dutch Deltaprogramma Zoetwater**
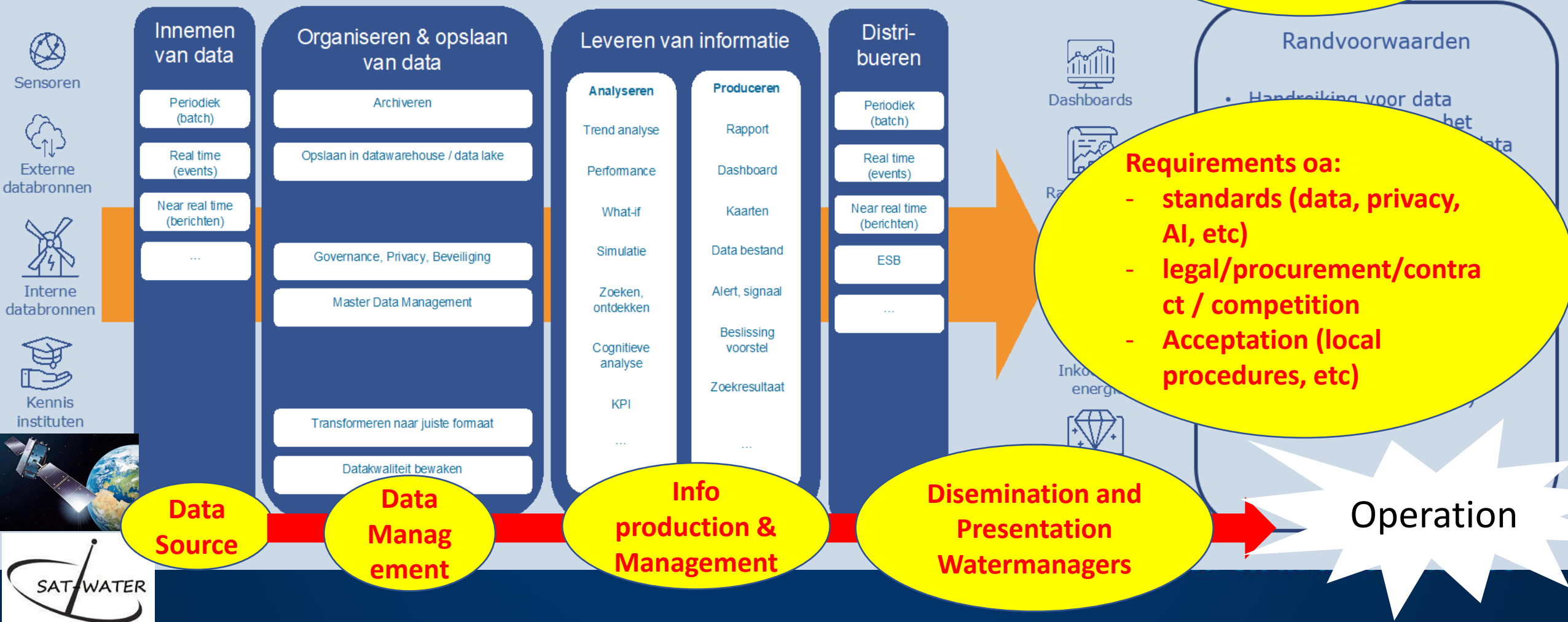
# SAT-WATER Program: Blue print for National use

Waterboards, ministries: monitoring **needs** in the frame of:

➢Delta Program (oa. DPRA), Sweet/Silt Water, Subsidence, etc.

➢Agriculture transition (oa. subsidence, waterquality, waterquantity)

➢Natura2000 policy (waterquality, waterquantity)

➢Climate Adaptation (DONAS, 6 ministries) (drought, waterexcess, heat, sealevel-rise/floods) & related emissions of greenhouse gasses

➢Etc.

# OWASIS on drought & waterexcess: practical level

1. **Actual Moisture Content soil profile Water management area ( peilgebied)**: Waterboards use OWASIS to assess the status of profile watercontent every day (for operational measures in times of waterexcess and drought)

2. **To pump or keep the water in management area:** Waterboarrds use OWASIS in combination with weather predictions to advice the water managers

3. **Waterbalance**: Waterboards use OWASIS as indicator for interactive waterbalance insights (e.g. Waterschap Brabantse Delta in their crisisroom for alerting and communication or water management measures)

4. **Information dashboard ARK/NZK (amsterdam region)**: Ministry Infra & Water (Rijkswaterstaat) use OWASIS to present regional difference in soil moisture for mutual smart management (between the water areas).

# OWASIS: what on policy level?

1. **Effect/impact monitoring:** Waterboards use OWASIS to evaluate the impact/effects on the change from winter to summer waterlevels

2. **Validation - waterbalance.** Indirectly OWASIS is used as indicator to validate waterbalance models and daily (field)measurements

3. Operational **Decision Support systems** (VIDENTE, peilbeheer)

4. To **advice waterboards** on the transition from

   summer to winter water levels (& vice versa)

5. And **many other functions in the policy cycle**

   not yet discovered (reference level (0-meting),

   time-series (trends/anomalies), monitoring &

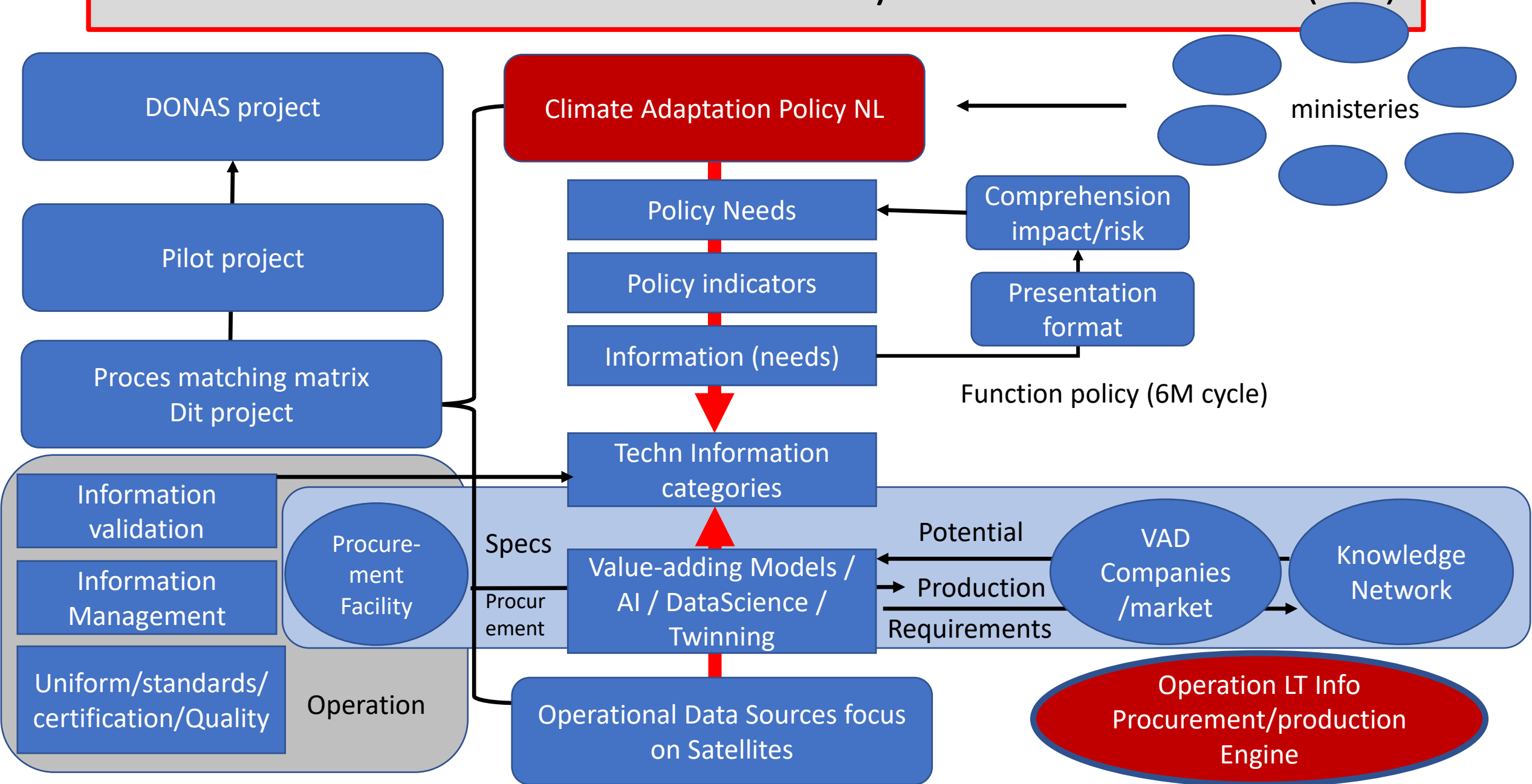   evaluation, Cost-benefits and efficiency, etc.
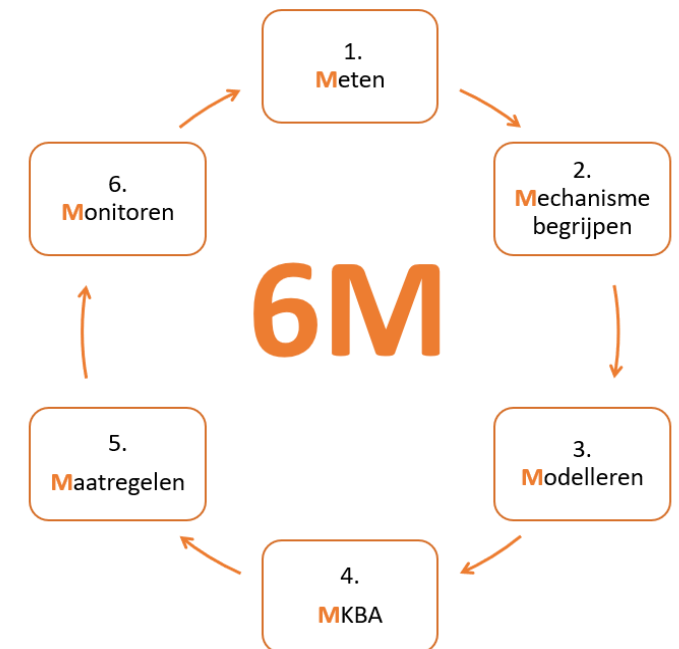
# Examples RS use for Climate Adaptation (on top of former water excess and drought examples)

➤ Greenhouse gas emission indicators (water management):
- In case of droughts: $CO_2$ emission by peat oxidation (subsidence)
- In case of water excess: $CH_4$ en $N_2O$ emission in anaerobic soil conditions

➤ Salinization risks (due to increase of drought and seepage pressure by sea level rise)

➤ Insight in the available sweet water storage in large Lakes like Ijsselmeer (relevant for the Dutch National LCW commission decision support)

➤ Insight in the amount of local water storage (saturation level) in soils in times extreme climate conditions in management areas (to anticipate timely for local flooding (e.g. Limburg 2021)

➤ Insight in drought conditions (agriculture & nature), irrigation limitations/ban, etc

➤ Transition/monitoring of the rural area functions in future (distribution of blue, green grey infrastructure)

➤ etc.

# Translation Process from Policy to Information (RS)

DONAS project

Pilot project

Proces matching matrix
Dit project

Climate Adaptation Policy NL

ministries

Policy Needs

Comprehension impact/risk

Policy indicators

Presentation format

Information (needs)

Function policy (6M cycle)

Techn Information categories

Information validation

Information Management

Procure-ment Facility

Specs

Value-adding Models / AI / DataScience / Twinning

Procurement

Potential

Production

Requirements

VAD Companies /market

Knowledge Network

Uniform/standards/certification/Quality

Operation

Operational Data Sources focus on Satellites

Operation LT Info Procurement/production Engine

**SAT-WATER Program & reach out for Europe**

National monitoring (water management) and **need for cooperation** with other similar EU-member states programmes on the EC policies in order to learn from each other and cooperate on supra national level is essential (e.g. watershed level, atmosphere and coastal issues, etc.) !!

Exchange mechanisms between national & European (member state) programmes need to be encouraged! How?

Questions
& Discusion