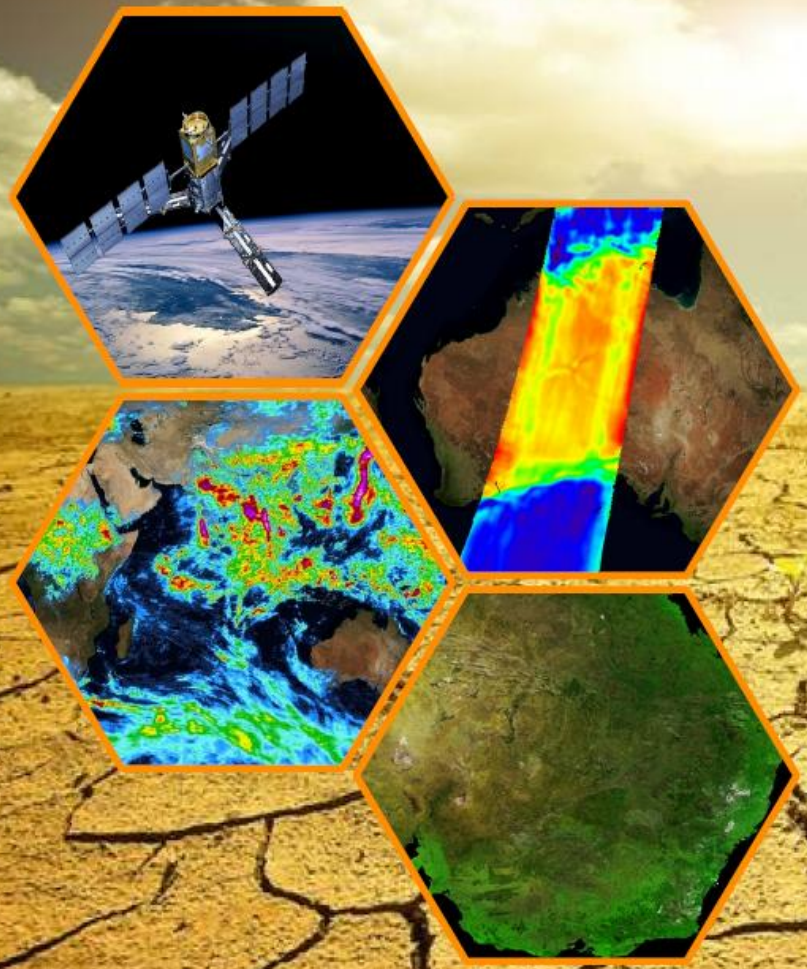


Multi-source satellite data assimilation for large-scale modelling and drought monitoring

Belgian Science Policy Office
belspo

GHENT UNIVERSITY

LIST

JÜLICH
FORSCHUNGSZENTRUM

HYDRAS+

PROJECT SCOPE

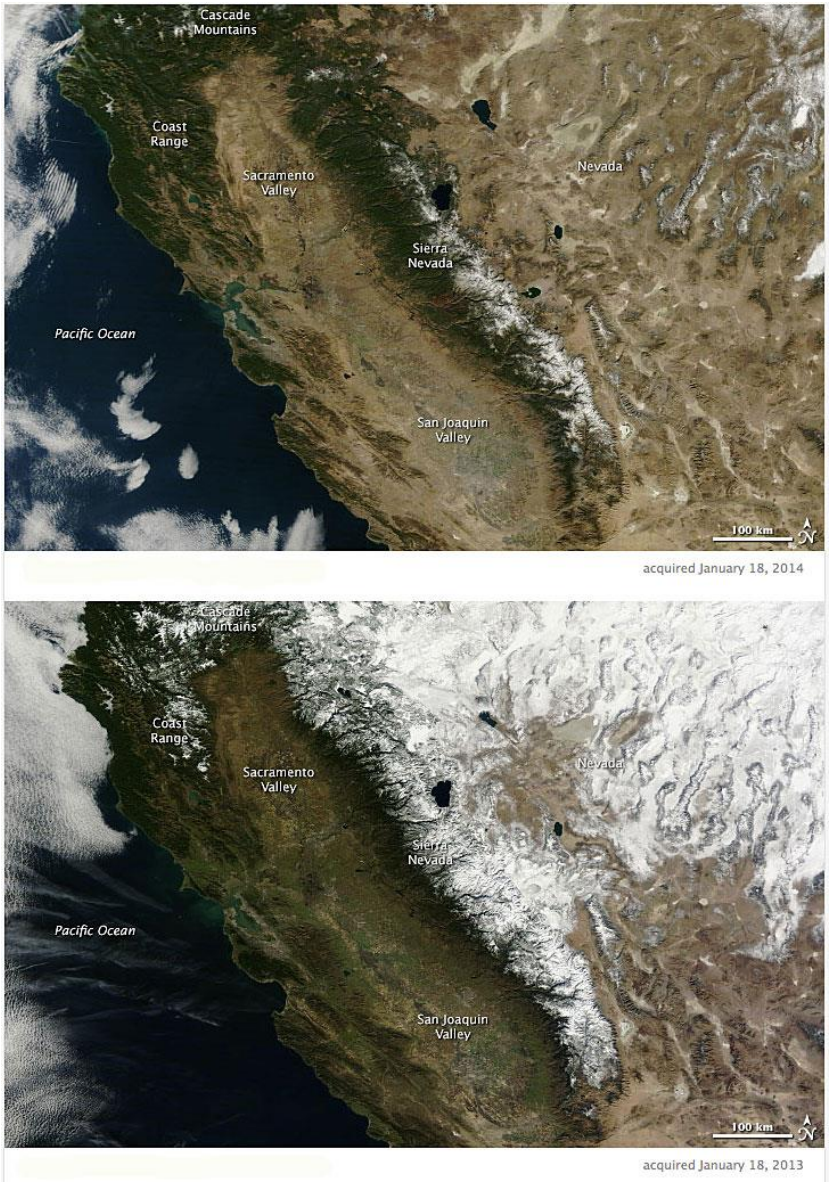
Drought is an important problem in many areas of the world

with devastating consequences...

- Is a drought event about to strike?
- Where is it occurring?
- How severe is the drought event?

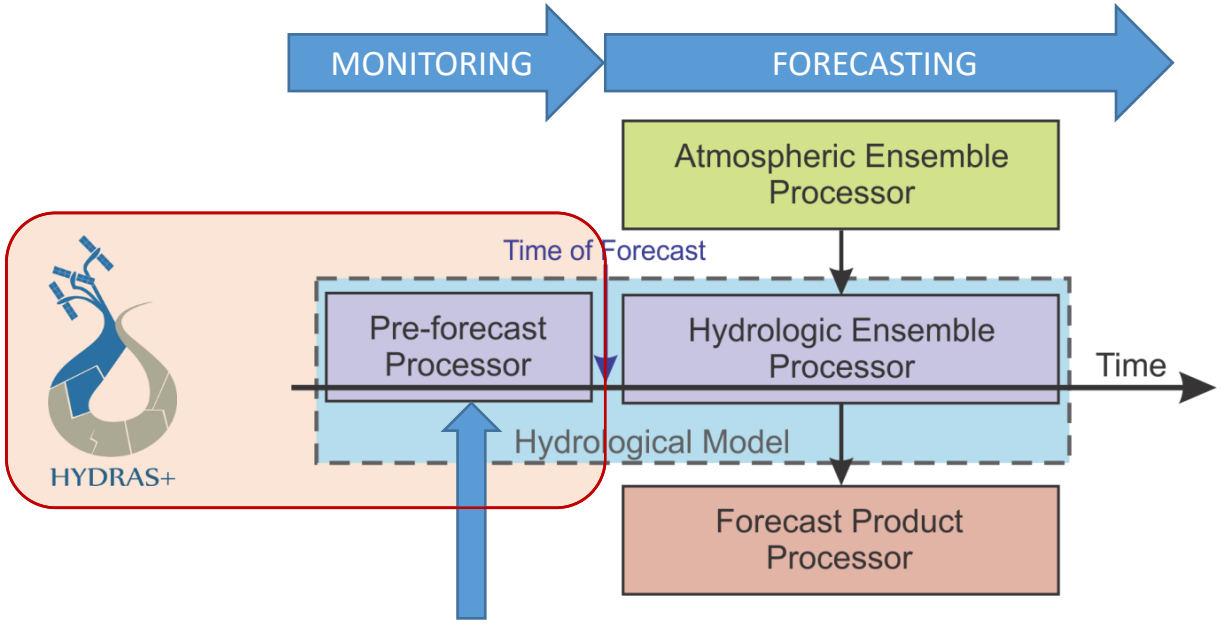
Drought monitoring & early-warning systems

... at a catchment scale



DROUGHT MONITORING AND FORECASTING

CURRENT DROUGHT MONITORING AND PREDICTION SYSTEMS



→CONTRIBUTION TO ENHANCED MONITORING AND BETTER INITIAL CONDITIONS FOR FORECASTS

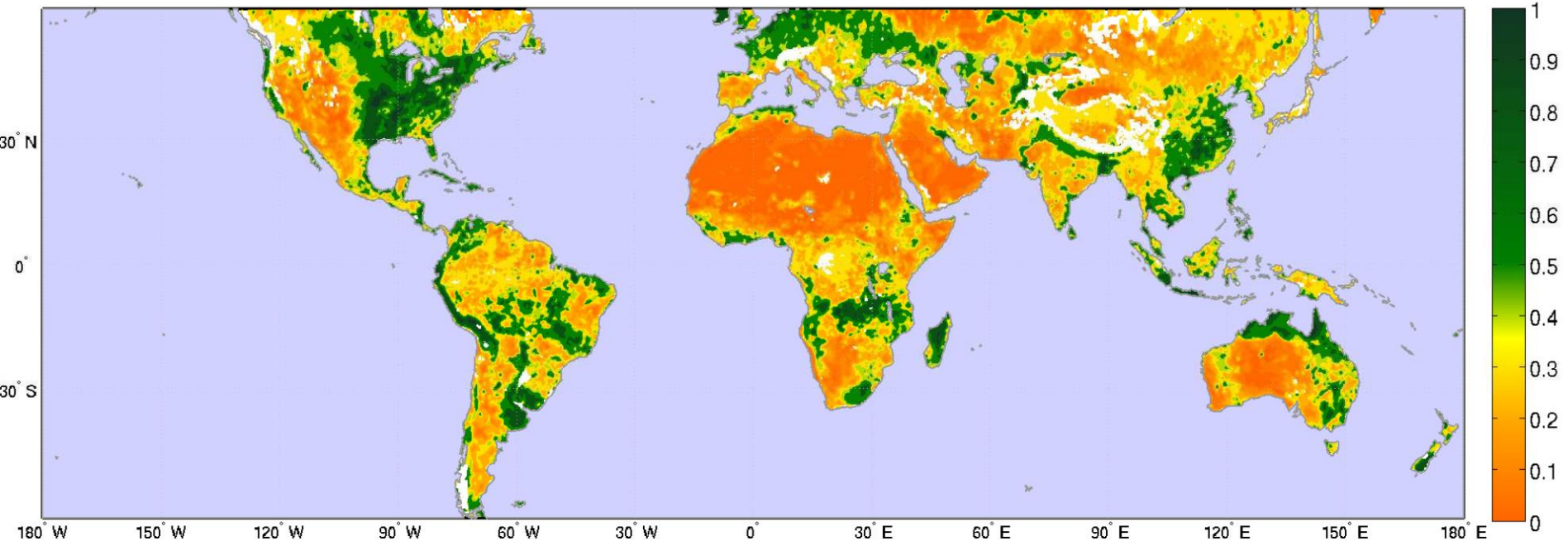
SATELLITE SOIL MOISTURE

PASSIVE L-BAND 1.4 GHZ RADIOMETERS (SMOS, SMAP)

ACTIVE RADAR SYSTEMS (ASCAT, SENTINEL 1)

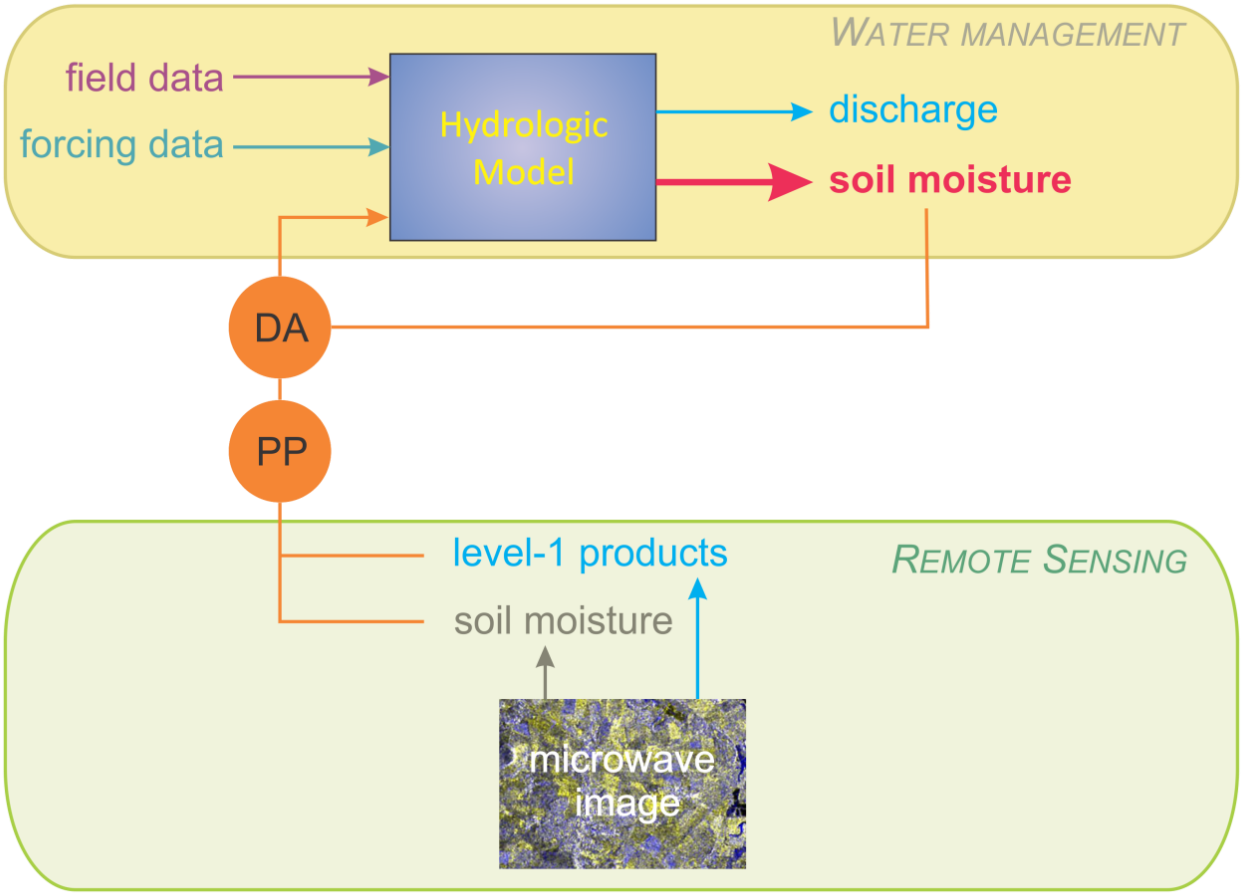
SATELLITE SOIL MOISTURE PRODUCTS ARE "CONTAMINATED" BY ANCILLARY DATA

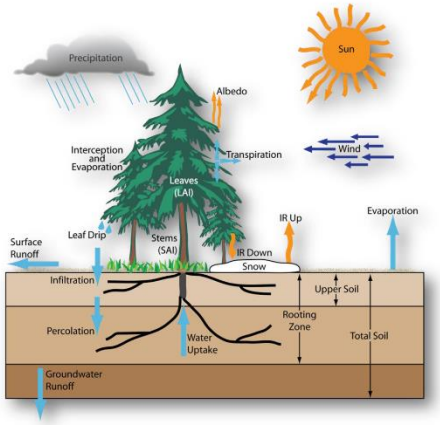
→ ASSIMILATION OF RAW DATA



DATA ASSIMILATION

SATELLITE DATA ASSIMILATION FOR SOIL MOISTURE

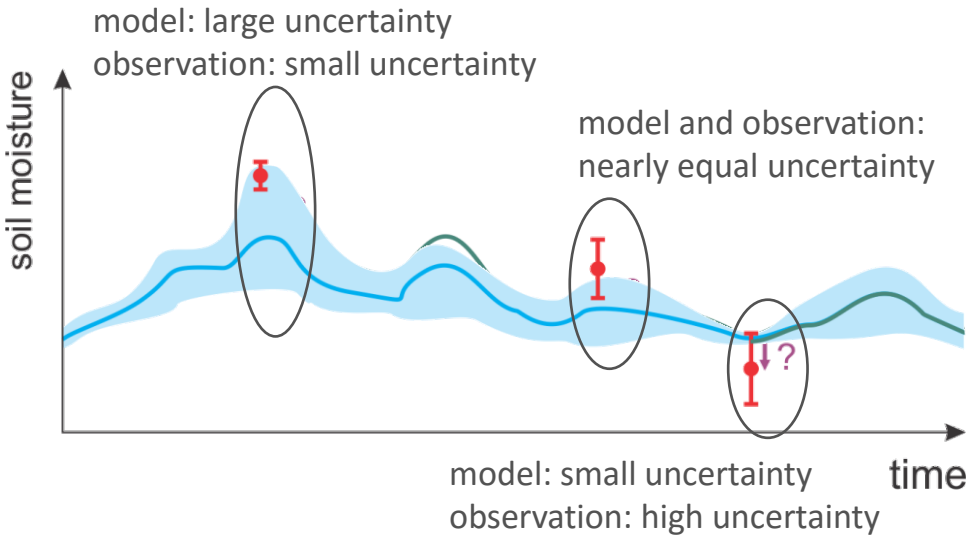




DATA ASSIMILATION

PASSIVE L-BAND 1.4 GHZ RADIOMETERS (SMOS, SMAP)

Principle of data assimilation

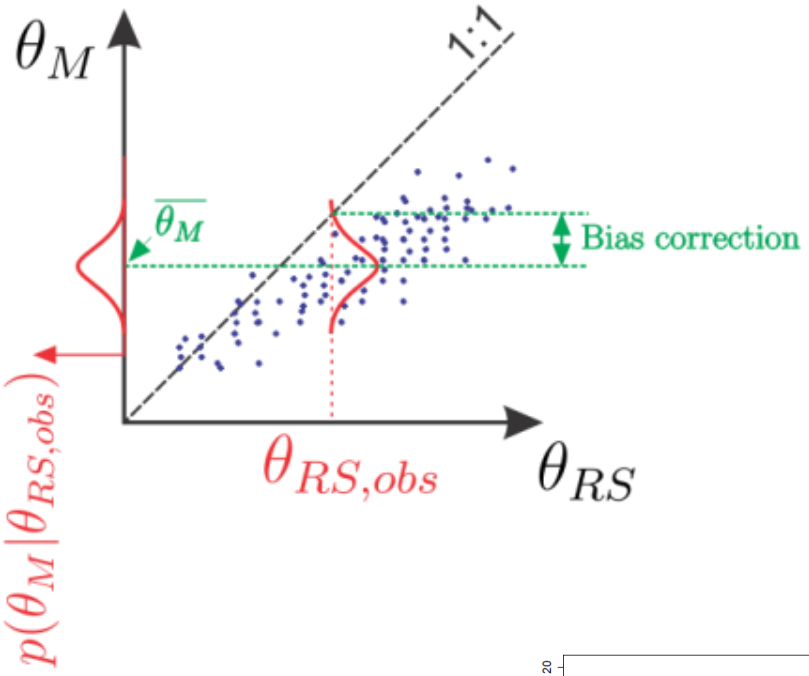


model state update should be a function of uncertainty in both model state and observations

Ensemble Kalman Filter

DATA ASSIMILATION

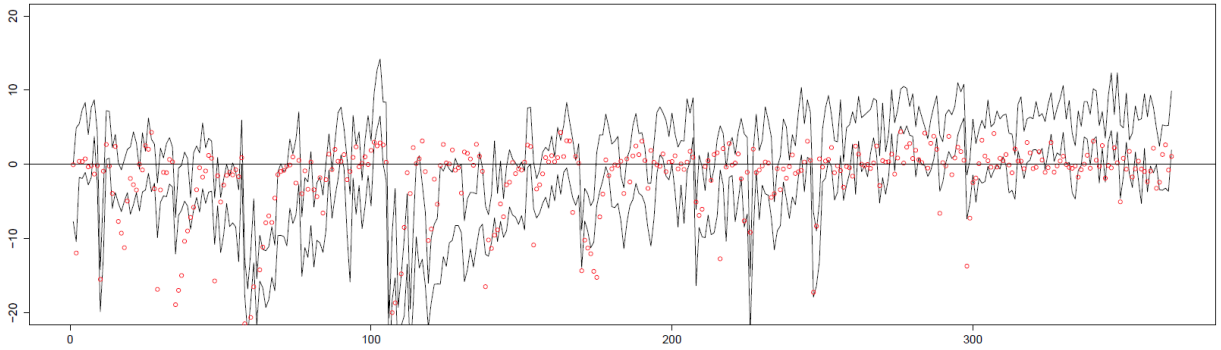
SATELLITE DATA ASSIMILATION FOR SOIL MOISTURE



→ OBSERVATIONS ARE REQUIRED TO BE UNBIASED

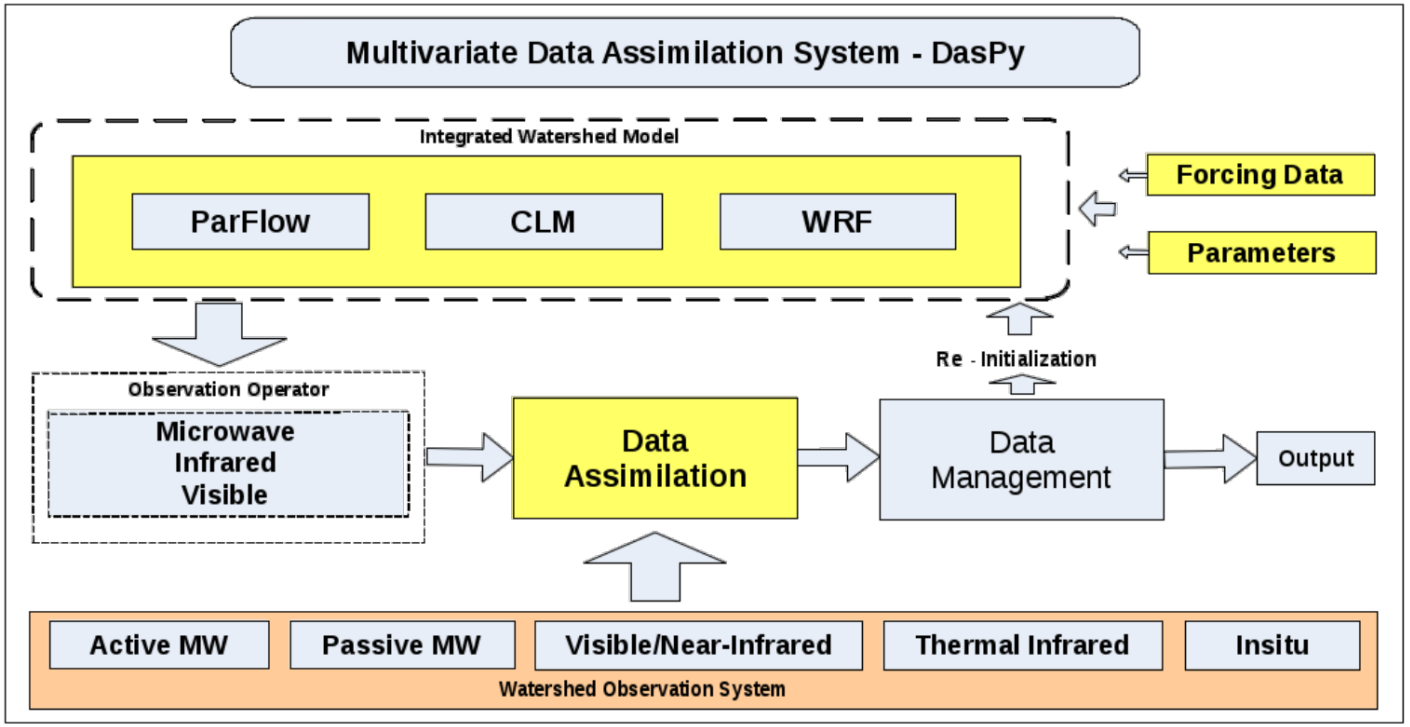
→ BOTH ANOMALY / CDF MATCHING APPROACH ARE FOLLOWED AS WELL AS A COPULA FRAMEWORK

→ COPULA FRAMEWORK USED TO SPATIALLY DOWNSCALE OBSERVATIONS TO FINER MODEL

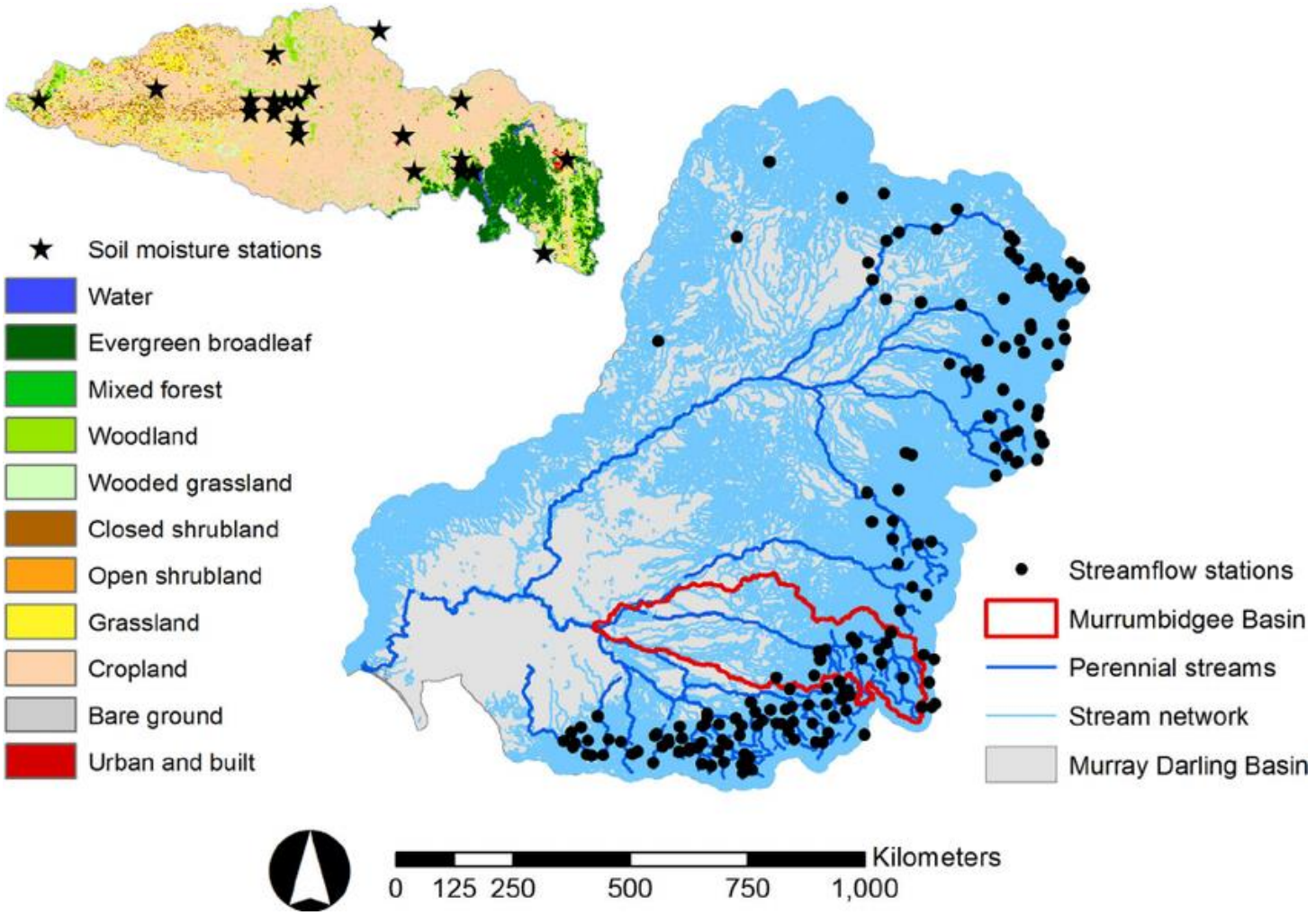


DATA ASSIMILATION FRAMEWORK DASPY

PYTHON + MODULES, OPENMP, MPI, FORTRAN, F2PY …

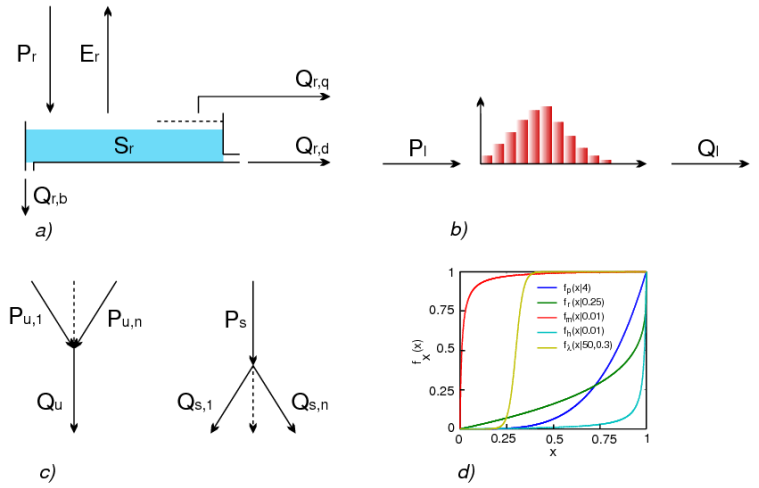


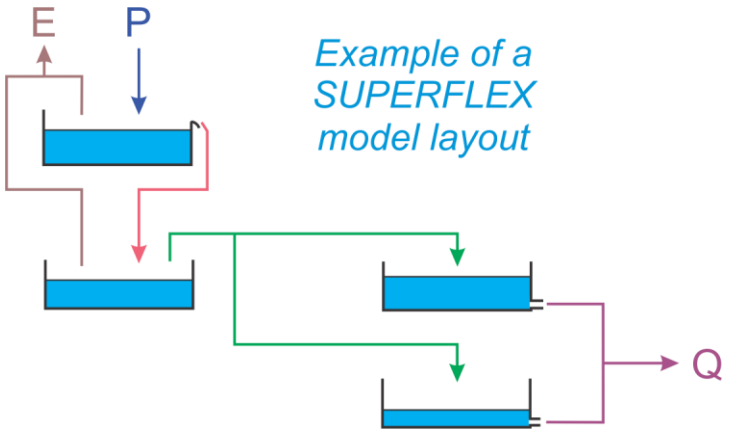
INITIAL FOCUS AREA



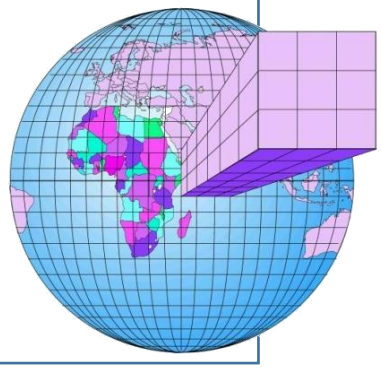
COMPARISON OF DIFFERENT MODELLING APPROACHES

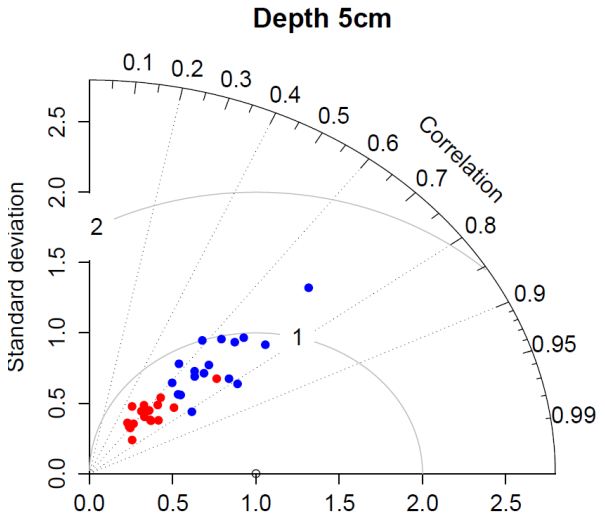
SUPERFLEX Modelling Framework

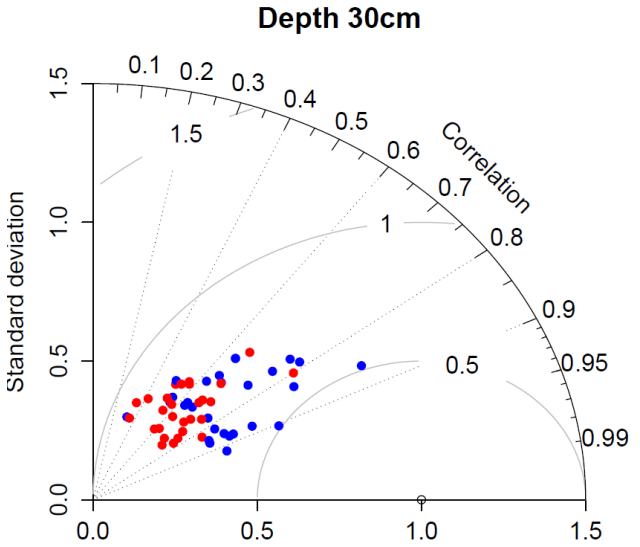




Example of a SUPERFLEX model layout

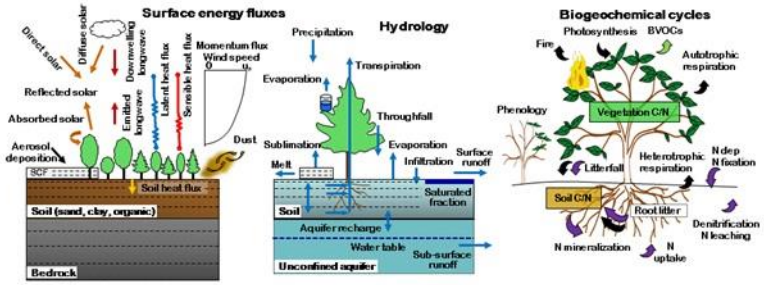


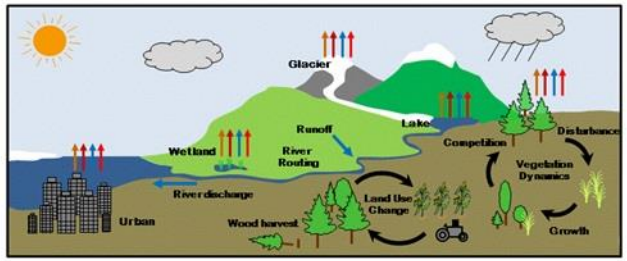


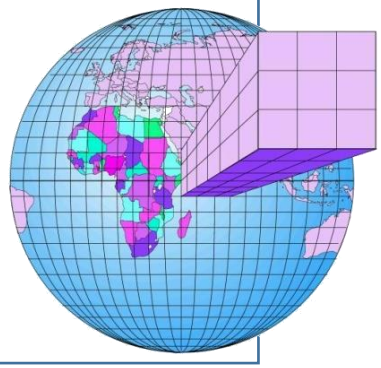


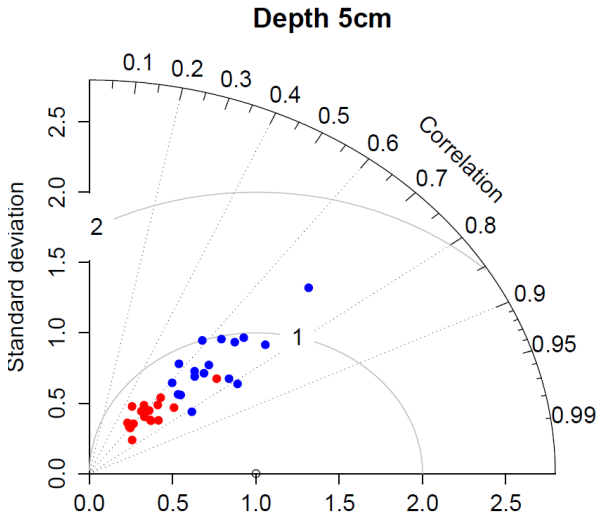
COMPARISON OF DIFFERENT MODELLING APPROACHES

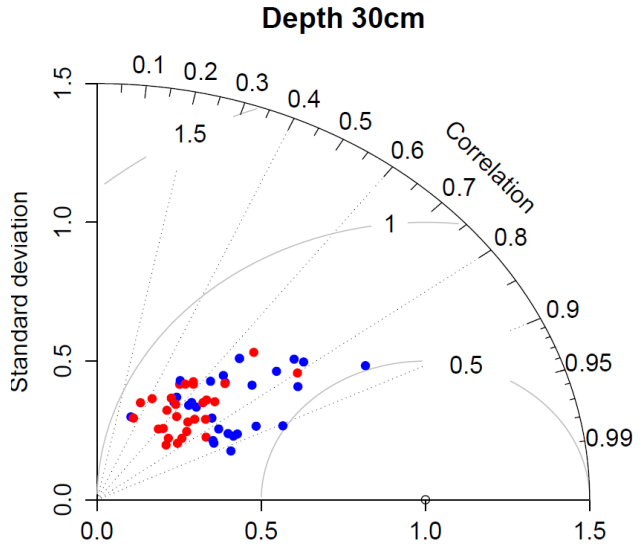
Community Land Surface Model





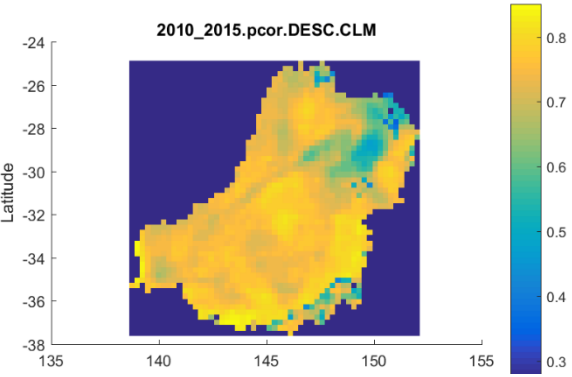


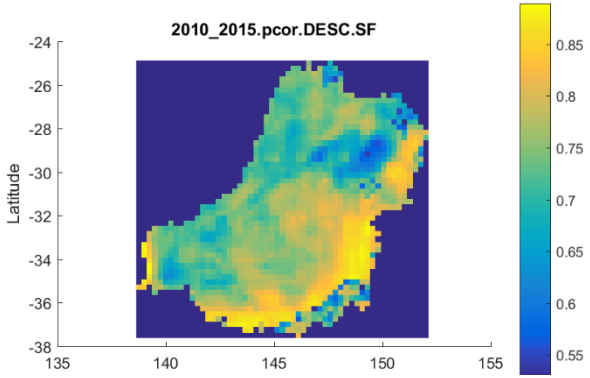


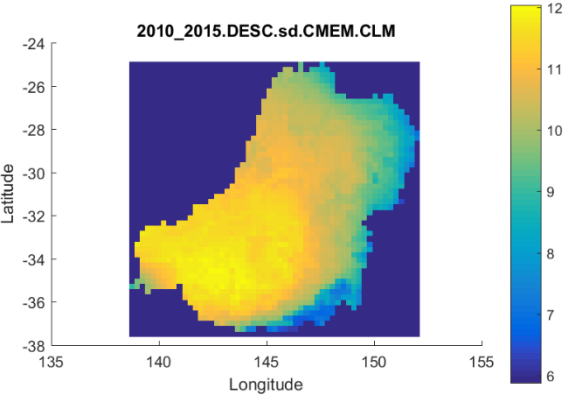


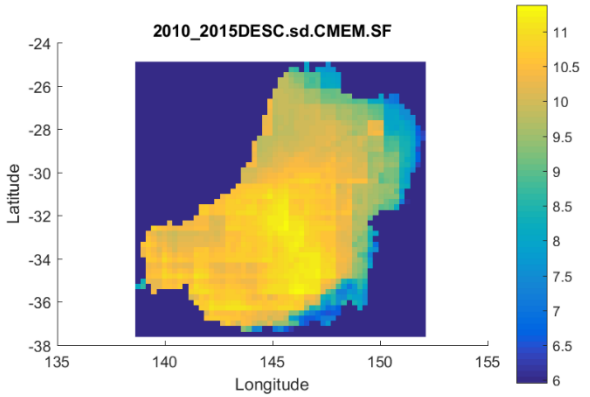
PASSIVE MICROWAVE FORWARD SIMULATIONS MURRAY-DARLING BASIN

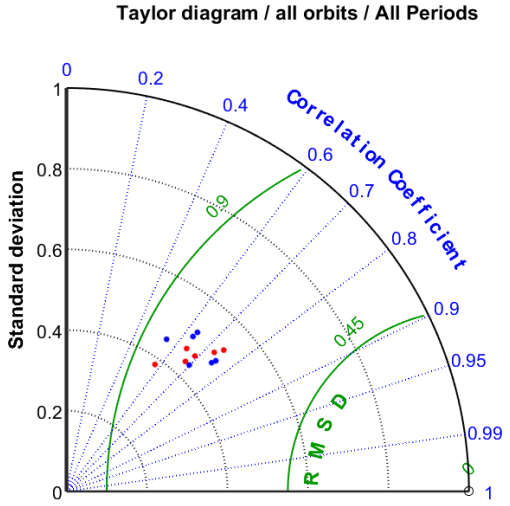
Community Land Surface Model



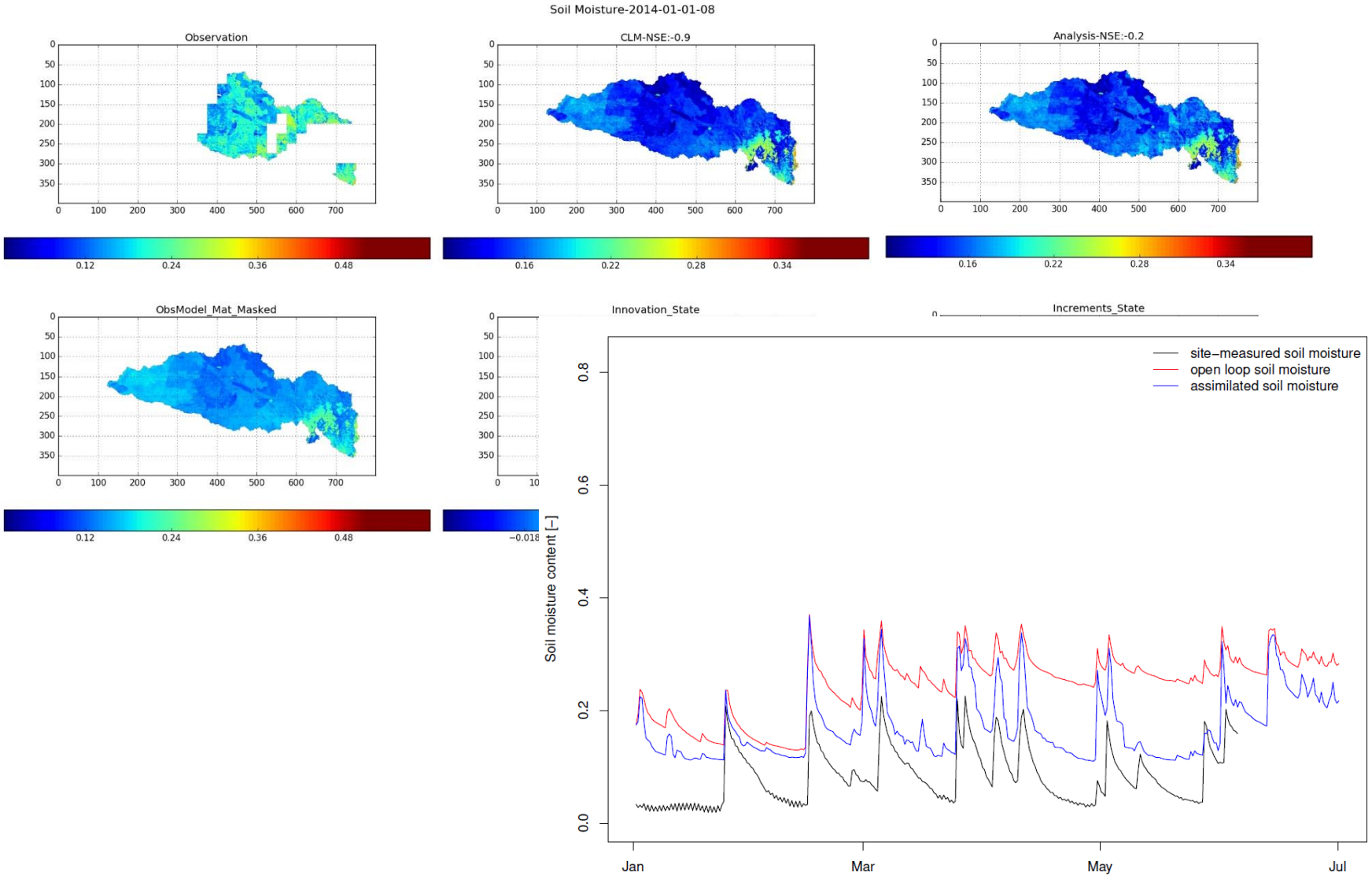








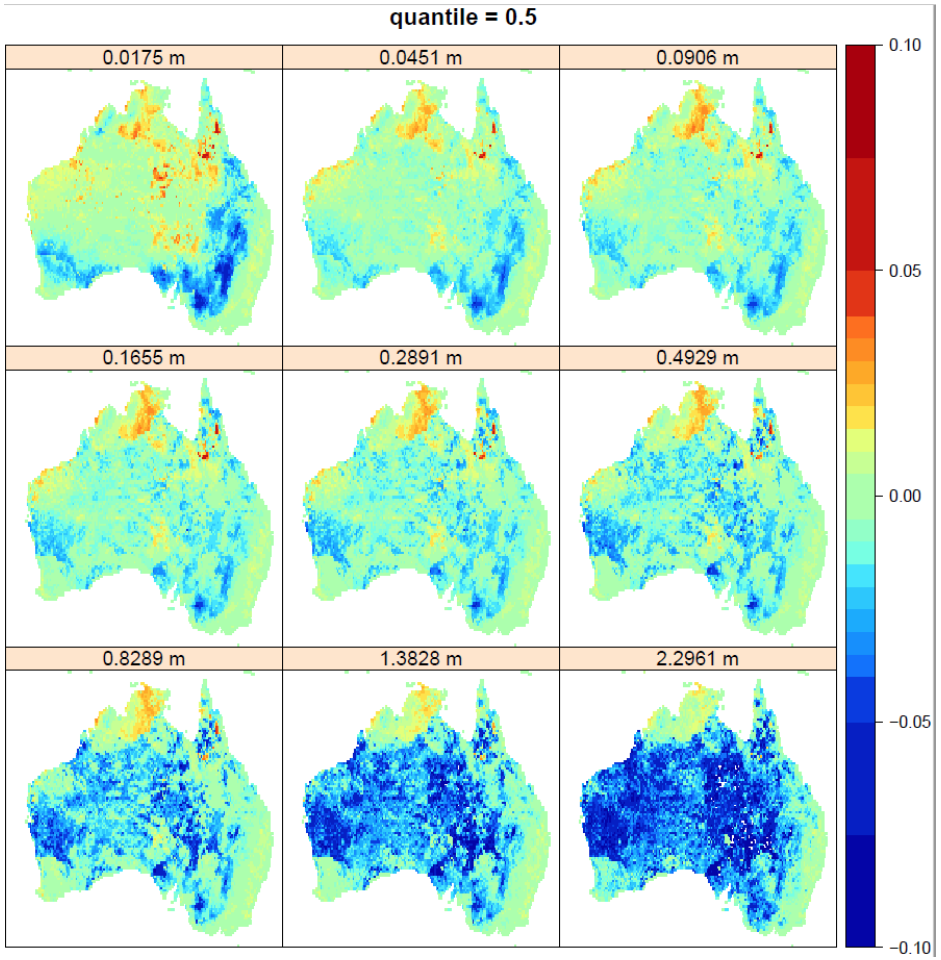
REGIONAL ASSIMILATION WITHIN THE MURRUMBIDGEE CATCHMENT

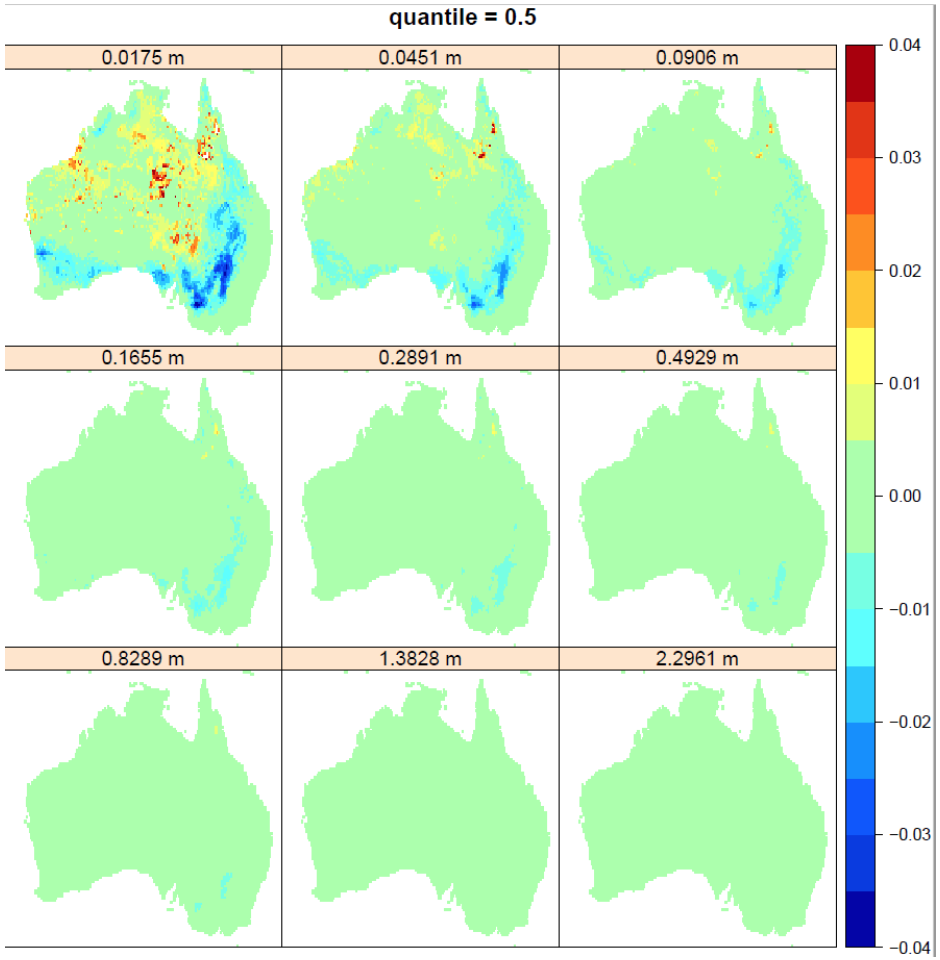


6 YEARS PASSIVE MICROWAVE ASSIMILATION OVER AUSTRALIA

SMOS 2010 – 2015 ASSIMILATION OVER AUSTRALIA

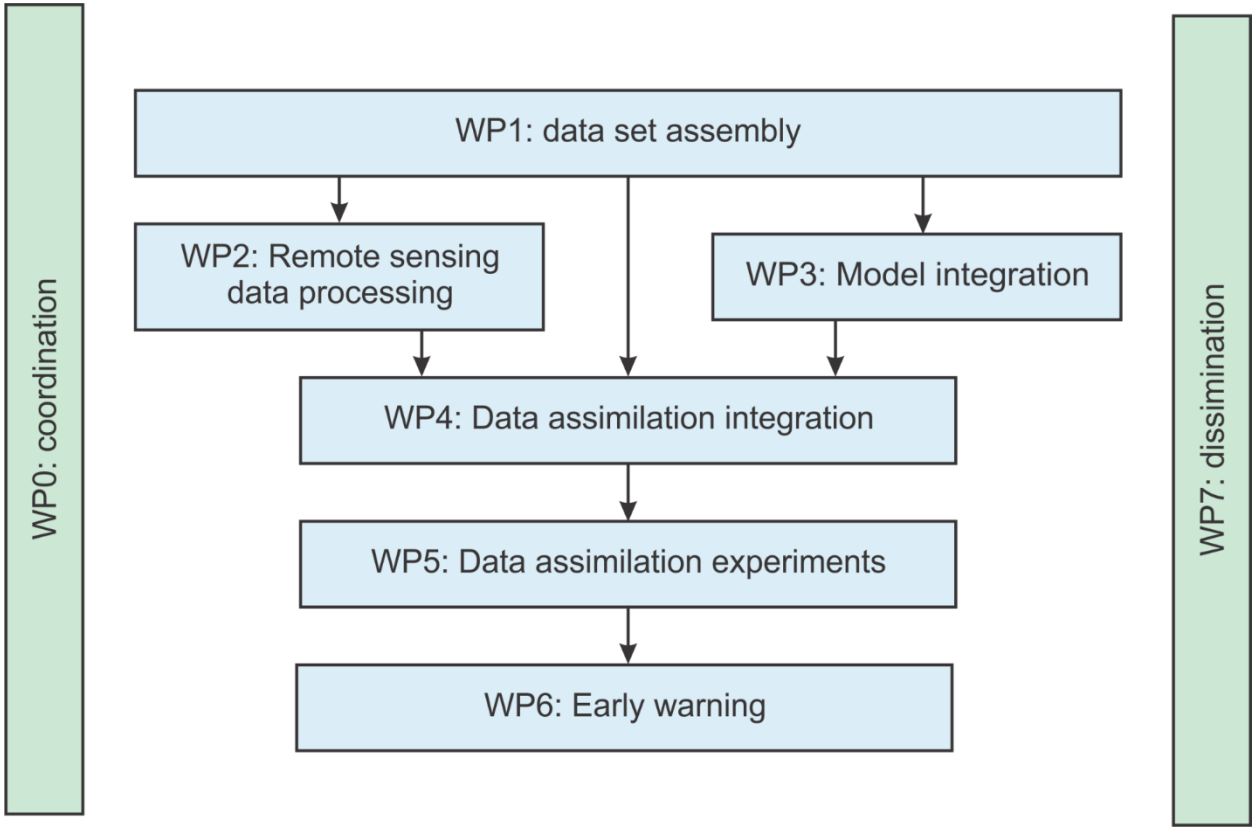
→ POSITIVE EFFECT ON CORRELATION COEFFICIENT, EFFECT ON LONG-TERM STATISTICS?





CURRENT STATUS

ASSIMILATION EXPERIMENTS ONGOING
ASSIMILATION EXPERIMENTS ONGOING



→ NEXT SMAP AND SENTINEL 1 ASSIMILATION (ASCAT)

→ DROUGHT STATISTICS