



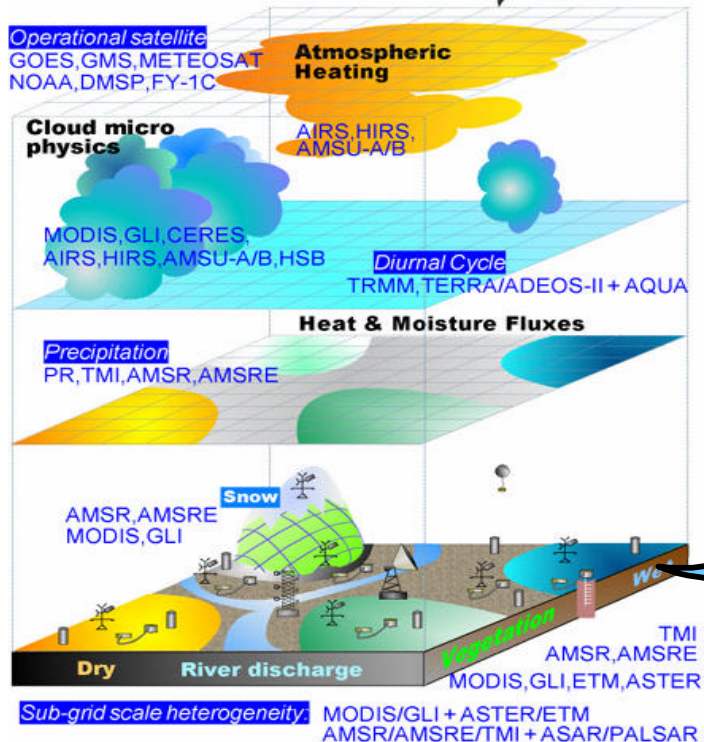
COORDINATED ENHANCED OBSERVING PERIOD

WORLD CLIMATE RESEARCH PROGRAMME

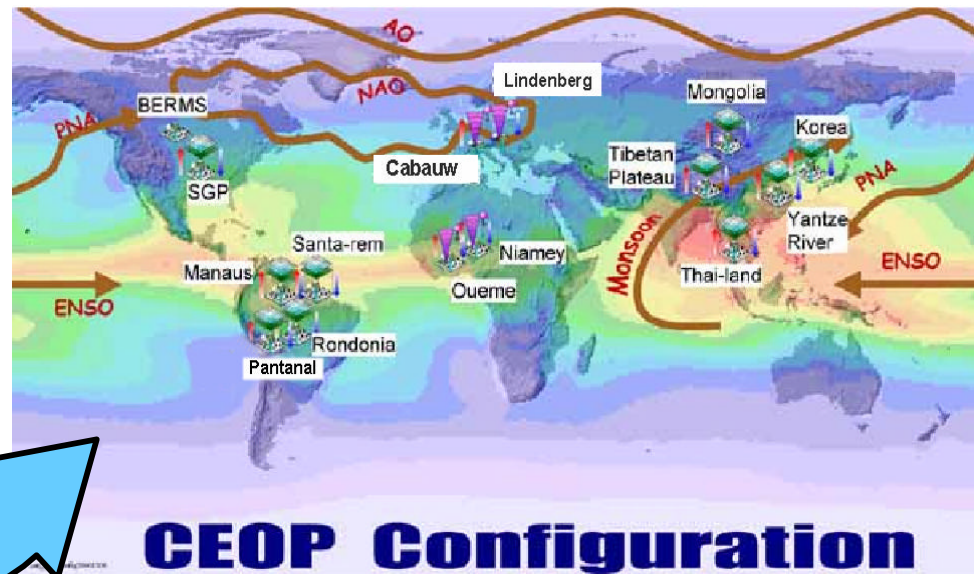
CEOP Watershed Hydrology Component

Integrated Data Approach

The 1st Opportunity for Global and Comprehensive Data Sets and the Beginning of the 21C
New Generation Satellite
TRMM, TERRA, AQUA, ADEOS-II, ENVISAT, ALOS



Reference Sites and Model Coverage





COORDINATED ENHANCED OBSERVING PERIOD

WORLD CLIMATE RESEARCH PROGRAMME

1. Discuss current strategy
2. Proposed 'augmented' strategy
3. Action items and discussion

Current CEOP-II implementation plan strategy

CEOP Hydrology Reference Sites

Under CEOP Phase II, there is an attempt to augment the CEOP tower flux sites with a small set of hydrological reference sites that will fulfill the following purposes:

- To serve as validation sites for the land surface parameterizations in coupled land-atmosphere-ocean models, essentially at a point or small area scale;
- To serve as "tie points" or ground truth reference sites for remote sensing products

<http://hydrology.princeton.edu/~luo/ceop.php>

CEOP Hydrology Reference Sites

Sites should meet the following criteria:

- Stream gauge information should be available for a catchment within which other (e.g., tower) observations lie. Catchment drainage area should ideally be in the range 100-1000 km², recognizing that for some sites drainage areas as small as 10 km² and as large as 10,000 km² may be acceptable;
- Precipitation data, either from gauges or radar, sufficient to resolve the major modes of spatial variability;
- Tower flux observations available for at least one site within the catchment, and land cover, soil and other ancillary data sufficient to support flux transfer methods which could provide spatial interpolation of tower evapotranspiration estimates;
- Ideally, multiple year time series of the major water and energy balance terms.

CEOP Hydrology Reference Sites

The current sites include:

- **ARM/SGP region of the USA -- HAVE DATA**
- **Zwalm river basin, Belgium -- HAVE SOME DATA**
- **Naqu river basin, China**
- **Walnut Gulch, Arizona, USA**
- Kyeamba Creek, NSW Australia
- Sleeven Polder, lower Feale River basin, County Kerry, Ireland
- Igarape Asu, Central Amazonia, Brazil
- Volta river basin, Ghana
- Wolf creek, Canada

Brief summaries are accessible from the web for each of the sites, as is a data entry form for entering summary information for new sites.



What is this?

Candidate Sites

- > Kyeamba Creek (Australia)
- > Sleeve Polder (Ireland)
- > Walnut Gulch (US)
- > Igarape Asu (Brazil)
- > **Zwalm River (Belgium)**
- > Volta River (Ghana)
- > Wolf Creek (Canada)
- > Naqu River (China)

Submit Your Site

Current Entries

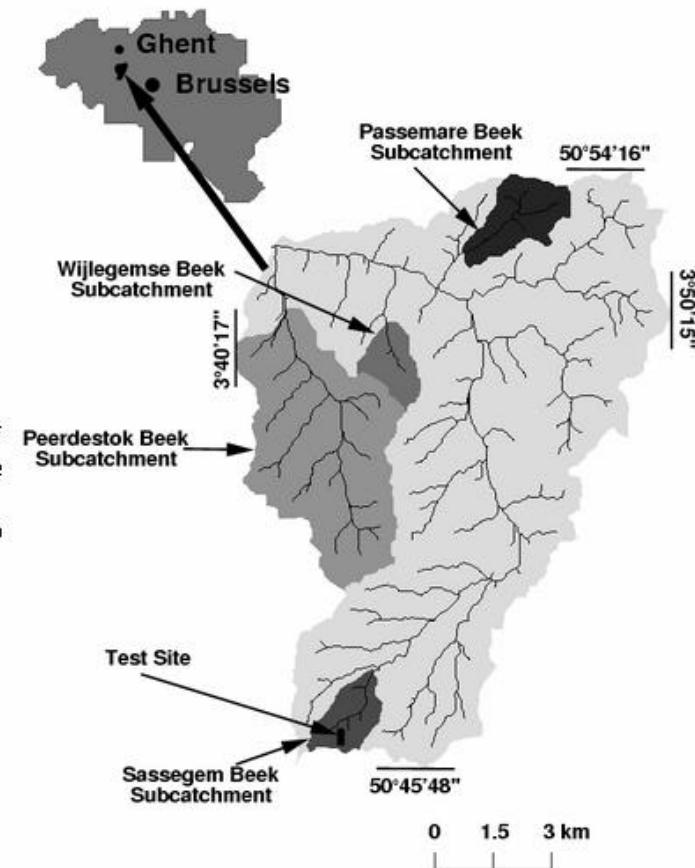
Zwalm River, Belgium

Site Summary

The Zwalm catchment, a subcatchment of the the Schelde River basin, is situated in the province of East-Flanders, Belgium at approximately 50.84°N and 3.78° E, (see Figure) with the outlet of the basin south of Gent near the village Nederzwalm. The total drainage area is 114 km² and the total length of perennial streams is estimated from topographic maps, scale 1:10000, to be 177 km. Therefore, the drainage density is 1.55 km/km², a value characteristic for humid catchments. The topography of the basin is characterized by rolling hills and mild slopes. The maximum elevation difference in the basin is 150 m. The mean slope of first order streams (Strahler order) is 3.8%. The catchment is situated in the sandy-loam area of Flanders. Surface sampling has confirmed that most of the top layer of the soil profile has sandy loam texture, even though the Belgian soilmap surface to consist of deep loam soils (A-texture). The depth of the eolic cover is estimated to range between 0 and 10 m. Most of the land use is agriculture (arable crops and permanent pasture) but in the southern portion of the catchment it is forested (~50% Brakel-bos). The degree of urbanization is about 10% with urbanized areas mainly situated in the Northeast (Zottegem) and Southeast (Brakel).

Within the Zwalm are a number of gauged subcatchments, as shown in the figure. The Passemare Beek is a second order (Horton order) stream with a drainage area of 2.52 km², and a total channel length of 2.97 km. The average slope is around 5% (channel slope 4.8% and hill slope 5.6%). The Sassegem subcatchment, with a drainage area of 2.49 km² and a total channel length of 2.92 km, is situated in the extreme south of the Zwalm catchment. With average slopes of 8.5%, it is steeper than the Passemare.

Climatic conditions can be described as humid temperate. The mean annual rainfall is 775 mm and is distributed almost uniformly over the year. The average year temperature is 10 deg. C, with January the coldest month (mean temperature 3 deg. C) and July the warmest month (mean temperature 18 deg. C). The annual evaporation is approximately 450 mm.



SITE INFO	<p>SITE NAME: Zwalm <i>Belgium</i></p> <p>SUMMARY:</p> <p>The total drainage area of the catchment is 114 sq. km and the total length of the perennial channels is 177 km. During the last glacial period (Wurm) the tertiary layers in the catchment were covered by eolic sandy-loam and loam soils. This cover is estimated to be between 0 and 10 m deep. The third soil type, clay, covers less than 5% of the total surface. The maximal elevation difference is 150 m. The average year temperature is 10 deg. C, with January the coldest month (mean temperature 3 deg. C) and July the warmest month (mean temperature 18 deg. C). The average yearly rainfall is 775 mm and is distributed evenly throughout the year. The annual evaporation is approximately 450 mm.</p> <p>AREA: 114.3 km² LAT: 50.88° LON: 3.68°</p>
DATA	<p>HYDROLOGICAL DATA: streamflow PERIOD: 1982– AVAILABILITY: digitized</p> <p>METEOROLOGICAL DATA: precip tair humid pres dew PERIOD: Feb. 2001– AVAILABILITY: digitized</p> <p>RADIATION DATA: Net Radiation PERIOD: Feb. 2001– AVAILABILITY: digitized Bowen Ratio PERIOD: Feb. 2001– AVAILABILITY: digitized</p> <p>OTHER DATA: Eddy correlation measurements are available from March through June 2002. TDR-based soil moisture measurements are available at the location of the weather station. From the Spring of 2004 on rain gauges and TDR instruments will be installed at four different locations in the catchments. Discharge measurements are available at the outlet in digitized format and four four subcatchments, till 2000 in digitized format and from 2000 on on hardcopies. These will be digitized in the near future.</p>
CONTACT	<p>NAME: Valentijn Pauwels PHONE: + 32 – 9 – 264 61 37 FAX: + 32 – 9 – 264 62 36 EMAIL: Valentijn.Pauwels@UGent.be</p>
SUPPORTING DOCUMENT	<p>zwalm_esa.eps (<i>application/eps 569545</i> Byte)</p>

Proposed 'augmented' strategy

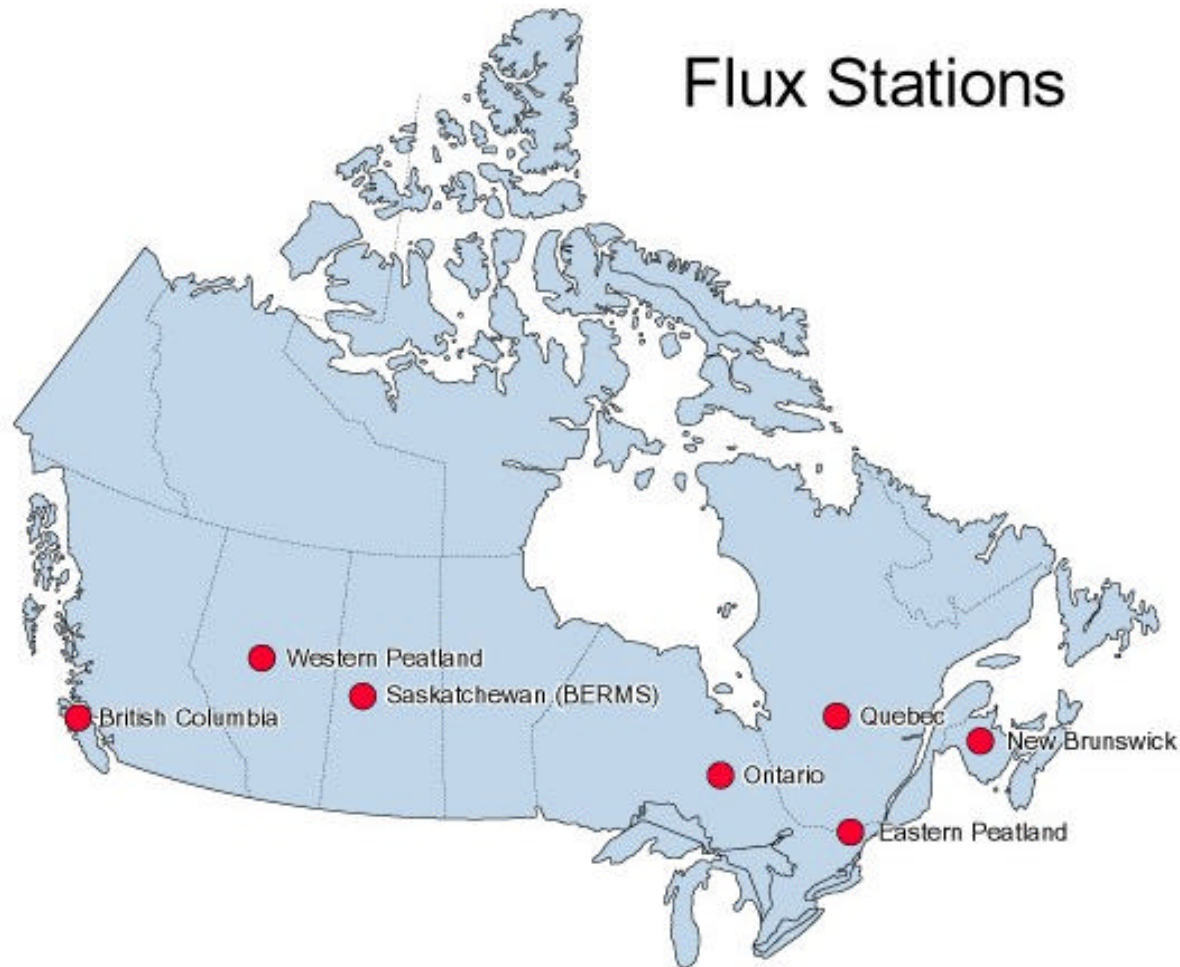
1. Classify the above sites as 'tier 1 sites'. Continue to work to obtain the promised data and to expand the number of sites.
2. Develop a set of global catchments 'tier 2 sites' with:
 - (i) high temporal (daily or finer) and spatial resolution forcing
 - (ii) daily gauged river flows
 - (iii) long term (>10 years) historical records
 - (iv) have near-by CEOP or FLUXNET type tower sites.
3. Develop a set of global catchments 'tier 3 sites' with data similar to tier 2 sites but lower temporal, spatial and historical requirements.
4. Partner with related efforts to identify global catchments: GEWEX/CSE, GHP/MOPEX, IAHS/PUB, UNESCO/HELP

Tier 2 proposed strategy

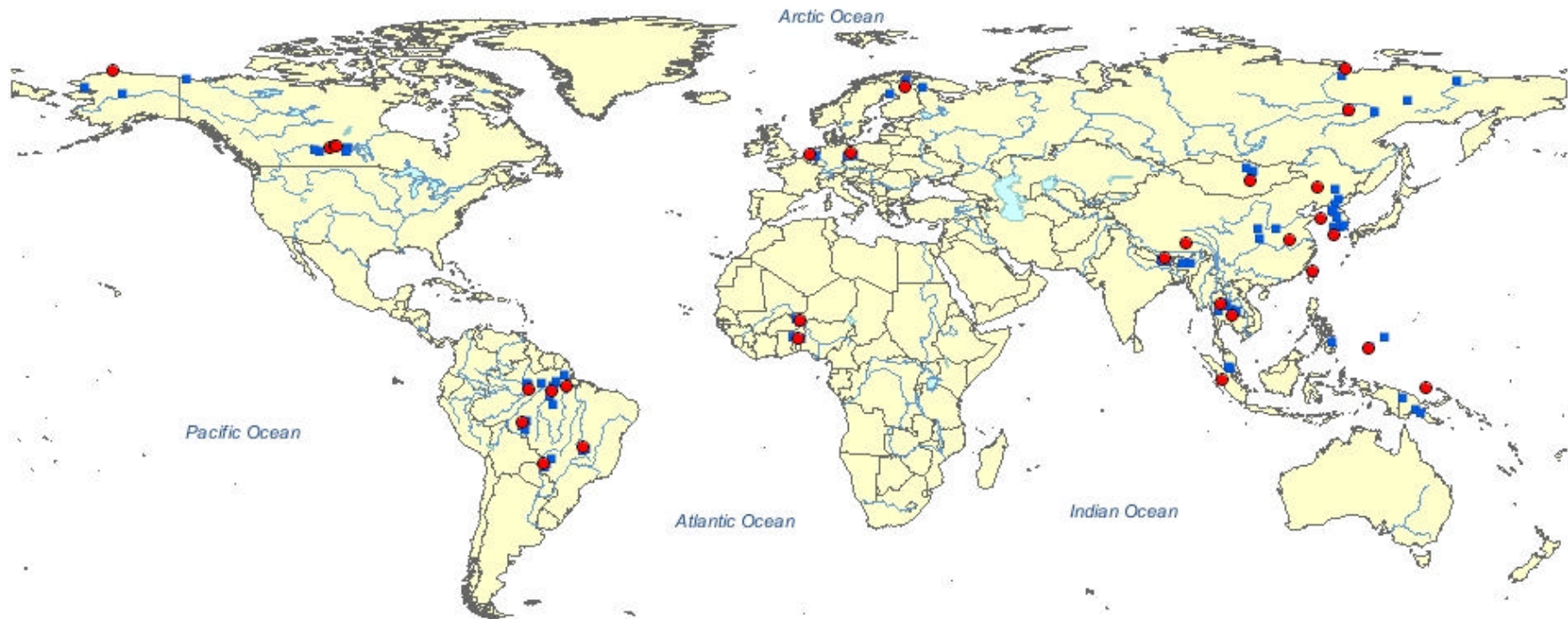
What action	Who
Identify basins with the necessary data criteria within the GEWEX CSEs.	GEWEX CSE data 'managers' and PIs.
Screen sites for CEOP appropriateness	CEOP watershed WG
Contact appropriate FLUXNET data managers about data availability for CEOP	CEOP data managers
Obtain and post the streamflow, FLUXNET, site characteristic data, and metadata	CEOP data managers

Example of FLUXNET sites in Canada

(obtaining FLUXNET data is uncertain – you have to register, they have to ‘approve’ you, etc etc.)



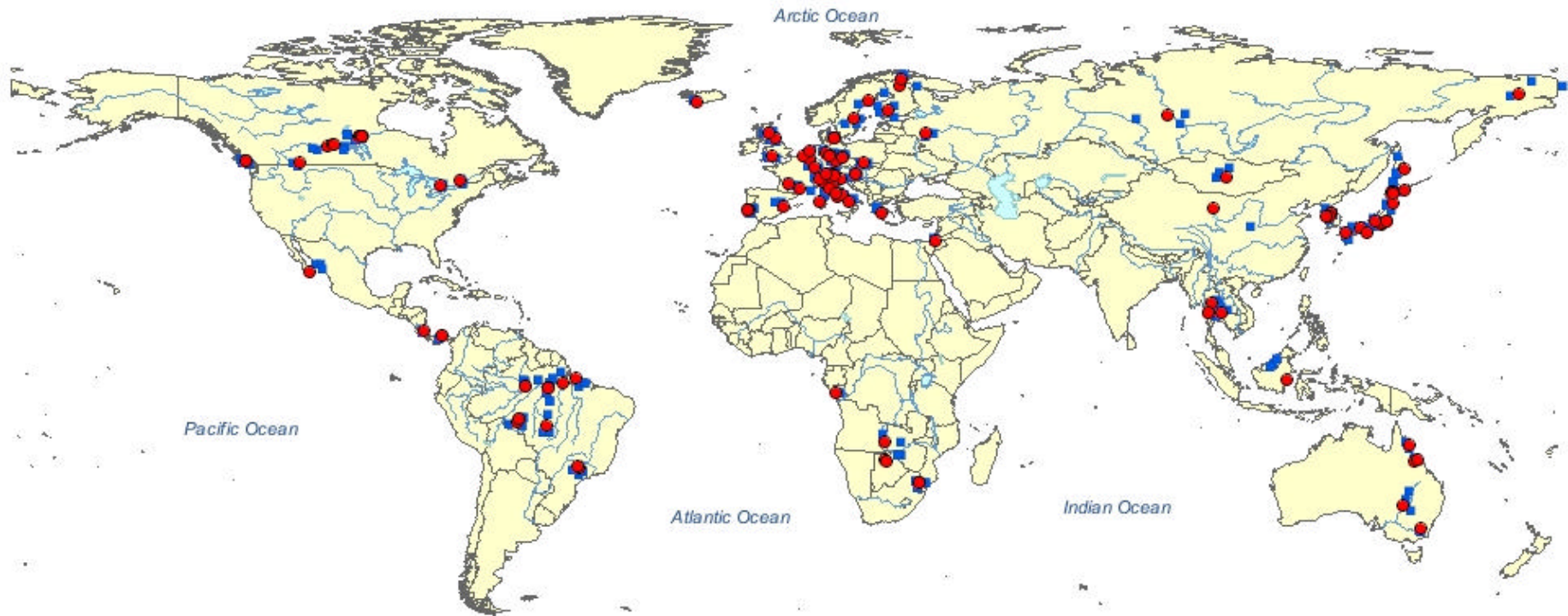
MOPEX basins near CEOP tower reference sites



Information provided by John Schaake

MOPEX basins near FLUXNET sites

(quality, duration and availability of the FLUXNET data is uncertain)



Information provided by John Schaake

Tier 3 proposed strategy

What action	Who
Identify basins with the necessary data criteria globally	Global Runoff Data Center, WMO/IGWCOS, UNESCO
Screen sites for CEOP appropriateness	CEOP watershed WG
Contact appropriate data managers about data availability for CEOP	CEOP data managers
Obtain and post the streamflow, site characteristic data, and metadata	CEOP data managers

Proposal to move Tier 2 and Tier 3 forward

The development of a global set of hydrology and catchment sites requires a joint effort by the diverse groups interested in developing this set:

- CEOP Watershed reference sites
- GHP/HAP demonstration sites
- IGWCOS sites
- UNESCO HELP basins and FRIEND
- IAHS Project for Ungauged Basins (PUB)

I propose that a workshop focusing on this topic be organized through UNESCO or GEWEX/GHP.