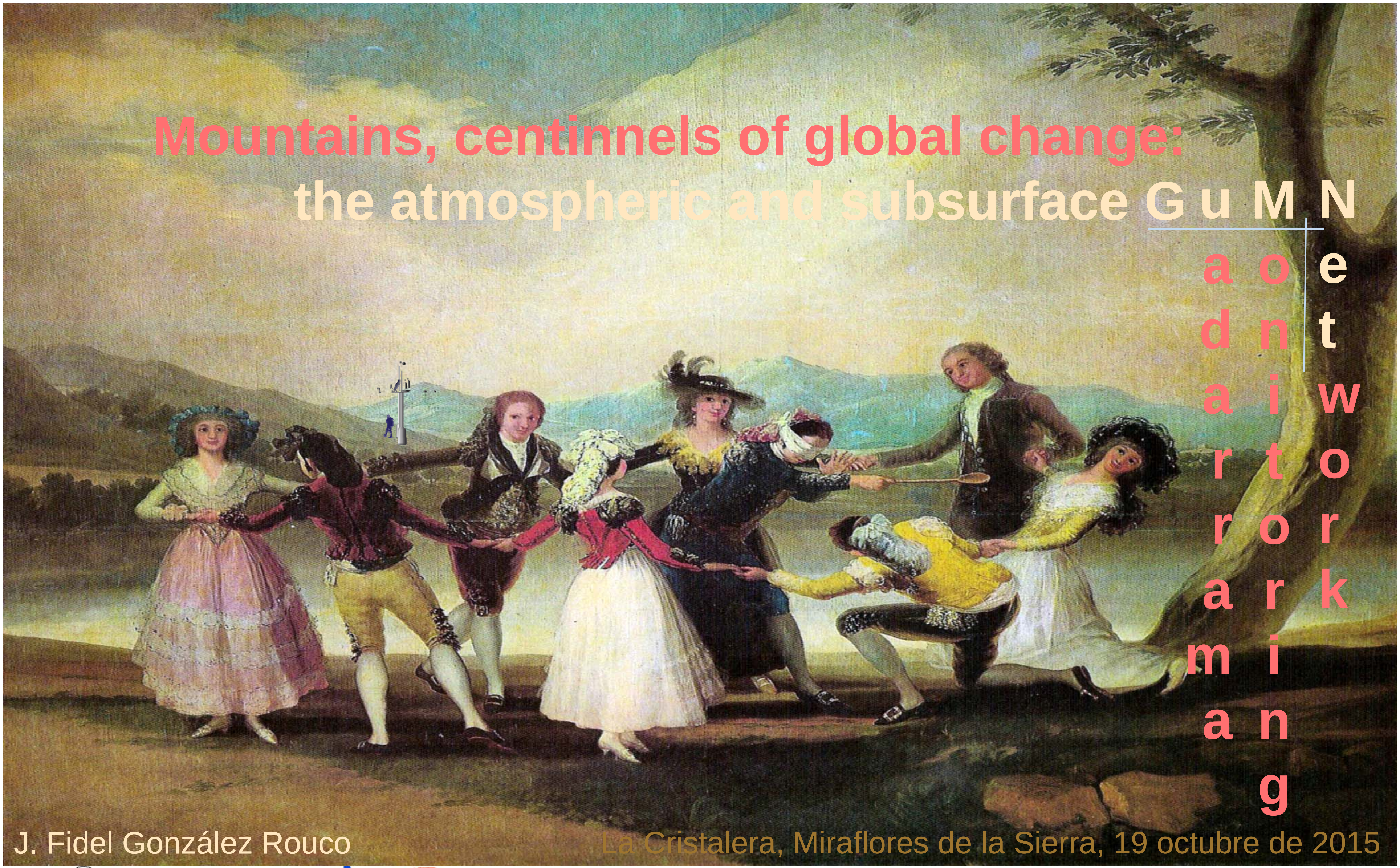


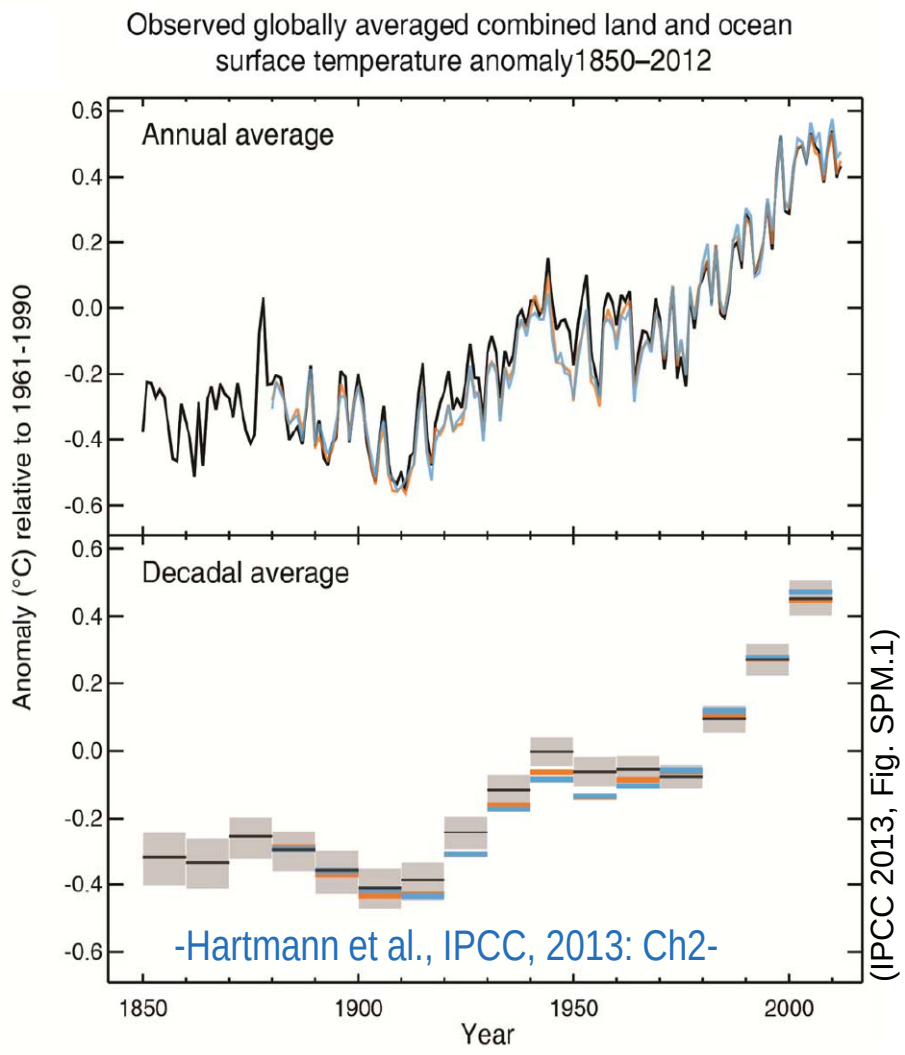
Mountains, centinnels of global change:

the atmospheric and subsurface GuMN (Guadarrama Monitoring Network)

J. Fidel González Rouco

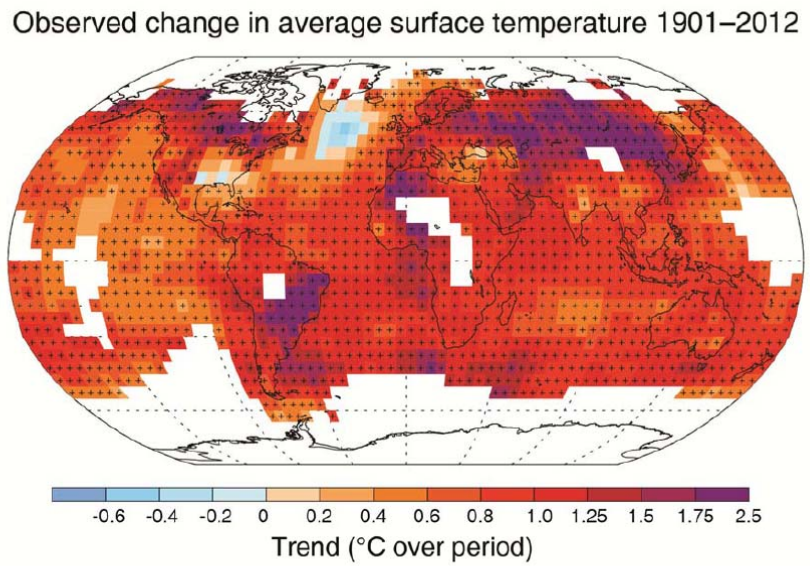
La Cristalera, Miraflores de la Sierra, 19 octubre de 2015

Observed changes in the climate system: atmosphere

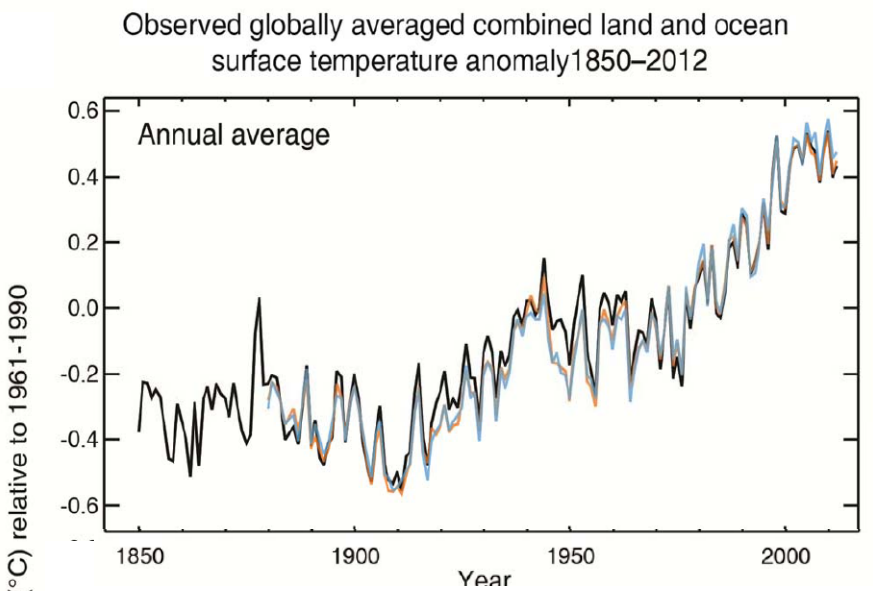


Warming in the climate system is unequivocal
Atmosphere and the ocean have warmed

- Tmax & Tmin have increased (virtually certain)
- 1901-2012: Almost the entire globe has warmed

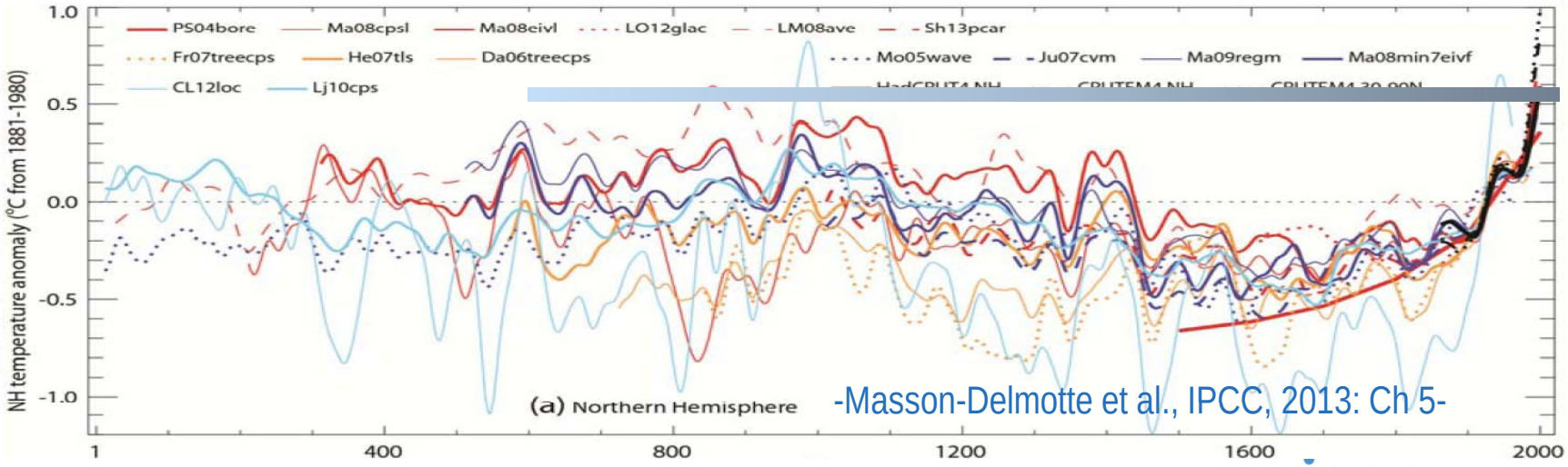


Observed changes in the climate system: atmosphere



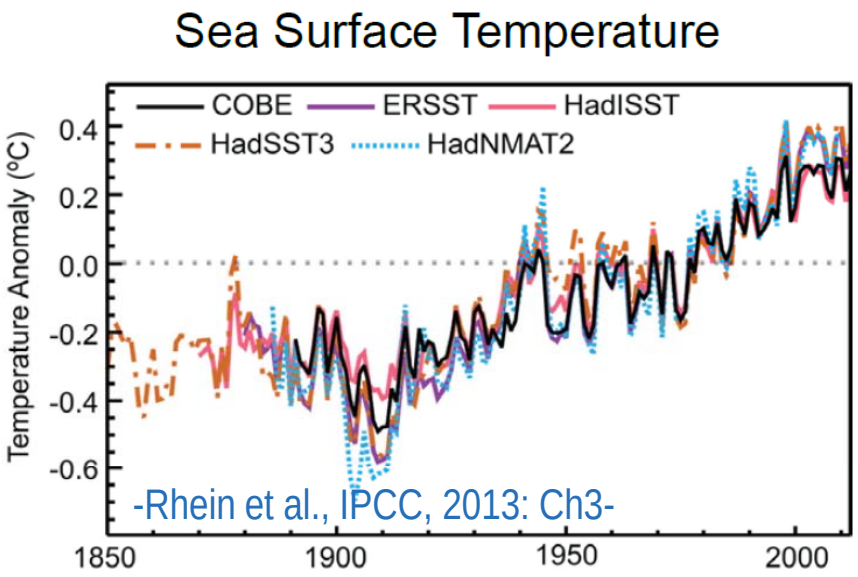
Warming in the climate system is unequivocal
Atmosphere and the ocean have warmed

1983-2012:
Very likely warmest 30-yr period of the last 800 yrs (high conf.) & likely the warmest of the last 1400 yrs (mid. conf).



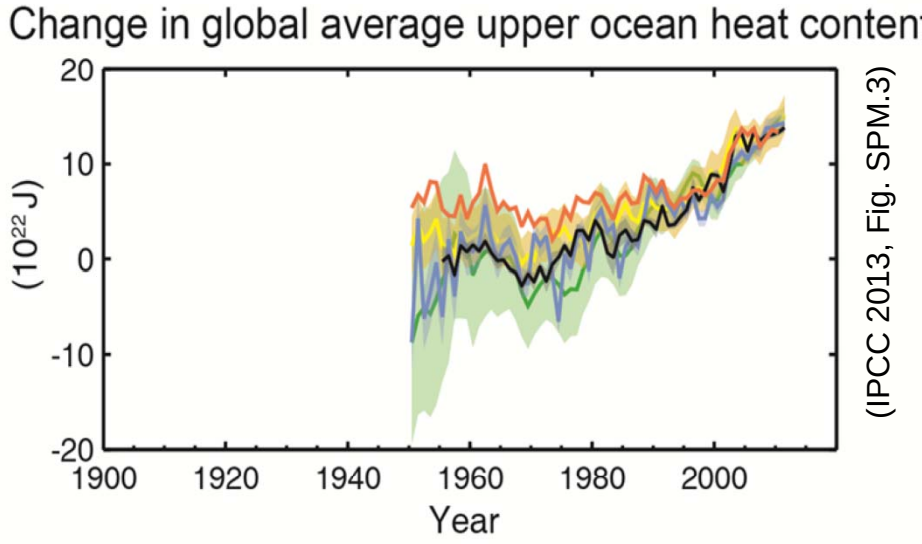
-Masson-Delmotte et al., IPCC, 2013: Ch 5-

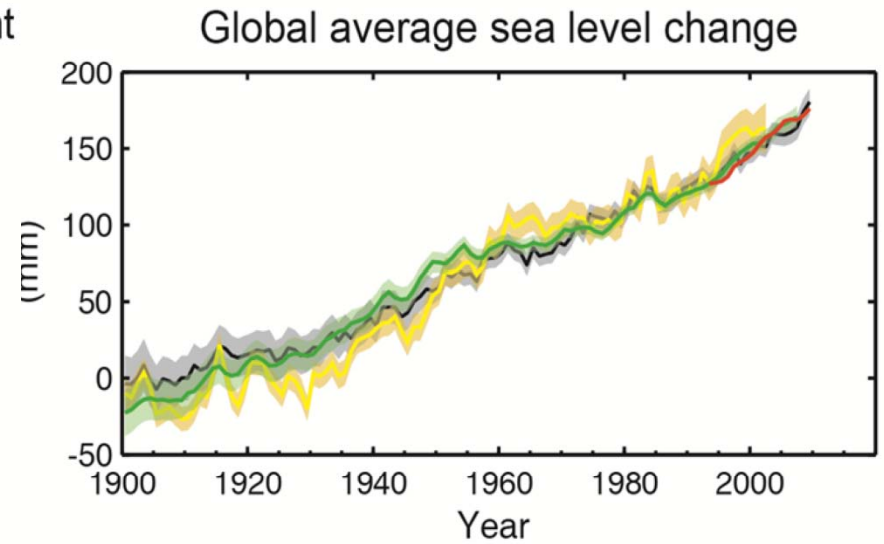
Observed changes in the climate system: ocean



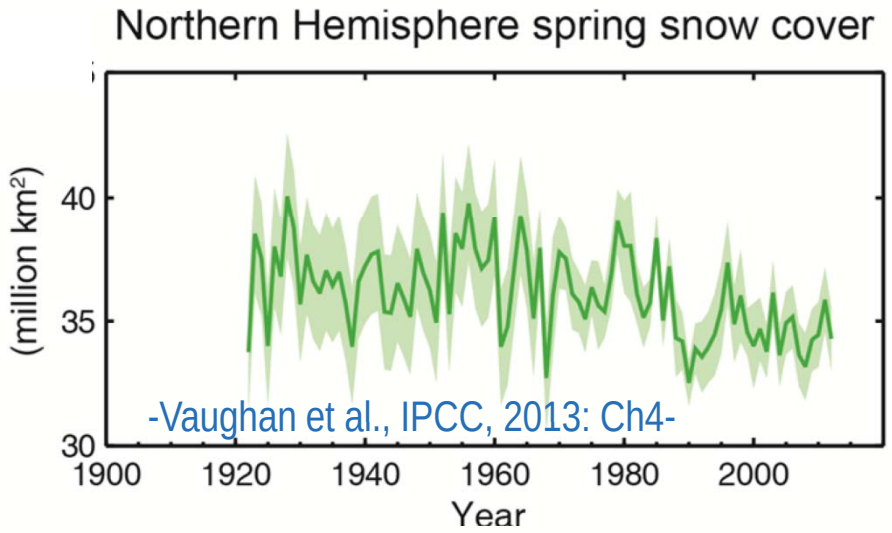
Warming in the climate system is unequivocal
Atmosphere and the ocean have warmed
Sea level has risen

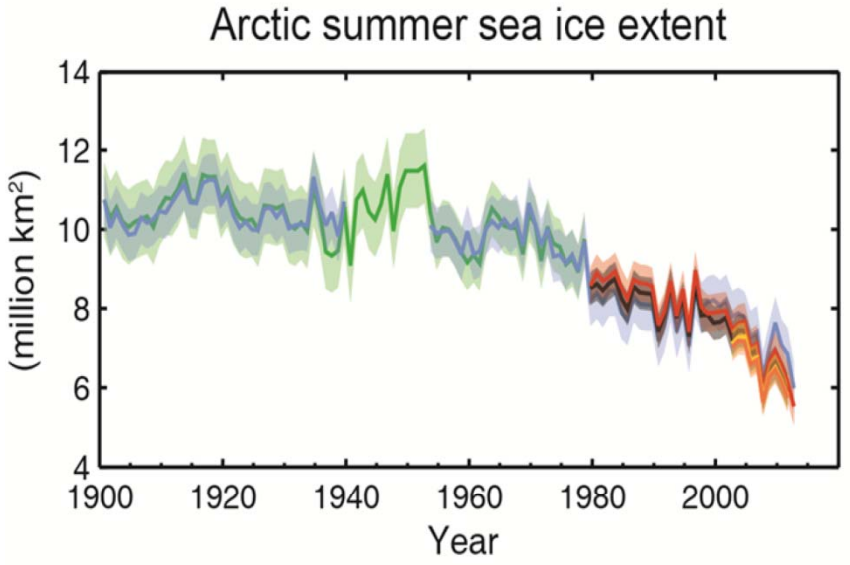
1901-2010: Gloobal mean sea level rose by 0.19 [0.17-0.21] m
Rate of sea level rise larger than mean rate during previous two millennia (high conf.)





Observed changes in the climate system: criosphere



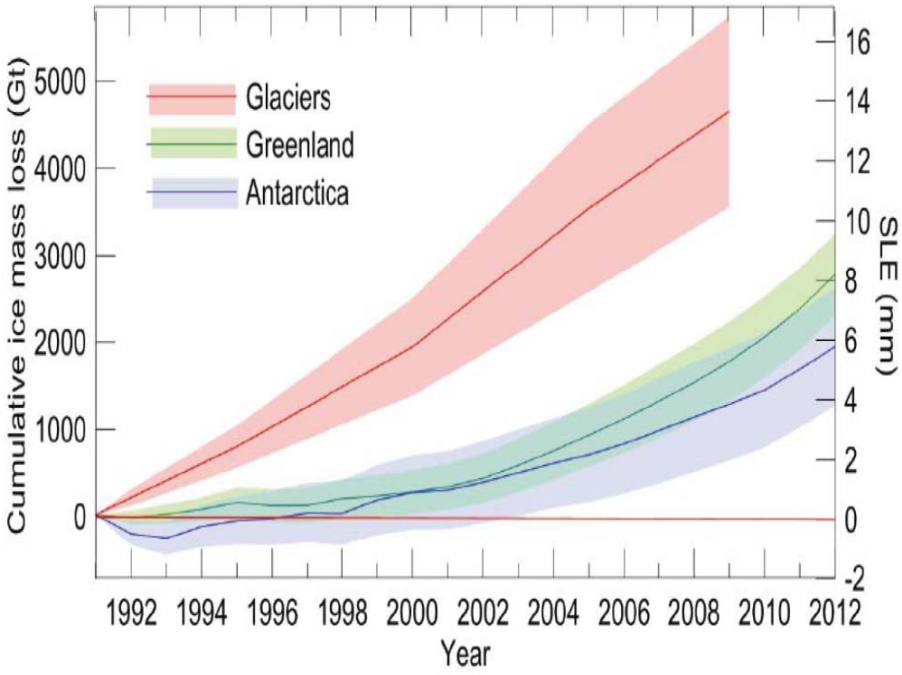


IPCC AR5 Working Group I
Climate Change 2013: The Physical Science Basis

Warming in the climate system is unequivocal
Atmosphere and the ocean have warmed
Sea level has risen
Snow and ice have diminished

1993-2009:
Glaciers have continued to srink
Actic sea ice & NH spring snow cover decrease

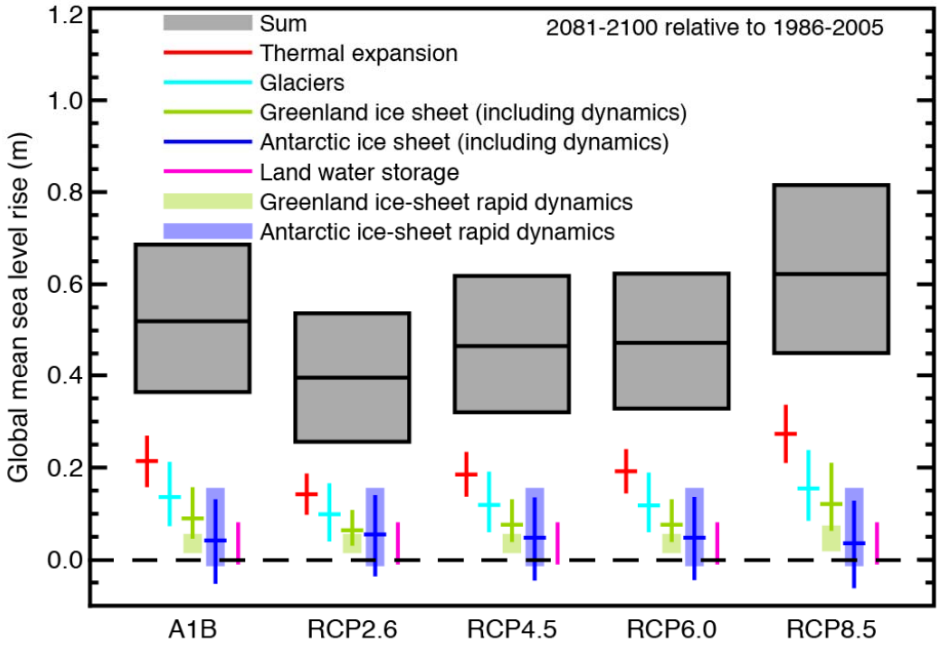
(IPCC 2013, Fig. SPM.3)



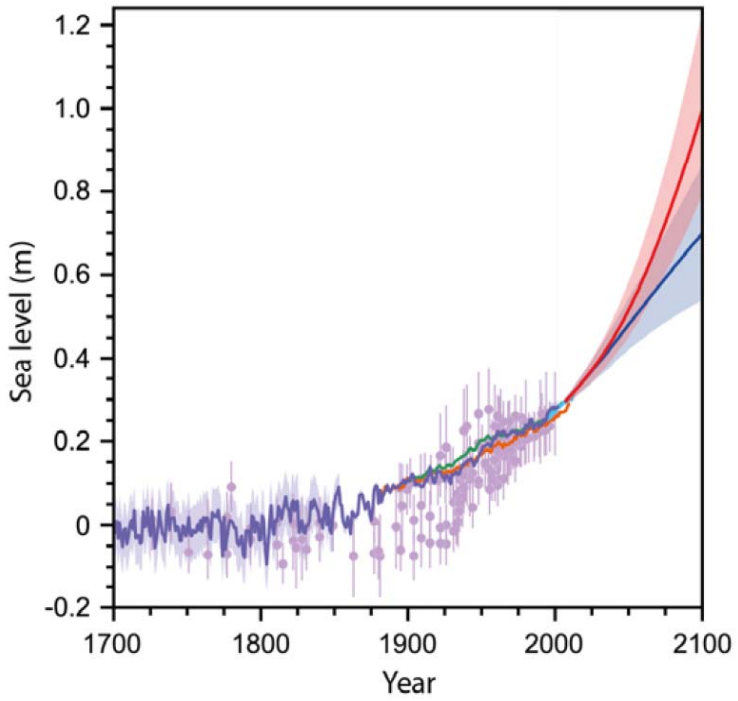
What are the expected changes for the future?: ocean & sea level

The global ocean will continue to warm during the 21st century.
Heat will penetrate from the surface to the deep ocean and affect ocean circulation and sea level rise

Global mean sea level will continue to rise during the 21st century. Under all RCPs the rate of sea level rise will very likely exceed the observed during 1971-2010.



(IPCC 2013, TS.21 TFE2.2)

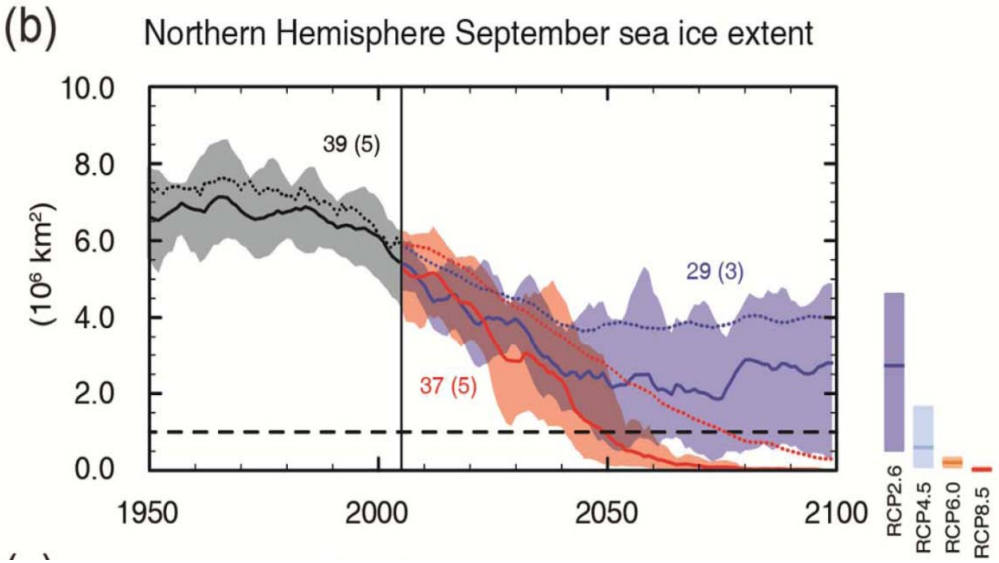


- Church et al., IPCC, 2013: Ch13-
- Collins et al., IPCC, 2013: Ch12-

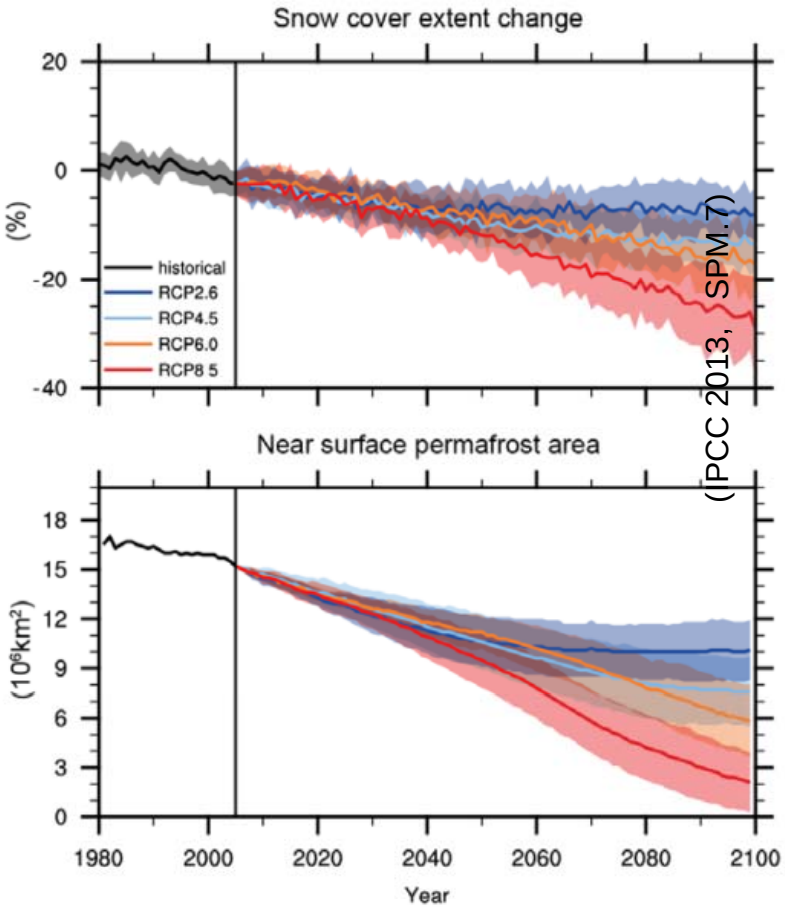
What are the expected changes for the future?: cryosphere

Arctic sea ice cover will very likely continue to shrink and thin

NH spring snow cover will decrease during the 21st century. Global glacier volume will further decrease



- Collins et al., IPCC, 2013: Ch12-



(IPCC 2013, SPM.7)

Mountain waters & glaciers

Sentinels of climate change

Mountain waters, a key resource for development

Mountains are the water towers of the world.

They provide freshwater to half of the world's population for irrigation, industry, domestic use and hydropower.

But mountains are also among the regions most sensitive to climate change.

Mountain waters & glaciers

hidrological reserves

Mountain waters, a key resource for development

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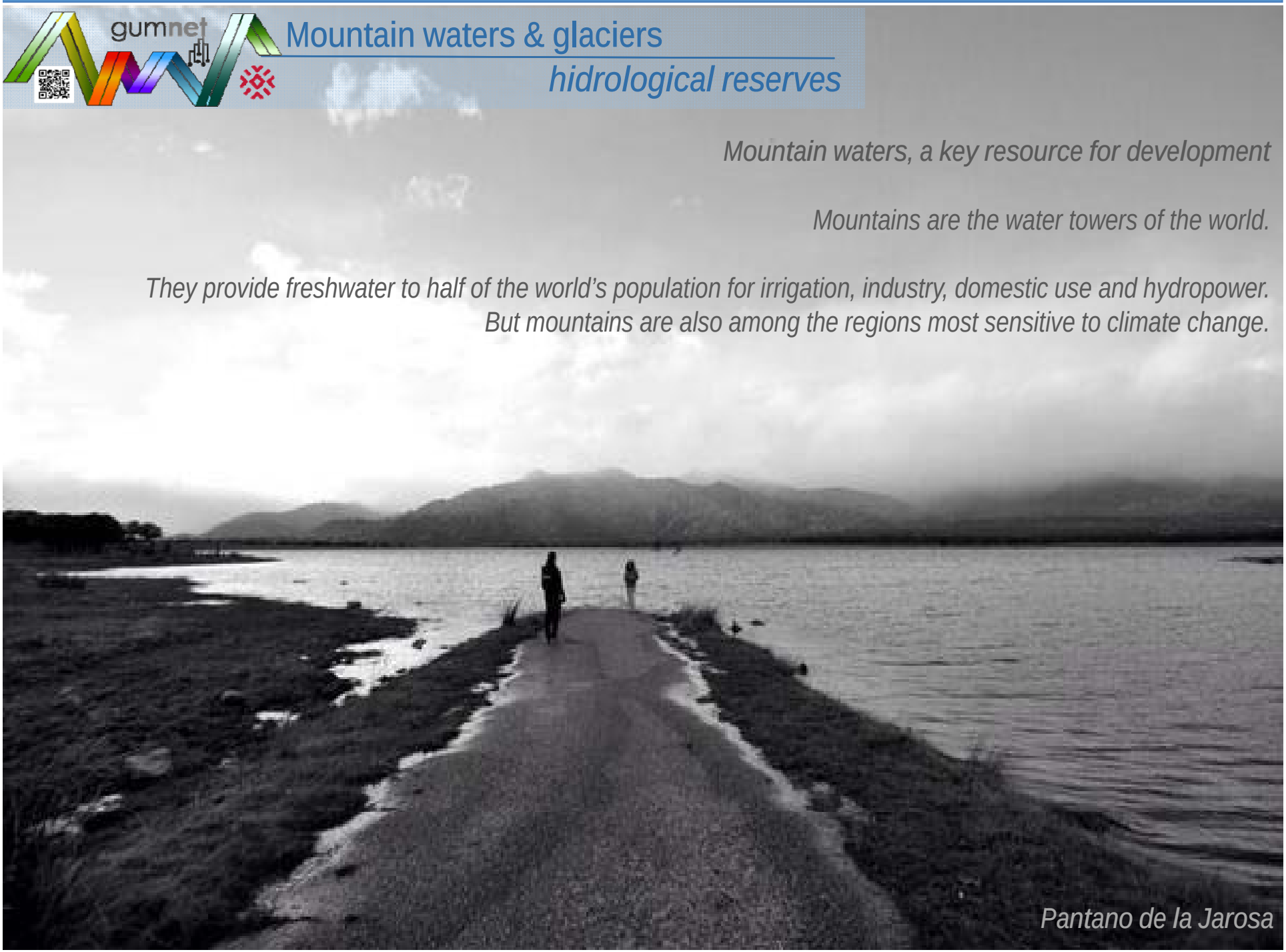


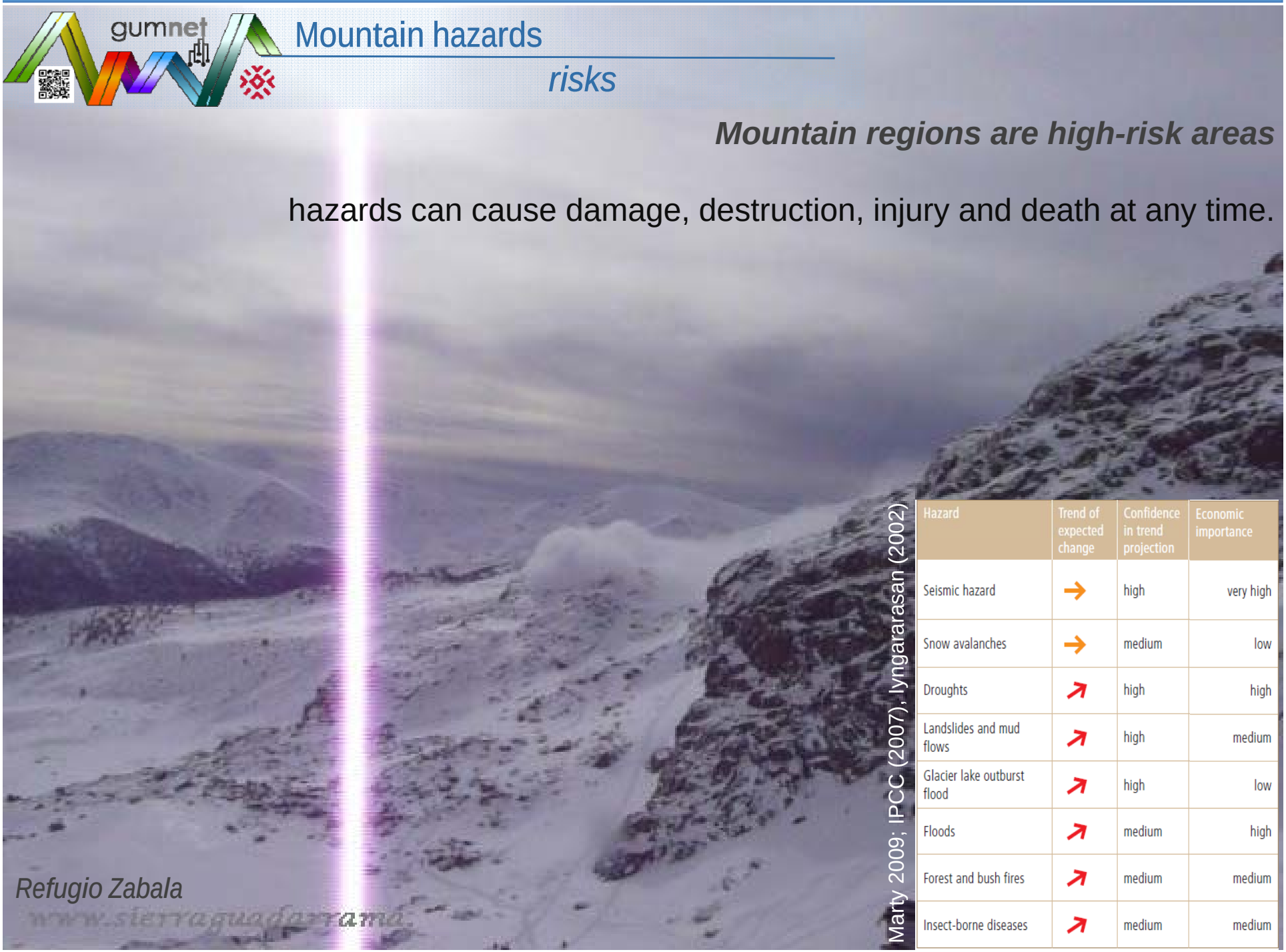
Pantano de la Jarosa

Mountain hazards

risks

Mountain regions are high-risk areas

hazards can cause damage, destruction, injury and death at any time.



Marty 2009; IPCC (2007), Iyngararasan (2002)

Hazard	Trend of expected change	Confidence in trend projection	Economic importance
Seismic hazard	→	high	very high
Snow avalanches	→	medium	low
Droughts	↗	high	high
Landslides and mud flows	↗	high	medium
Glacier lake outburst flood	↗	high	low
Floods	↗	medium	high
Forest and bush fires	↗	medium	medium
Insect-borne diseases	↗	medium	medium

Biodiversity in Mountains

A Natural Heritage Threatened by Climate Change

The world's mountains are **focal points** of global biodiversity, hosting about half of the world's biodiversity hotspots. This is due to the great diversity of habitats within short distances, which is a result of altitudinal gradients, changes in exposition, and varying geology and soils.

La Pedriza

Mountains as focal points

Education

Pinar de Valsaín

Mountains as focal points

Research

Laguna Grande de Peñalara

Laguna Grande de Peñalara

Mountains as focal points

Management & protection

gumnet

Hidrological reserves

Sentinels of Climate Change

Hazards / risks

Resources

Watch

Natural heritage

Security

Sustainability

Wealth

From understanding to action

Education

Research

Health/leisure

Management

Outline

Sustainability

What is GuMNet?

a glimpse at the facility

Our vision:

a high mountain observatory

How do we get there?

a two sided infrastructure

What is GuMNet?

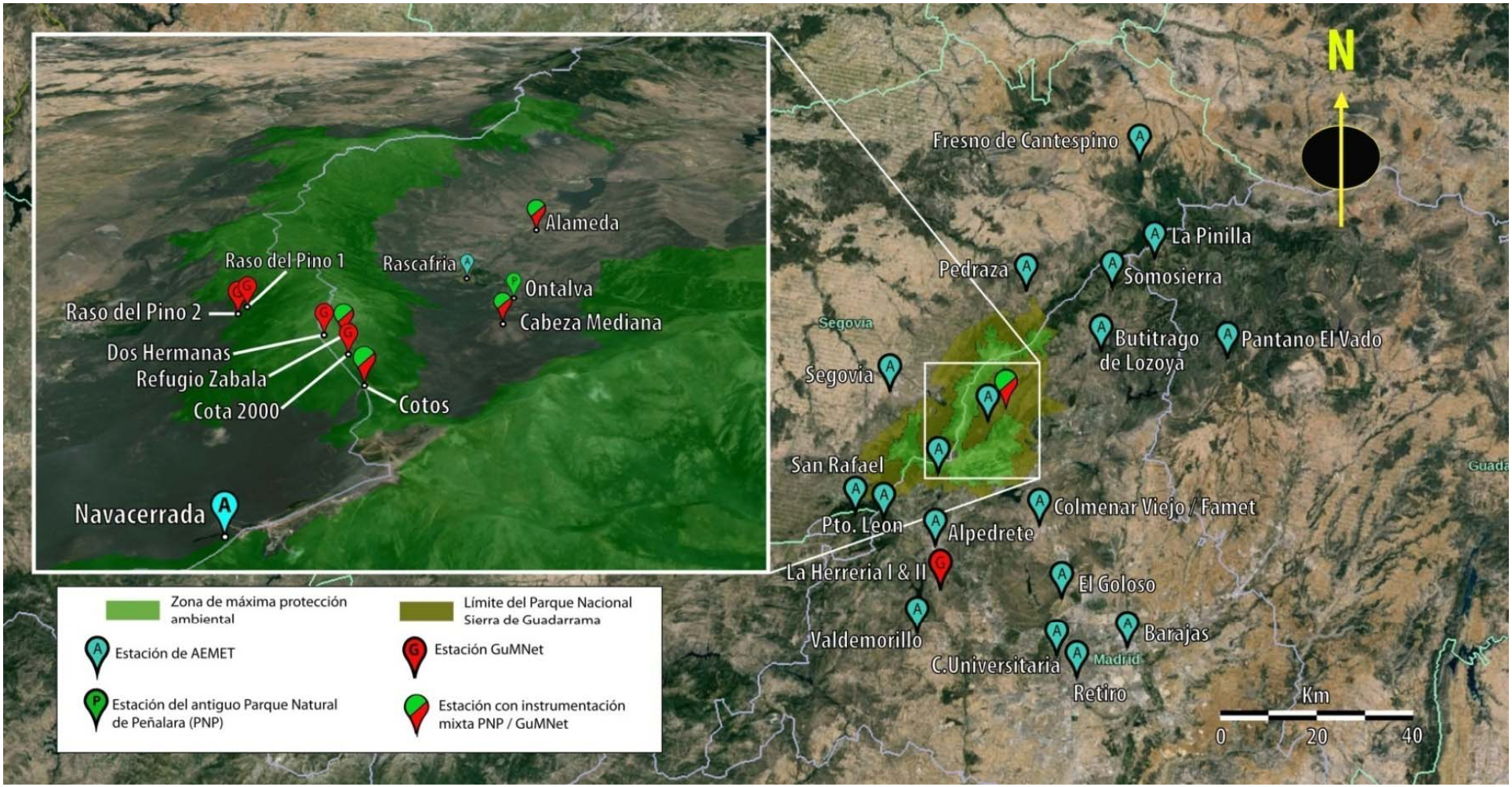
a glimpse at the facility

GuMNet is a new infrastructure of atmosphere, surface and subsurface observation

It leans on an existing facility promoted by the Parque Nacional de Peñalara

... updated, enlarged in instrumentations, sites.

It will merge with the meteorological network of AEMET



What is GuMNet?

a glimpse at the facility

Public Bid call: CAIMON 2010 (CEI) → 353.966,14 €

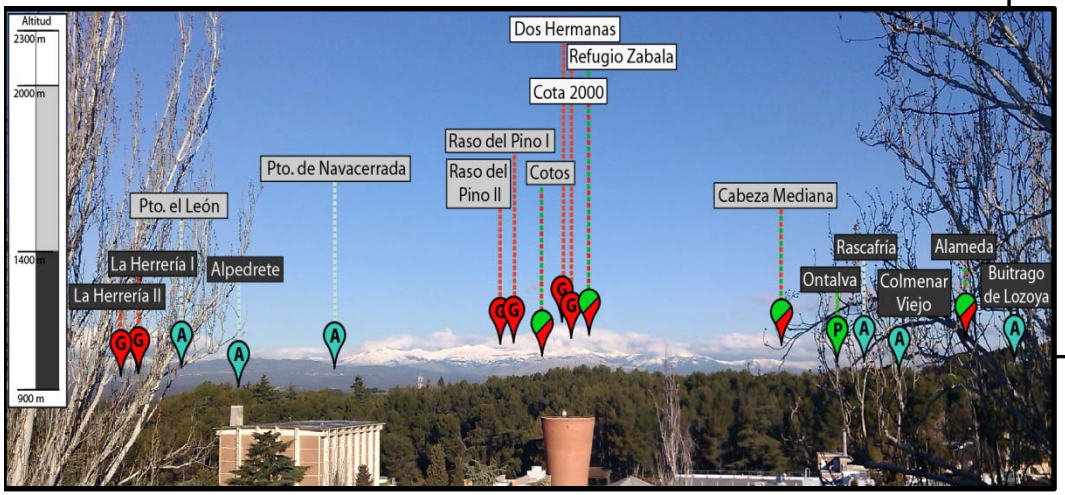
Call resolved: February,27th 2014, 4 bid packages

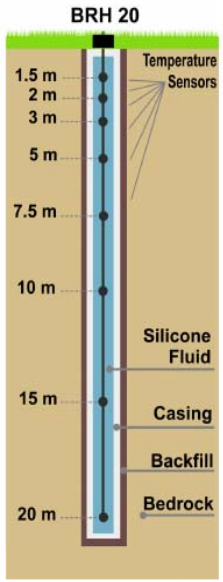
➢ **Package 1: Surface & subsurface.**
Insitu Testing S.L. , 52.998,00 €

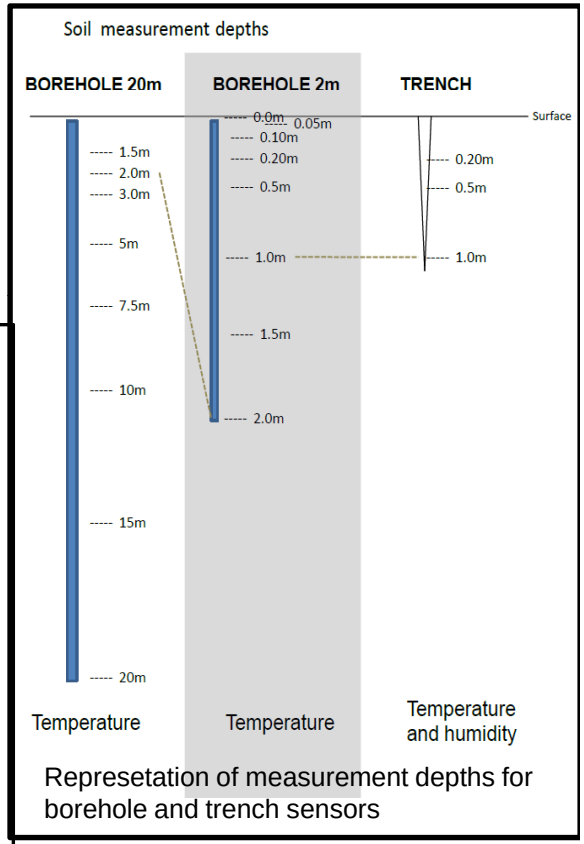
✓ 6 boreholes of 20 m depth

✓ 8 boreholes of 2 m depth

✓ 9 trenches (temperature & humidity)
20, 50 y 100 cm, at 8 sites.







Represetation of measurement depths for borehole and trench sensors

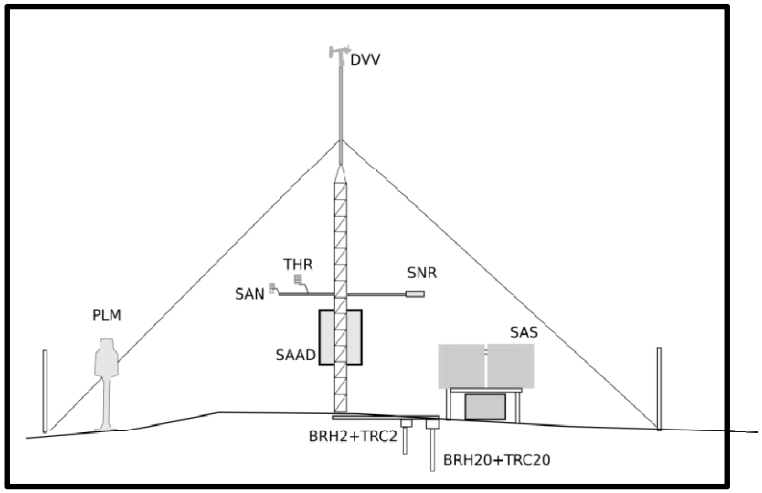
GuMNet sites as seen from UCM

What is GuMNet?

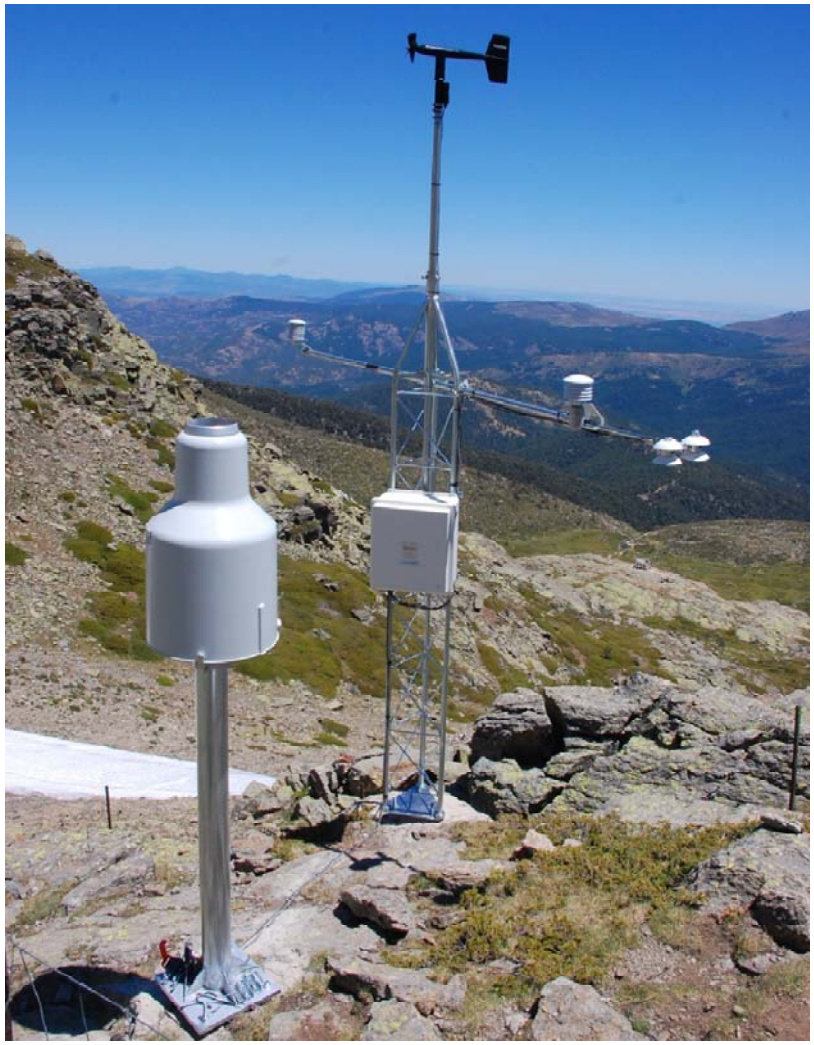
a glimpse at the facility

➢ **Package 2: Hydro-Meteorological instrumentation.**
OTT Medio Ambiente Iberia S.L. (145.422,64 €)

✓ 7 WMO standar sites



Scheme ofr a hydro-met site



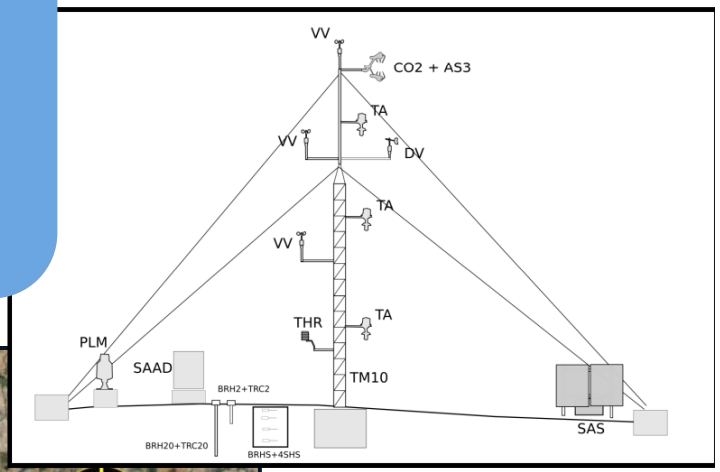
Dos Hermanas

➢ Package 3: Eddy-covariance / CO2 towers

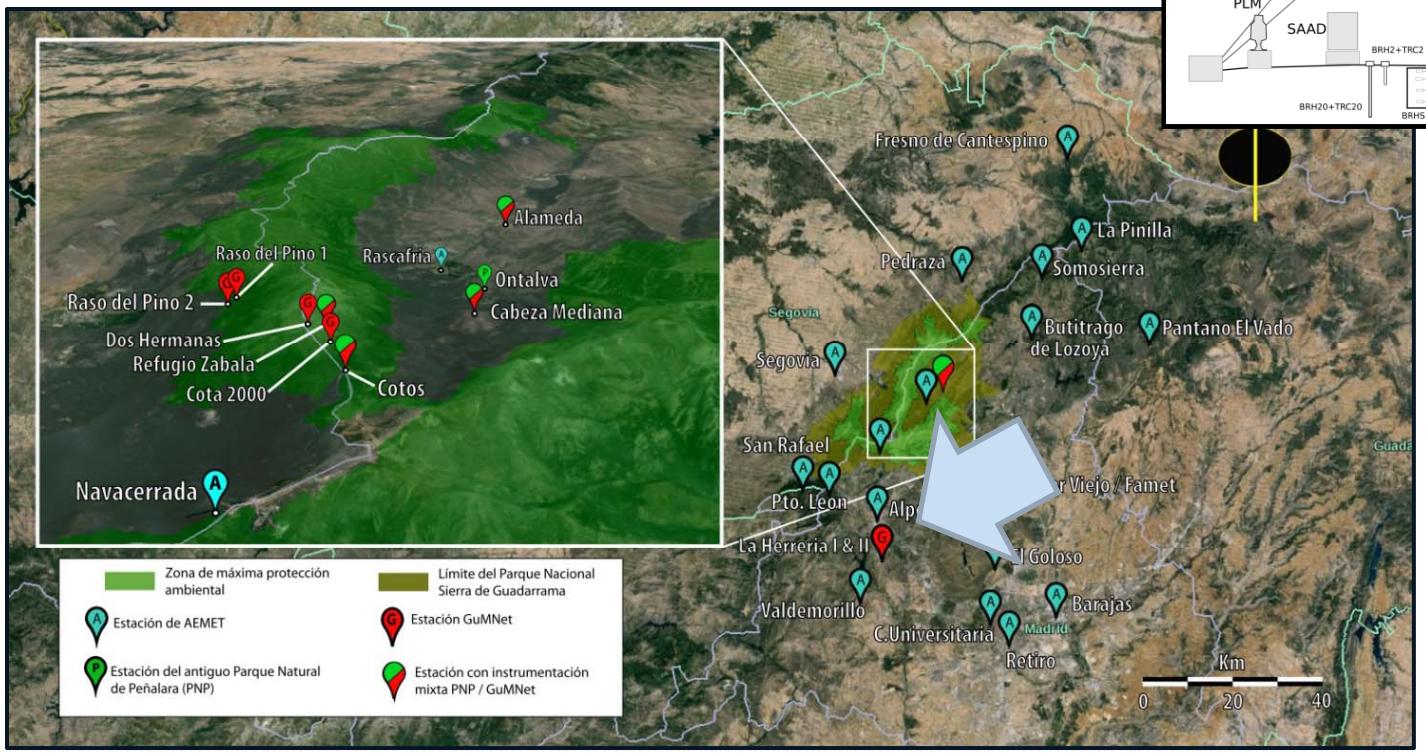
Barlovento Recursos Naturales S.L. (112.590,50 €)

✓ 10 m towered site with wind observations at various highs + CO2 fluxes

✓ A portable 4 m tower (wind & CO2)



Wind & CO2 tower



What is GuMNet?

a glimpse at the facility

➢ Package 4: Communications & Management Software

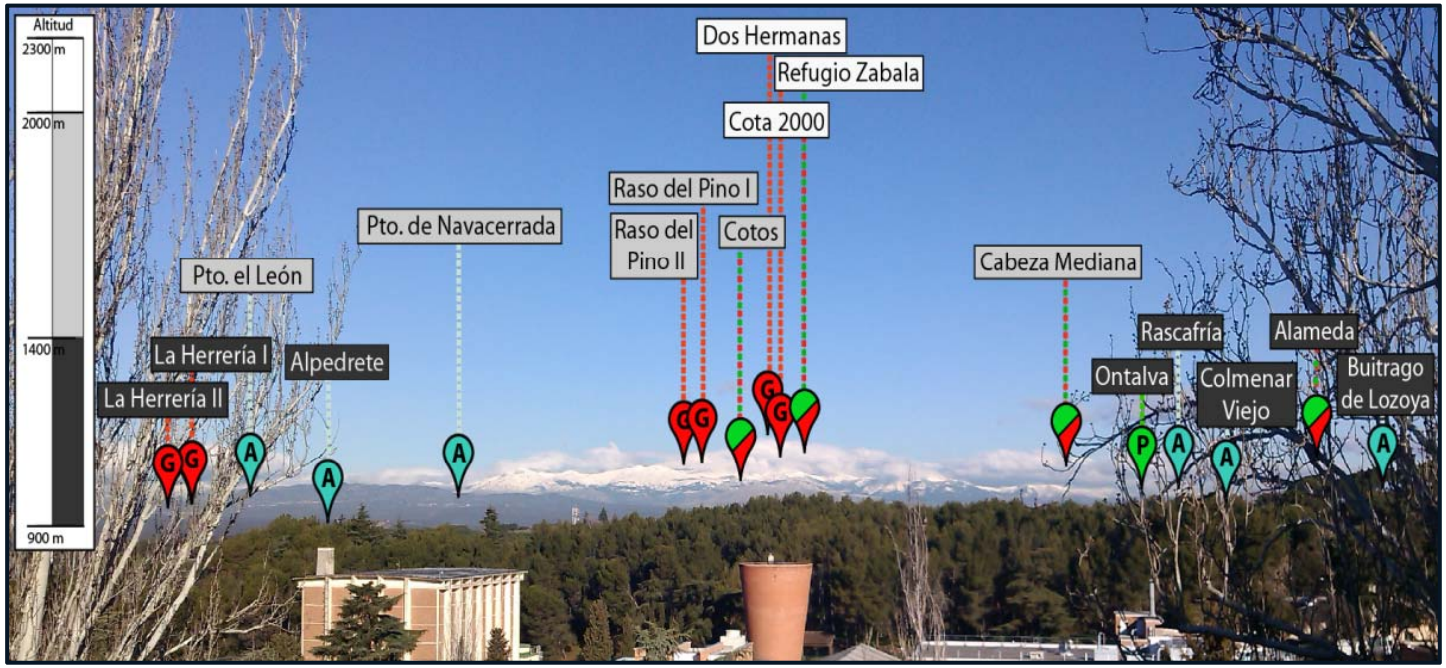
Satel Spain S.L. (42.955,00 €)

✓Site-centric GPRS comm. System

✓Cuasi-real time data access

✓ Management software: data, infrastructure, users/contacts, ticketing, operations…

GuMNet sites as seen from UCM



How do we get there?

Surface & Subsurface WG

Members: Esperanza (UPM), Rosa (Ciemat), Ana T. (UPM), Thomas (Ciemat).

Objectives:

- Optimal description/documentation of each site and surroundings (surface / subsurface).
- Criteria for extraction, organization, analysis and storage of borehole drilling samples.
- Collecting surface samples (edafology).
- Strategy for sampling and future analysis and research activities.

Drilling at **Raso del Pino I** *(Mustang type driller - January'2015)*

How do we get there?

Documentation WG

Members: Jacinto (UCM), Edmundo (UCM), Goyo (UCM), CarlosY.(UCM) y Fidel (UCM) .

Objectives:

- Generate efficient document organization and labeling.
- Generate document formats: standard formats and outlook, homogeneous structure and easy use by GuMNet partners.


Notas de la reunión

Lugar: Fac. CC. Físicas UCM 4ª planta– Seminario 215.0

Fecha de reunión: 23 de junio de 2014

Horario: 9:30 – 13:30

Fecha de publicación de las notas: 3 de julio de 2014

Grupo de Trabajo / tipo de reunión: Segunda Reunión Plenaria GuMNet

Asistentes

Ángeles, Luis A.	UCM-C.Información
Casado, Ana	CEI
Casado, M. Jesús	AEMET
Durán, Luis	InterMET SL
González, Fidel	UCM- Físicas
Granados, Ignacio	CISE – PNSG
Inclán, Rosa	CIEMAT – M.Ambiente
Jiménez, José A.	UCM-C.Información
Luque, Esperanza	UPM-CEIGRAM
Maqueda, Gregorio	UCM- Físicas
Navarro, Jorge	CIEMAT – Energía
Rodríguez, Ernesto	AEMET

Acrónimos:

CEIGRAM	Centro de Estudios e Investigación para la Gestión de Riesgos Agrarios y Medioambientales (UPM).
CEI	Campus de Excelencia Internacional Moncloa.
PNP	Antiguo Parque Natural de Peñalara.
PNSG	Parque Nacional Sierra de Guadarrama.
OAPN	Organismo Autónomo de Parques Nacionales.
GT	Grupo de Trabajo.
CISE	Centro de Investigación, Seguimiento y Evaluación del PNSG.

- DG**00** : Normas generales, estructura documental y modelo documentales
- DG**01** : Politica de datos
- DG**02** : Normas técnicas y científicas
- DG**03** : Infraestructura
- DG**04** : Software
- DG**05** : Proyectos y colaboraciones
- DG**06** : Divulgación
- DG**10** : Administración y seguimiento

Sub-grupo:

- DG03**00** : Documentos generales sobre infraestructura
- DG03**01** : Inventario
- DG03**02** : Mantenimiento
- DG03**03** : Operación


CEI Moncloa. Proyecto GuMNet

J. Fidel González Rouco
Instituto de Geociencias (UCM-CSIC)
Dpto. Astrofísica y CC. de la Atmósfera
Facultad de CC Físicas
Universidad Complutense de Madrid
28040 Madrid

Madrid, 23 de julio de 2014

Asunto: Informe para recepción LOTE 2 GuMNet

D. Fidel González Rouco, Profesor Titular de la Facultad de CC. Físicas de la Universidad Complutense de Madrid e Investigador Principal del Proyecto de Infraestructuras GuMNet

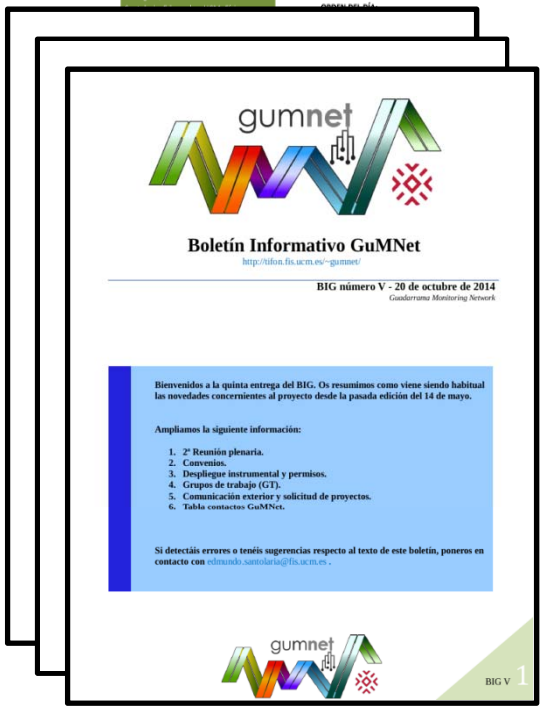
CERTIFICA:

Que el material suministrado por OTT Medio Ambiente Iberia S.L., Expte: 2013/000130-12/14, correspondiente a las siete estaciones meteorológicas del LOTE 2, RED HIDRO-METEOROLOGICA DE ALTA MONTAÑA (SUMINISTRO PARA LA ADQUISICION E INSTALACIÓN DE LA RED METEOROLÓGICA DE GUADARRAMA GUMNET) PARA EL CEI CAMPUS MONCLOA. PROGRAMA CEI 2009) Código CPV: 38127000-1 cumplen con los requisitos técnicos y funcionales requeridos en el pliego de prescripciones técnicas incluyendo los equipos que se detallan a continuación:

Coordenadas: 40°50'36.87"N, 3°54'29.24"O, Altitud: 1682 m

Relación de material:

1 CR3000. Registrador de datos
1 NL115: Adaptador TCP/IP y C.Flash
1 Compact Flash


Boletín Informativo GuMNet

http://tifon.fis.ucm.es/~gumnet/

BIG número V - 20 de octubre de 2014

Guadarrama Monitoring Network

Bienvenidos a la quinta entrega del BIG. Os resumimos como viene siendo habitual las novedades concernientes al proyecto desde la pasada edición del 14 de mayo.

Ampliamos la siguiente información:

1. 2ª Reunión plenaria.
2. Convenios.
3. Despliegue instrumental y permisos.
4. Grupos de trabajo (GT).
5. Comunicación exterior y solicitud de proyectos.
6. Tabla contactos GuMNet.

Si detectáis errores o tenéis sugerencias respecto al texto de este boletín, poneros en contacto con edmundo.santolaria@fis.ucm.es .

BIG V 1

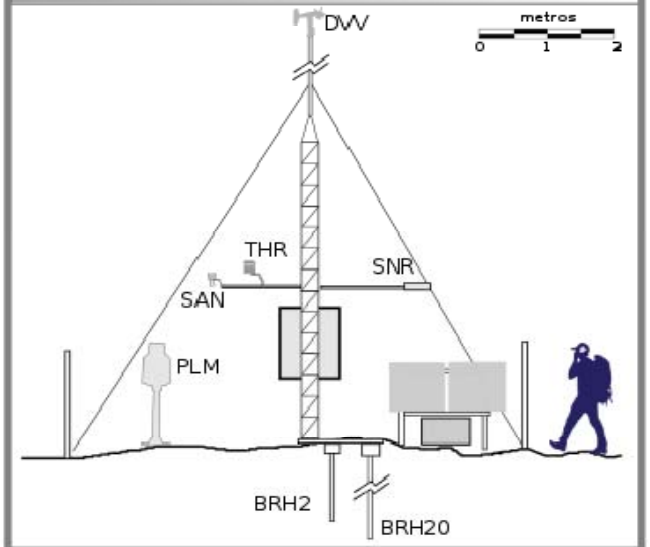
How do we get there?

Documentation WG

FICHA TÉCNICA: ESTACIONES HIDRO-METEOROLÓGICAS GUMNET

EG001-Cabeza Mediana	**Consideraciones:**	Alto grado de protección ambiental	**Fecha emisión:**	24/06/2014
	Coordenadas:	40º 50' 36.87" N 3º 54'29.24" O	**Altitud:**	1682 m.s.n.m.
Acceso:	5 km de pista forestal de acceso altamente restringido desde M-604, dificultad media.			
Instalaciones disponibles:	Vallado, torre, anclajes		**Fechas de instalación:**	Verano - 2014

Croquis



Elementos de medida que integra:

BRH20: T_{suelo} (-1.5, -2, -3, -5, -7.5, -10, -15 y -20 metros).

BRH2: T_{suelo} (0.0, -0.05, -0.1, -0.2, -0.5, -1, -1.5 y -2.0 metros).

SAN: Altura de nieve por ultrasonidos.

SNR: Radiación neta 4 componente.

THR: T_{aire} y humedad relativa del aire.

PLM: Precipitación líquida, sólida y mixta.

DVV: Dirección y velocidad del viento.

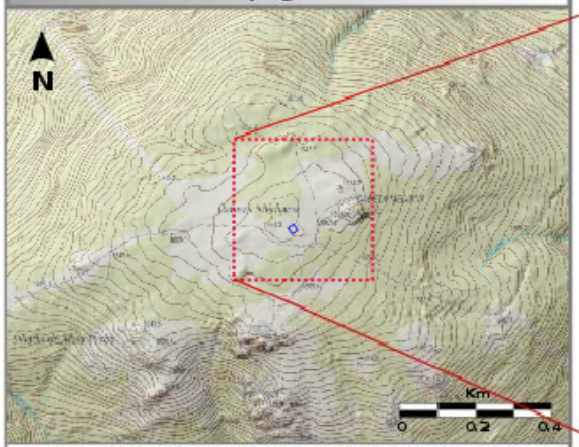
Comentarios

La Estación meteorológica de Cabeza Mediana fue implantada por el Parque de Peñalara en 1999. En la nueva estación hidro-meteorológica no habrá medidas en trinchera debido a la imposibilidad de cabar zanjas en roca granítica.

Vista Este (verano)

Vista Este (invierno)

Topografía:



◇ Localización de Cabeza Mediana

Fotografía Aérea:

◇ Localización de Cabeza Mediana

How do we get there?

Communication & Outreach WG

Miembros: M. Jesús (AEMET), Kiko (OAPN), Jorge (Ciemat), Ana C.(CEI), Ricardo (UCM) y Fidel (UCM)

Objectives:

.

Design and develop strategy of dissemination and outreach documents and activities.

Develop **audiovisual materials** that will provide visibility for GuMNet activities, useful for teaching and dissemination of the monitoring network and related research activities: documentaries, teasers, promotional units...

Instruments

Interviews

Sites

Meetings

How do we get there?

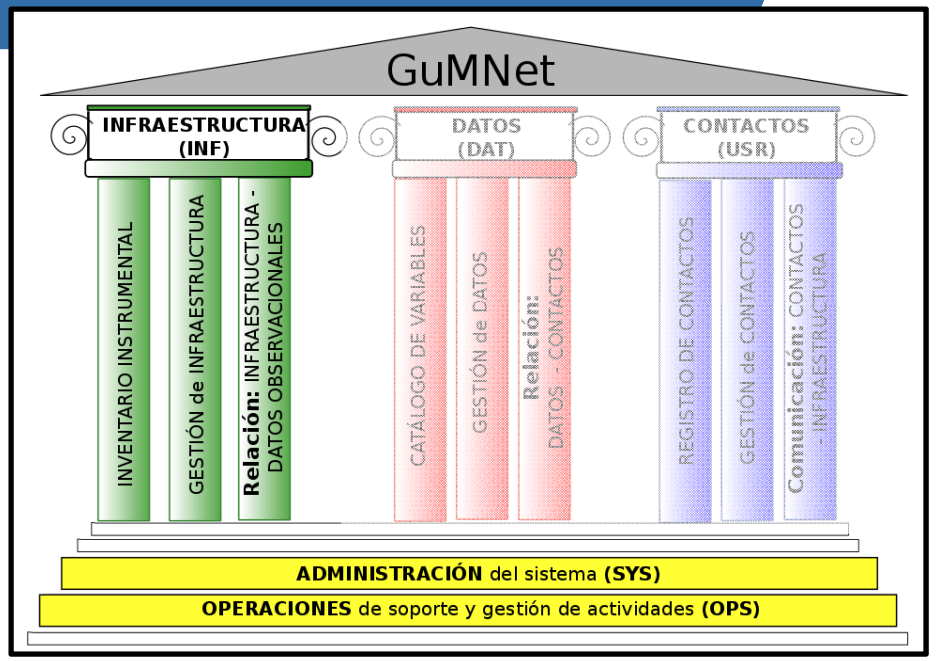
SoftwareWG

Miembros: InterMet (L. Durán, I Rodríguez, A. Montesinos), Jacinto (UCM), Edmundo (UCM) y Fidel (UCM)

Objectives:

- **Coordinate development of a management tool for data, inventory and users/contacts.**
- **This tool should facilitate**

… labeling and tracking of instruments, description of actual state, alarms for callibration, etc



How do we get there?

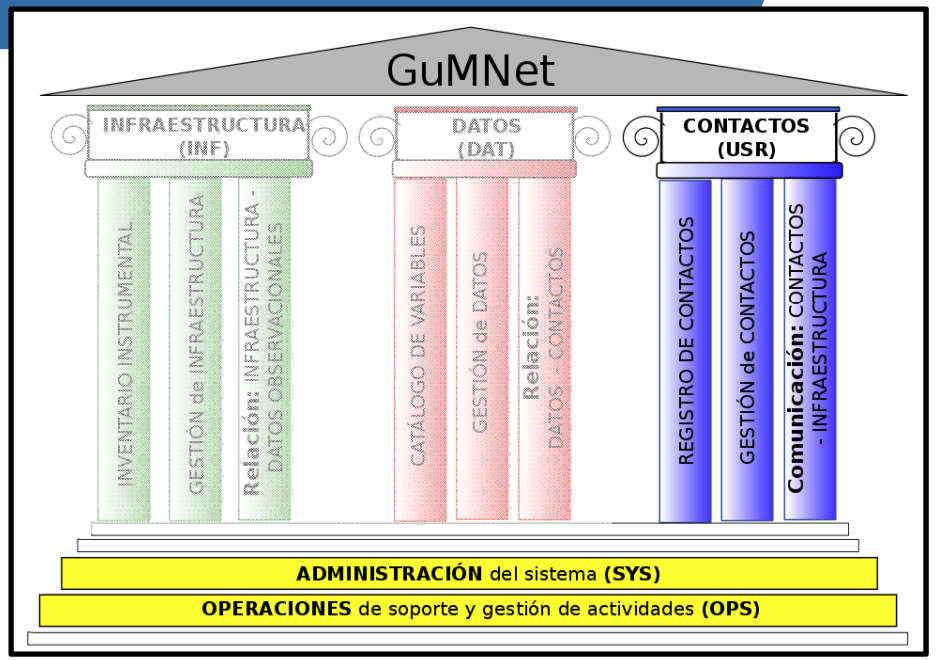
SoftwareWG

Miembros: InterMet (L. Durán, I Rodríguez, A. Montesinos), Jacinto (UCM), Edmundo (UCM) y Fidel (UCM)

Objectives:

- **Coordinate development of a management tool for data, inventory and users/contacts.**
- **This tool should facilitate**

… an inventory of users and contacts (researchers, students, companies, institutions) and their relations to data and materials.



How do we get there?

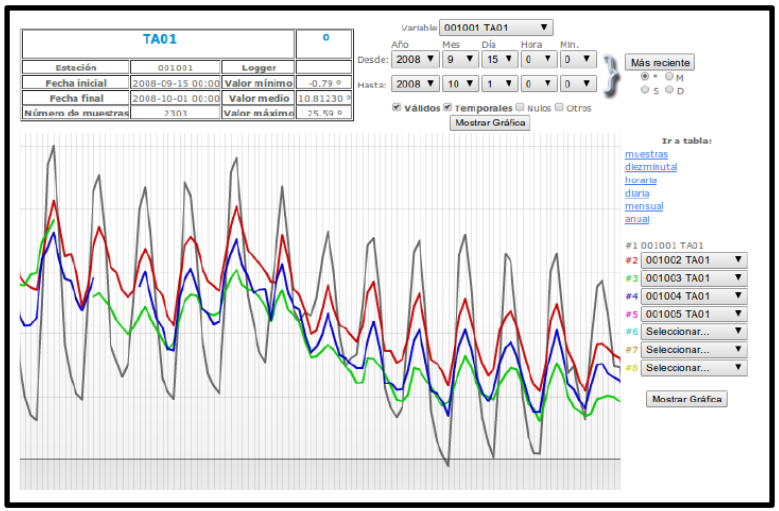
SoftwareWG

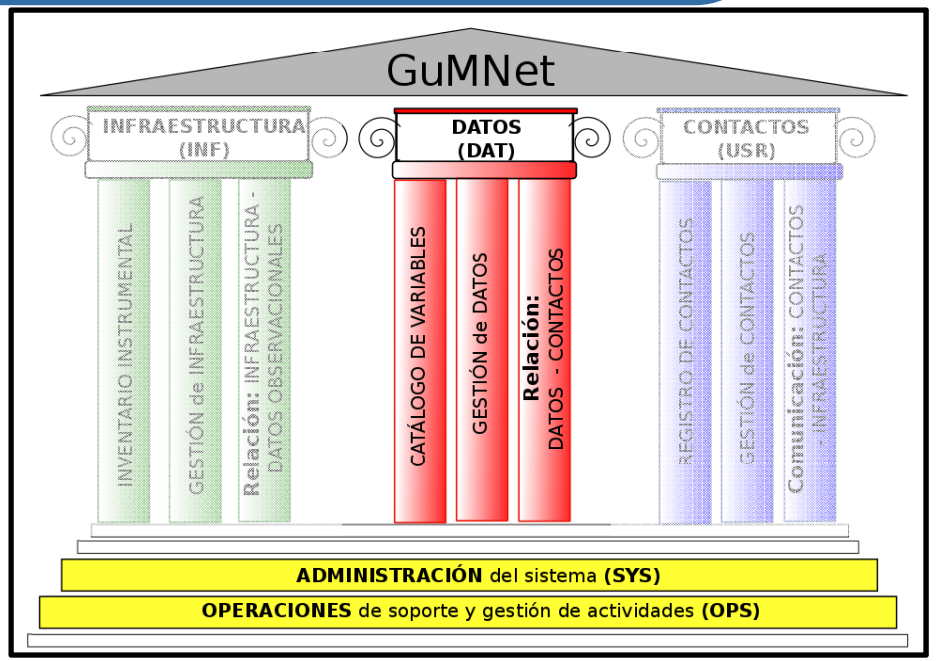
Miembros: InterMet (L. Durán, I Rodríguez, A. Montesinos), Jacinto (UCM), Edmundo (UCM) y Fidel (UCM)

Objectives:

- **Coordinate development of a management tool for data, inventory and users/contacts.**
- **This tool should facilitate**

… a data communication system under GPRS, tools for online Quality control, data visualization and diagnosis, …





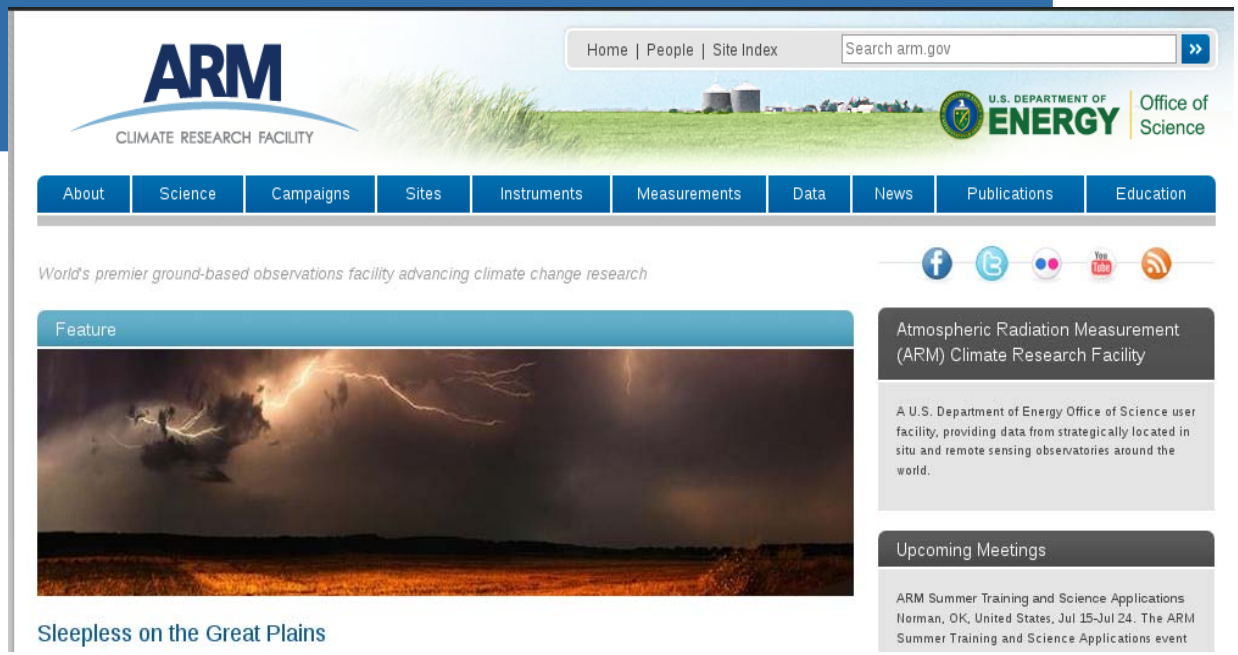
How do we get there?

Network Policies WG

Members: Ernesto (AEMET), Kiko (OAPN), Volker (UCM), Esperanza (UPM), Begoña (Ciemat) y Fidel (UCM).

Objectives:

- ✓ **Data policy directives:**
  - Analyse potential user types
  - Data access types, ownership.
  - Discuss quality processes within GuMNet
  - Handling, storage and management conditions of data
- ✓ **Governability….**



How do we get there?

Management Unit

Members: Edmundo (UCM), Jacinto (UCM) y Fidel (UCM).

Objectives:

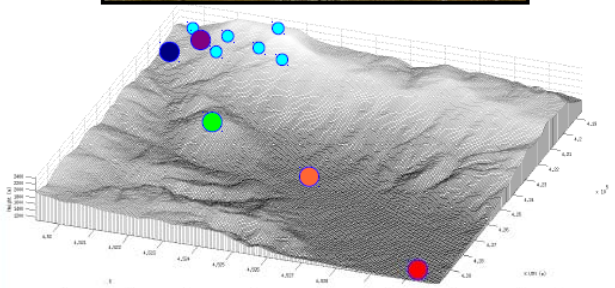
- ✓ **Coordination of WGs**
- ✓ **Coordination of maintenance issues and planning**
- ✓ **Development of instrumentation deployment**
- ✓ **Coordination of field activities (agenda) with companies**
- ✓ **Search for funding: national & EU projects**
- ✓ **Inter-nacionalization (links to international networks and institutions): EURAC, MRI, ARM, ICOS, IHFC…**
- ✓ **Intra-nacionalization (links to national networks and institutions): Red Seguimiento Cambio Global…**
- ✓ **Other…**

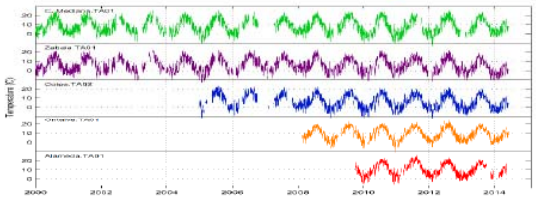
PNSG @ Science

Hydrology

OBSERVACIÓN

- Red Meteorológica del Parque Natural de Peñalara

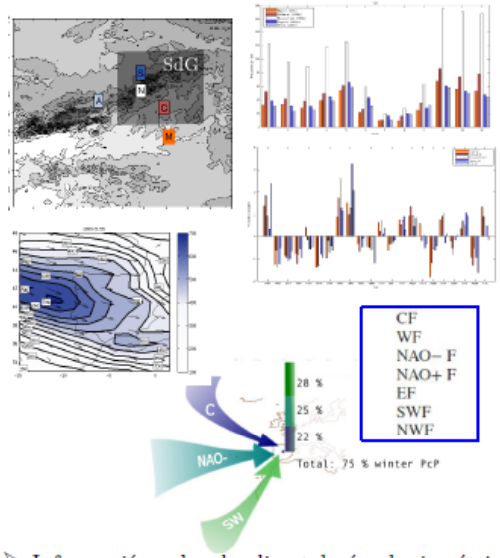




- Base de datos con 14 años de observaciones meteorológicas
- Experiencia en observación meteorológica en montaña

ANÁLISIS

- Análisis estadístico de las estaciones AeMet en SdG
- Análisis del forzamiento sinóptico

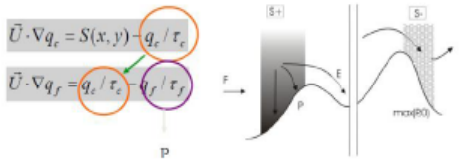


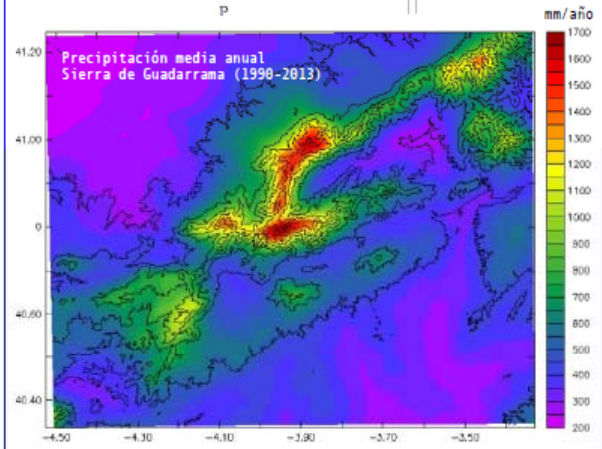
- Información sobre la climatología pluviométrica de la Sierra de Guadarrama
- Conexión entre el forzamiento sinóptico
- Importancia de los flujos de humedad y la fenomenología pluviométrica
- Importancia de la precipitación de origen orográfico

MODELIZACIÓN

- Modelización física de la precipitación en la SdG mediante modelo de precipitación orográfica
- Análisis de la importancia de la precipitación de origen orográfico

Smith and Barstad (2004)





- Base de precipitación en malla de la Sierra de Guadarrama con 200 m de resolución para el periodo 1990-2013

TESIS DOCTORAL: Evaluación integral de la precipitación en la Sierra de Guadarrama mediante observación y modelización

23 Octubre 2015

Luis Durán Montejano

Facultad de CC. Físicas. Departamento de Geofísica y Meteorología
Universidad Complutense de Madrid

Dirigida por: Dr. Enrique Sánchez Sánchez (UCLM)
Dr. Carlos Yagüe Anguis (UCM)

PNSG @ Science

NDVI statistical distribution of pasture areas

J. J. Martín-Sotoca, A. M. Tarquis, A. Saa-Requejo and C. H. Díaz-Ambrona

"Biomass indexes" based on satellite images such as Normalized Difference Vegetative Index (NDVI) have been used in countries like USA, Canada and Spain for drought-damaged pasture and forage insurance for the last years (Rao, 2010). This type of agricultural insurance is named as "index-based insurance" (IBI).
An IBI, "when drought occurs" is defined through NDVI thresholds mainly based on statistical parameters (normal distributions). In this work a pasture area at the north of Community of Madrid (Spain) has been delimited by means of MODIS images. A statistical analysis of the NDVI histograms was applied to search for the best statistical distribution (maximum likelihood method). The results show that the normal distribution is not the optimal representation (Martín-Sotoca, 2014).

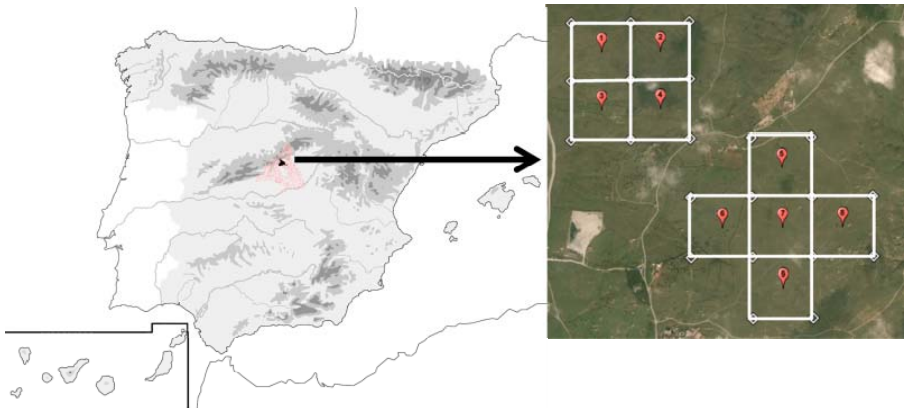


Figure . The study area is in the center of the Iberian peninsula (Community of Madrid). RGB image of 9 pixels area used for case study is shown (Google Earth´s image)

GEV and Gumbel PDFs fit better in a large amount of intervals. We show intervals 4, 9, 17 and 21 as examples of better Gumbel/GEV fit (figure 4).

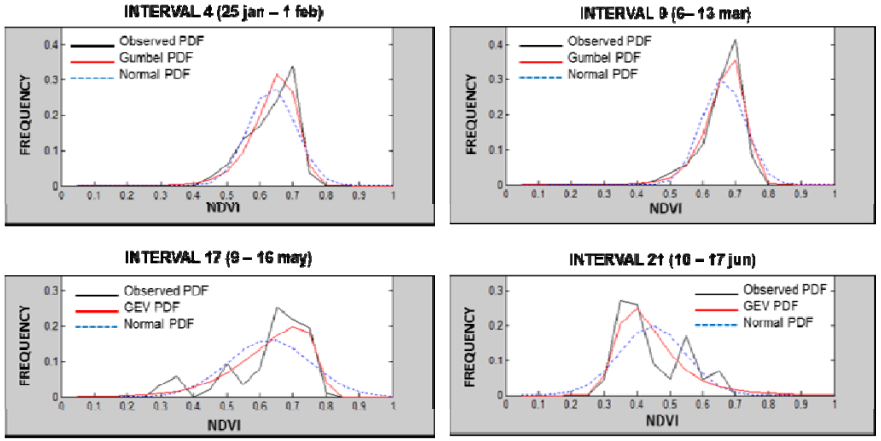


Figure. Observed-GEV/Gumbel-Normal PDFs comparison.

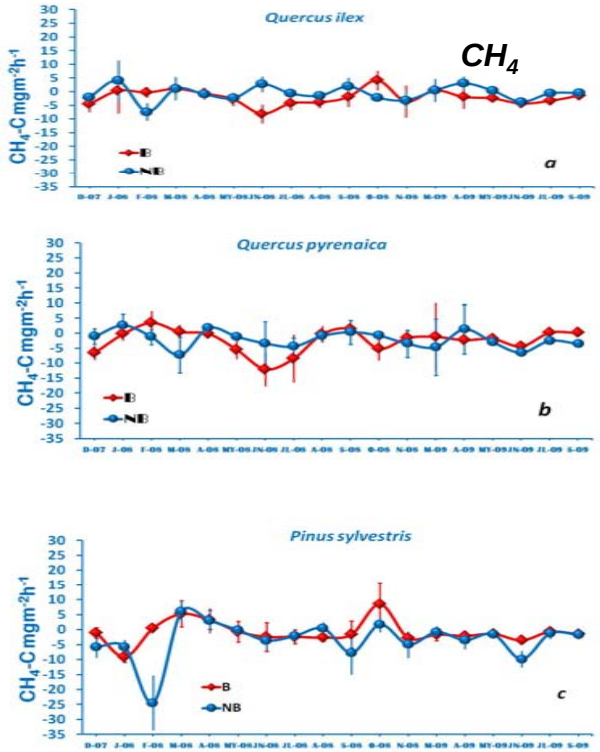
PNSG @ Science

CH_4 and N_2O fluxes in undisturbed and burned forests in Madrid

R Inclán, C Uribe, L Sánchez, D. M. Sánchez, Á Clavero, A M Fernández, R Morante, A Blanco, R Jandl

Undisturbed and burned *Quercus ilex*, *Quercus pyrenaica* and *Pinus sylvestris* forests

- **N_2O and CH_4 seasonal variation were mainly related to soil water availability.**
- **The impact of fire on the fluxes of N_2O and CH_4 differed from one ecosystem to another, and from one season to another. The burned sites showed higher CH_4 oxidation in *Quercus ilex* stands, and lower oxidation rates in *Pinus sylvestris* stands. Fire decreases N_2O fluxes in *Quercus pyrenaica* stands.**



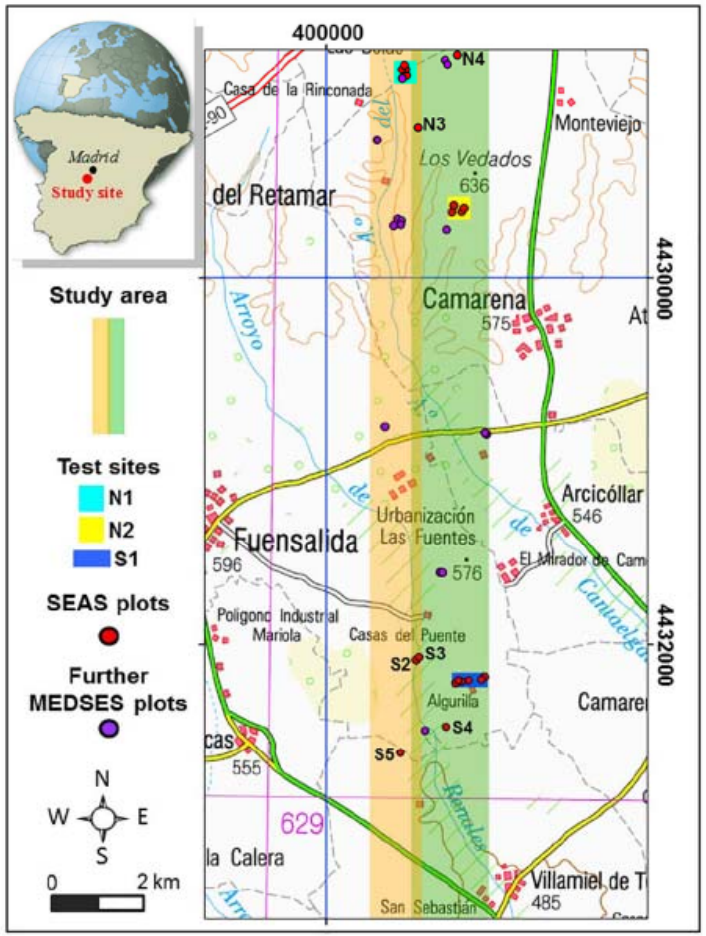
Soil CH_4 flux varied over the measurement period. CH_4 uptake was highest in dry months (JN, JL) and F 2008. A net source of CH_4 was found during wet months. PS and QP stands were found to absorb more CH_4 than QI stands.

IEEE JOURNAL OF SELECTED TOPICS IN APPLIED EARTH OBSERVATIONS AND REMOTE SENSING

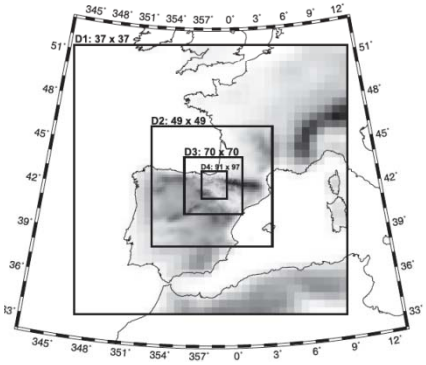
Characterization of Soil Erosion Indicators Using Hyperspectral Data From a Mediterranean Rainfed Cultivated Region

Thomas Schmid, *Member, IEEE*, Manuel Rodríguez-Rastrero, Paula Escribano, Alicia Palacios-Orueta, Eyal Ben-Dor, Antonio Plaza, *Fellow, IEEE*, Robert Milewski, Margarita Huesca, Ashley Bracken, Víctor Cicuéndez, Marta Pelayo, and Sabine Chabrillat

This study includes:
1) field and laboratory characterization of the main soil types in the study area;
2) Identification and definition of indicators of soil erosion and accumulation stages (SEAS);
3) compilation of the site-specific MEDiterranean Soil Erosion Stages (MEDSES) spectral library of soil surface characteristics using field spectroscopy;
4) using hyperspectral airborne data to determine a set of endmembers for different SEAS and introducing these into the support vector machine (SVM) classifier to obtain their spatial distribution; and
5) evaluation of the accuracy of the classification applying a field validation protocol.

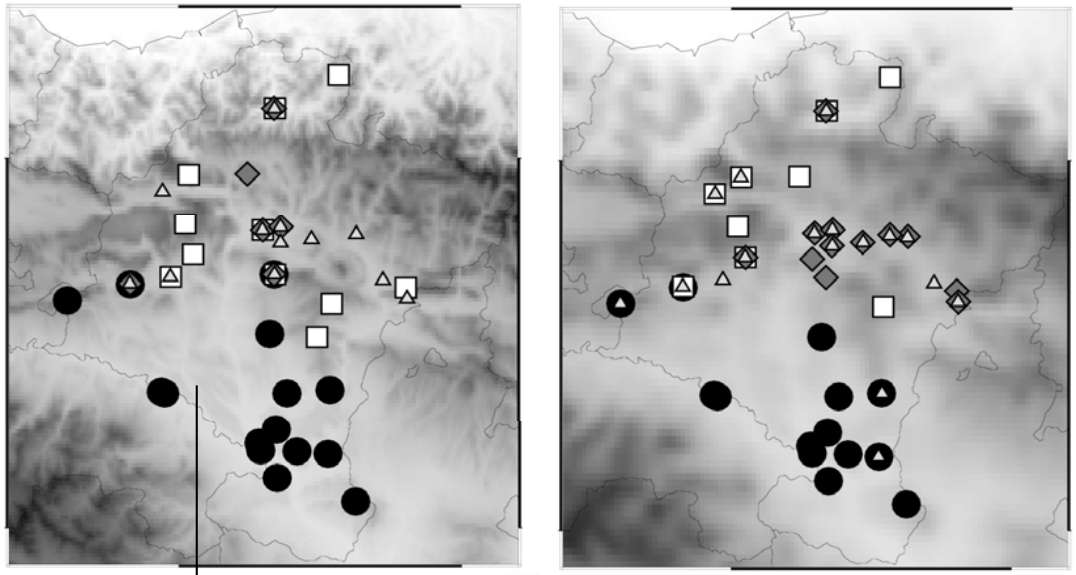


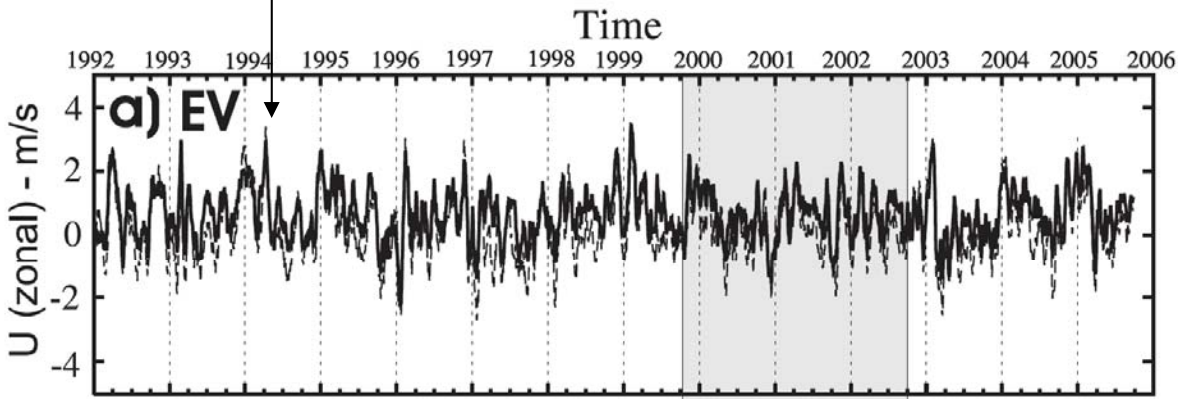
Camarena study region with two hyperspectral flight lines acquired during the 2011 EUFAR campaign



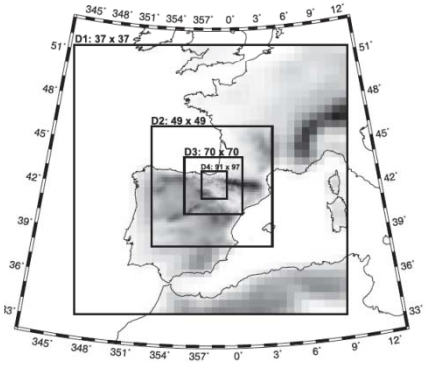
Observations

Simulation

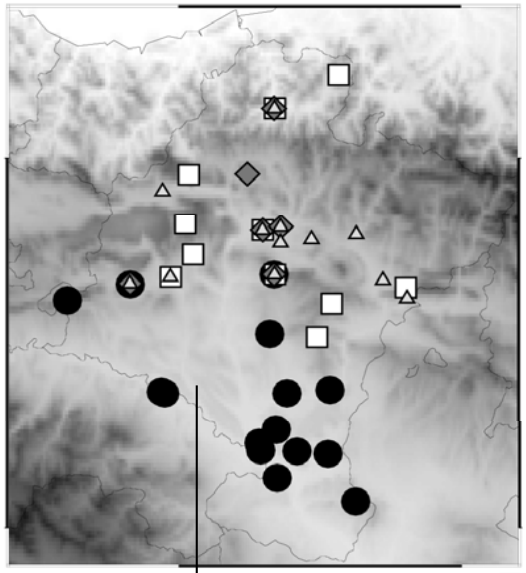




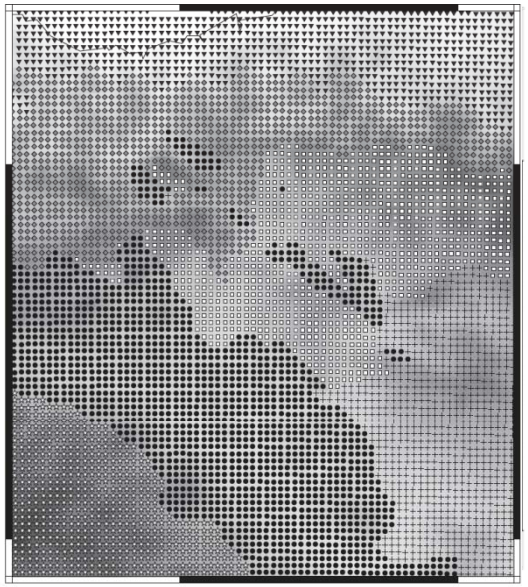
Jiménez *et al.*, 2008, 2009, 2010

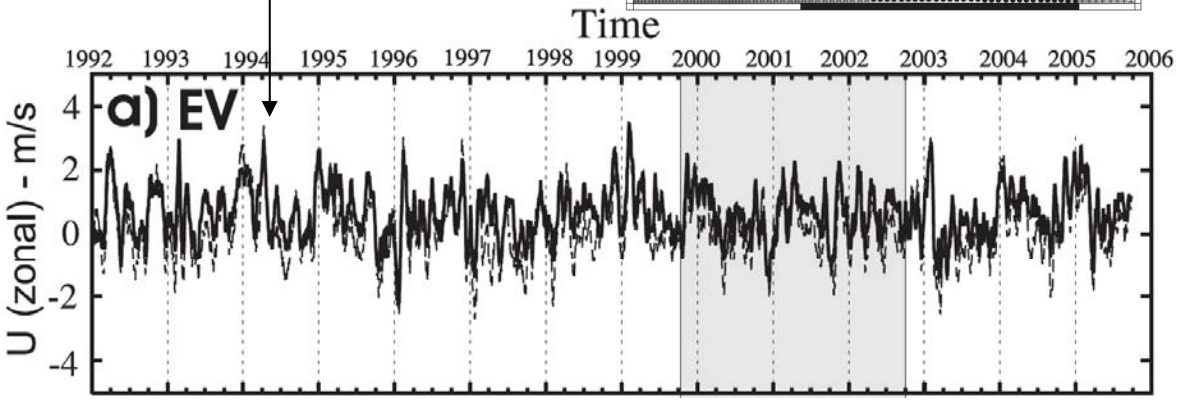


Observations



Simulation



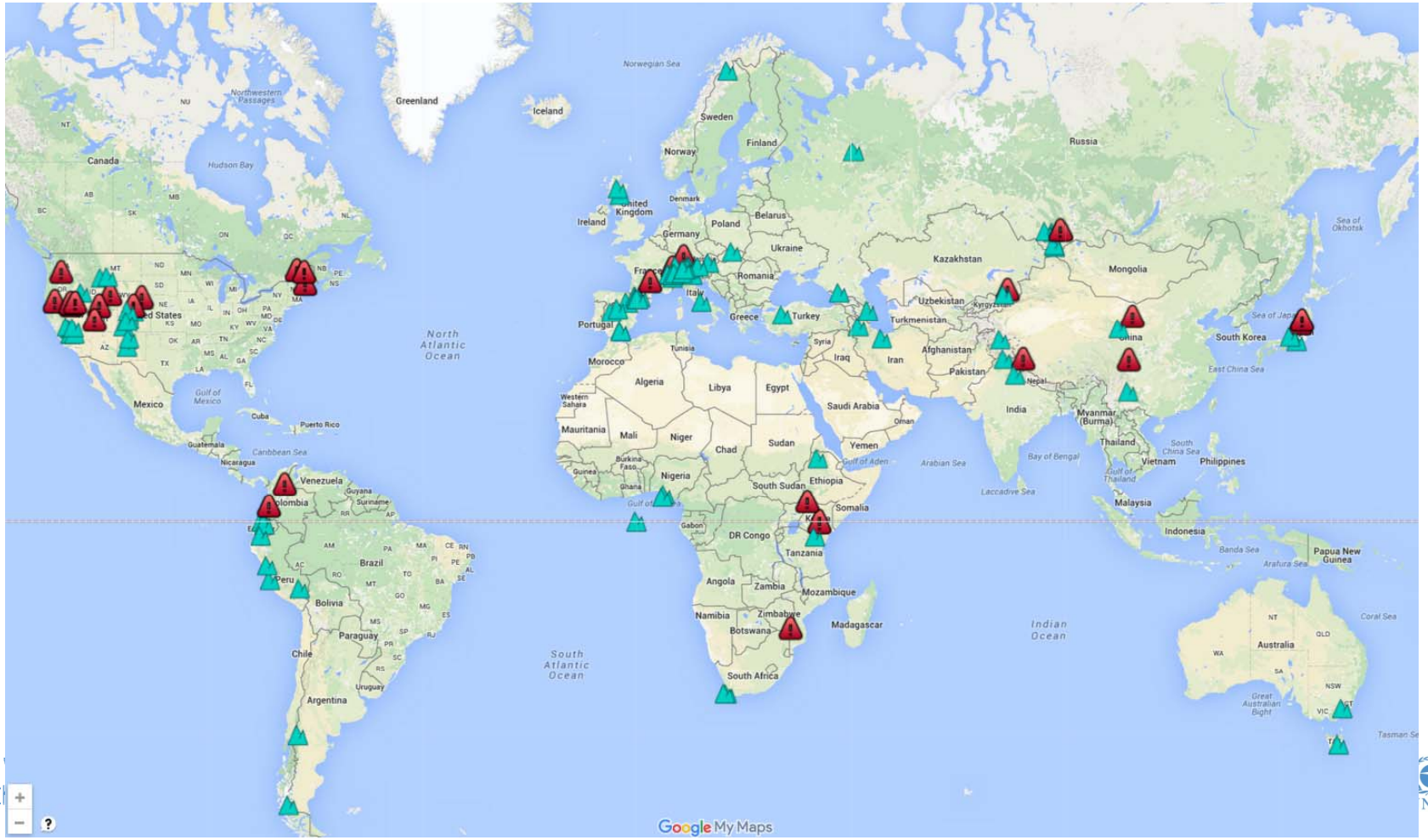


Jiménez *et al.*, 2008, 2009, 2010

How do we get there?

Intra- Inter-nacionalization

The Mountain Research Initiative
Advancing Global Change Research in Mountains



IPCC AR5
Climate Ch

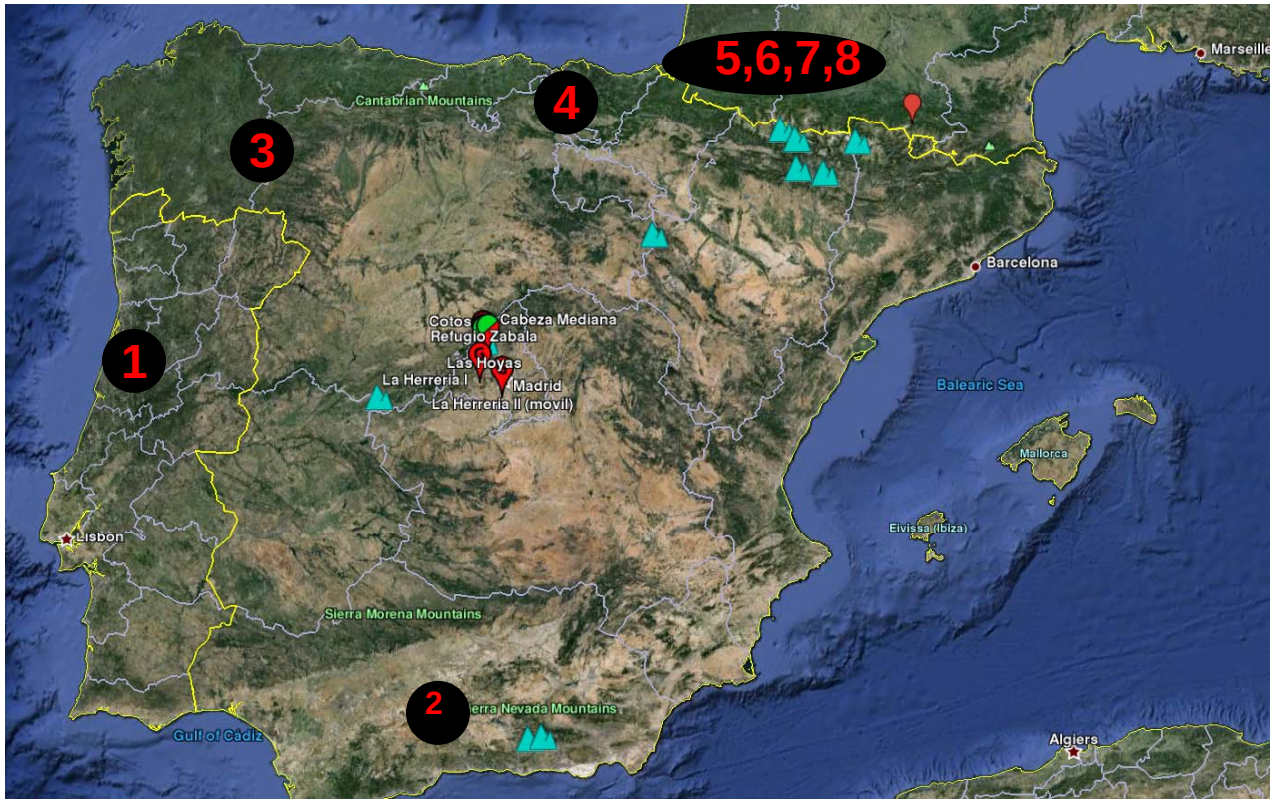
NEP

How do we get there?

Intra- Inter-nacionalization

The Mountain Research Initiative
Advancing Global Change Research in Mountains

Conjunto de observatorios de alta montaña, proyectos de monitorización y bases de datos observacionales en España registrados en el censo del MRI



1) Sierra de gredos

2) Sierra Nevada LTER site

3) GuMNet (Guadarrama Monitoring Network)

4) Gloria ES-MON (Moncayo)

5) GLORIA ES-CPY (Parque Nacional de Ordesa y Monte Perdido)

6) Pyrinees Climate Change Observatory (OPCC)

7) LOOP – Limnological Observatory of the Pyrenees

8) GLORIA ES-SPY (Valle de Tena y Robiñera)

In brief...

A high mountain observatory

What is GuMNet? *an atmosphere-subsurface monitoring network*

Our vision: *a high mountain observatory*

How do we get there? *a two sided infrastructure*

El mes era de março, día de Sant Meder
pasada de Loçoya fuy camino prender
de nieve e de graniso no'm pudía defender
≪quien busca lo que non pierde,
lo que tíen' deve perder≫.

Arcipreste de Hita Libro de Buen Amor

Gracias