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CopPhil Day 1 Session 1: Copernicus Sentinel Data Deep Dive & Philippine EO Ecosystem – Speaker Script

Slide 1: Session Introduction – "Copernicus Sentinel Data Deep Dive & the Philippine EO Ecosystem" *(Time: ~5 min)*
Speaker Notes:
Hello everyone! Welcome to Session 1 of our 4-day advanced training. I'm excited to kick off this session, titled **"Copernicus Sentinel Data Deep Dive & the Philippine EO Ecosystem."** In the next two hours, we'll set a strong foundation for our course. We'll explore the **Copernicus programme** and its **Sentinel satellite data**, and then connect that with the **Philippine Earth Observation (EO) ecosystem** – basically, the key agencies, platforms, and resources here in the Philippines that support the use of satellite data. I want this to be **interactive and friendly**, so please feel free to **ask questions** or share your experiences anytime – either by raising your hand or typing in the chat if you're joining online. Our audience today is EO professionals like you, with intermediate experience, so I know many of you already have some background – but I hope everyone will learn something new and useful.

Just to give context: this training is part of the **Copernicus Capacity Support Programme for the Philippines (CopPhil)**, an EU-funded partnership that supports PhilSA, DOST, and other partners to improve the use of EO data for **disaster risk reduction (DRR)**, **climate change adaptation (CCA)**, and **natural resource management (NRM)** [1]. So, the skills and knowledge we cover here are meant to help you tackle real-world challenges in those areas. By the end of this session, you'll have a deeper understanding of **Sentinel-1 and Sentinel-2 data characteristics**, know what **products and tools** are available, and see how they can be applied in the Philippine context. We'll also introduce you to the **local EO landscape** – the agencies and programs that you can tap into – and show you where to find **data and training materials** through CopPhil's resources.

(Transition:) Let's start with an outline of what we'll cover, and then dive right into the Copernicus program basics.

Slide 2: Session Objectives & Outline *(Time: ~3 min)*
Speaker Notes:
On this slide, I've listed the **objectives and main topics** for this session:

- **Copernicus Program Overview:** We'll begin with the basics of the EU's Copernicus Earth observation program – what it is, why it exists, and how it makes data freely available.
- **Sentinel-1 & Sentinel-2 Deep Dive:** We'll focus on these two satellite missions. We'll discuss their **sensor types** (radar vs optical), **spatial resolutions** (for example, 10 m, 20 m, 60 m for Sentinel-2; and up to 5 m × 20 m for Sentinel-1's standard mode), **spectral bands** (for Sentinel-2), and **temporal revisit** frequencies (like Sentinel-2's ~5 days with two satellites, Sentinel-1's 6–12 days with its constellation). We'll also explain the standard **data product levels** – for instance, Sentinel-2 Level-1C

vs Level-2A, and Sentinel-1's GRD product. Plus, I'll show ways to **access** these data, including the Copernicus hubs and Google Earth Engine.

- **Use Cases (DRR, CCA, NRM):** Next, we'll look at **practical examples** of how Sentinel-1 and 2 are used in the Philippines for disaster management, climate adaptation, and resource management. This will make the data characteristics more concrete – you'll see them in action for floods, droughts, land cover mapping, etc.
- **Philippine EO Ecosystem:** Then, we shift to our local context – introducing the **key agencies**: the Philippine Space Agency (PhilSA), NAMRIA, DOST-ASTI, PAGASA, etc., along with their platforms like the Space Data Dashboard, the Geoportal, and projects like DATOS, SkAI-Pinas, DIMER, AIPI. We'll discuss how these institutions and tools support your work and how local datasets (like NAMRIA land cover maps or PAGASA weather data) can **complement Sentinel data**.
- **CopPhil Mirror Site & Digital Space Campus:** Finally, as a short activity, I'll give you a **walkthrough** of two important resources: the **CopPhil Mirror Site**, which is a local repository of Copernicus data (so you can get Sentinel data faster, from a server here in the Philippines), and the **CopPhil Digital Space Campus**, which is an online platform where all our training materials, data, and notebooks are available for you. This will help you access everything during and after the training.

Throughout, I'll include some **engagement**: I might ask questions or encourage you to share experiences (e.g. if you've used these data or tools before). So do participate – it will make the session more lively and relevant for everyone. Alright, if that sounds good, let's jump into the Copernicus program overview.

Slide 3: Copernicus Program Overview *(Time: ~5 min)*
Speaker Notes:
First, what is **Copernicus**? Simply put, Copernicus is the **Earth Observation (EO) component of the European Union's Space Programme**, run by the European Commission in partnership with ESA and other agencies [2]. It's an ambitious program aimed at providing continuous, high-quality information about our planet – to **benefit the environment, manage climate change, and ensure civil security** [3]. One of the most remarkable things about Copernicus is that **all the data and products are free and open to everyone** [4]. This is a huge deal – it means *you* and I, and our institutions, can access satellite imagery and derived information **at no cost** and use it for our projects. *(Encourage interaction:)* Quick show of hands (or a quick yes in the chat) – how many of you have *already* used Copernicus data like Sentinel images in your work? (Pause for responses.) Great, I see some of you have! And if you haven't, no worries – by the end of today, you'll know exactly how to get started.

Now, Copernicus isn't just one satellite – it's a *whole program*. It has a **space component** made of a series of dedicated satellites called the **Sentinels**, plus some contributions from other satellites. It also includes **in-situ data** (like ground sensor networks) and **six thematic services** (for atmosphere, marine, land, climate, emergency, and security) that provide ready information like maps and forecasts [5]. But in this session, we're mainly focusing on the **space component**, specifically the Sentinel satellites that produce the images and data we'll use in AI/ML applications.

(Transition:) Let's get an overview of the **Sentinel missions**. There are several families of Sentinel satellites – each designed for different purposes. We'll highlight the ones relevant to us (Sentinel-1 and 2) and briefly note the others so you know what's out there.

Slide 4: Sentinel Satellite Constellation *(Time: ~5 min)*
Speaker Notes:

This slide shows the **Sentinel satellite family**. The Copernicus program currently has **six Sentinel mission lines** (and more planned), each numbered 1 through 6, and typically each mission has multiple identical satellites (usually at least two) flying in constellation. Here's a quick rundown:

- **Sentinel-1** – a pair of **radar imaging** satellites (1A launched 2014, 1B in 2016). Sentinel-1 provides **Synthetic Aperture Radar (SAR)** images. We'll dive deeper on the next slide, but note that SAR means it works in **microwave wavelengths**, so it can **see through clouds and at night**. Sentinel-1 data is great for monitoring floods, land movements, etc. Originally two satellites gave a 6-day revisit; right now, with Sentinel-1B out of service, there's about a 12-day gap, but Sentinel-1C was launched in late 2024 to restore the constellation.
- **Sentinel-2** – a pair of **multispectral optical** satellites (2A launched 2015, 2B in 2017, and more coming). These are like high-resolution cameras capturing **13 spectral bands** (from visible blue, green, red to near-infrared and shortwave infrared). They provide beautiful **true-color images** and rich spectral information for land monitoring. With two satellites, Sentinel-2 can revisit every ~5 days at the equator (and even more frequently in mid-latitudes).
- **Sentinel-3** – this mission has instruments for **land and ocean monitoring** (measuring sea surface temperature, ocean color, land vegetation state, etc.). It's less about high-res imagery and more about environmental measurements at moderate resolution (300 m to 1 km). We won't cover it in detail today, but it's good to know it exists (especially for marine and climate applications).
- **Sentinel-4 and 5** – these are focused on **atmospheric monitoring** (things like air quality, trace gases). Sentinel-5P (Precursor) is already up, measuring things like pollution (e.g., nitrogen dioxide levels). These are more specialized and not our focus here.
- **Sentinel-6** – also known as Jason-CS, for **ocean altimetry** (precise sea level measurements). Again, very important for climate but not directly used in our land-focused AI exercises.

(Engage with audience:) That's a lot of satellites! But don't worry – for this training we'll mainly work with **Sentinel-1 and Sentinel-2** data. By focusing on these two, we cover the two most commonly used types of EO data: **radar** and **optical imagery**. Does anyone have any questions about the overall Sentinel fleet? (Pause briefly and address any general questions.) If not, let's zoom in on Sentinel-1 first.

Slide 5: Sentinel-1 (SAR) – Key Characteristics *(Time: ~10 min)*
Speaker Notes:
Sentinel-1 is our **radar eye in the sky**. Here are its key characteristics and why it's so powerful:

- **Sensor Type:** Sentinel-1 carries a C-band **Synthetic Aperture Radar (SAR)** instrument. Unlike a camera that relies on sunlight, SAR is **active** – it sends microwave pulses to the Earth and measures the signals that bounce back. This means Sentinel-1 can **operate day or night and see through clouds** and rain. In a tropical country like the Philippines, where cloud cover is a constant challenge, this capability is a game changer, especially for disaster monitoring during storms. *(Reiterate with an example:)* Think of a typhoon – it's dark, cloudy, power is out on the ground, but Sentinel-1 flying overhead can still map which areas are flooded because its radar penetrates the clouds. We'll see an example of this in a few minutes.

- **Spatial Resolution:** Sentinel-1 images are high resolution. In its common **Interferometric Wide Swath (IW)** mode used for land, the resolution is about **5 m by 20 m on the ground**. To simplify, you can think roughly on the order of ~10 m detail. This is good enough to detect features like large buildings, roads, or floodwaters in fields. The imagery is in **grayscale** (because it's one radar frequency, not true color), and typically we get two **polarizations** (VV and VH for land mode). Those are like two channels that can help distinguish surfaces; for instance, VH is cross-polarized and often more sensitive to vegetation structure, whereas VV might show water surfaces differently.

- **Revisit Frequency:** With two satellites (1A and 1B historically), Sentinel-1 could visit the same spot every **6 days** (sometimes even more frequently at higher latitudes). Currently, as I mentioned, it's effectively ~12 days for many areas with just 1A in operation, but **Sentinel-1C** is expected to join and bring the revisit back to 6 days soon. Every time it passes, it can cover a 250 km wide swath in IW mode, so it images large areas systematically.

- **Data Products:** The standard product we use from Sentinel-1 is called **GRD (Ground Range Detected)**. This is essentially a processed radar image (intensity values per pixel, georeferenced on the ground). GRD images have been multilooked and projected, so they're easy to use in a GIS or analysis – for example, each pixel's value relates to radar backscatter (bright means a strong return, like buildings or rough surfaces; dark means low return, like open water which is usually smooth). There's also an SLC (Single Look Complex) product which includes the phase information and is used for advanced applications like interferometry (measuring ground motion). But SLCs are heavier and more complex to handle, so for most general purposes (like flood mapping, or feeding into AI models), **GRD is what we use**. In this training, when we work on floods, we'll be using GRD images.

- **Uses and Examples:** Sentinel-1 is incredibly useful for **Disaster Risk Reduction (DRR)**. Flood mapping is a prime example – radar can detect water extent even when clouds from a storm obscure the area. It's also used for **landslide and earthquake monitoring** (through interferometry to detect ground movement), **volcanic deformation** (seeing the bulge of a volcano lifting or subsiding), and even for **ship detection and oil spill monitoring** at sea (metal ships and oil films on water show distinct radar signals). In agriculture, SAR can monitor rice fields (the rice mapping folks in the Philippines use Sentinel-1 to distinguish planted paddies, since the signal changes as rice grows). So it's a versatile tool.

(Interactive prompt:) Quick question – **has anyone here tried working with Sentinel-1 SAR data before?** Maybe using SNAP, Google Earth Engine, or any platform? What was your experience? (Give time for 1–2 responses if possible. If someone mentions the difficulty with noise or processing, acknowledge it.) Yes, SAR images can be a bit tricky at first – they have that speckled noise and not the familiar colors. But once you get the hang of it, they reveal information you just can't get from optical data during bad weather. And of course, part of why we're here is to learn techniques (even AI techniques) that handle these images and extract useful info.

Alright, if there are no further questions on Sentinel-1, let's move to its counterpart, **Sentinel-2**.

Slide 6: Sentinel-2 (Optical) – Key Characteristics *(Time: ~10 min)*
Speaker Notes:
Now on to **Sentinel-2**, which is like the **digital camera** (actually a very advanced multispectral scanner) in orbit. Key points for Sentinel-2:

- **Sensor Type & Bands:** Sentinel-2 is an **optical sensor** – it observes reflected sunlight in a **wide range of wavelengths**. It has **13 spectral bands**. For those familiar, it includes the visible bands (Blue, Green, Red – which are at 10 m resolution), four "red-edge" and near-infrared bands (some at

10 m, some at 20 m resolution), and shortwave infrared bands (at 20 m), plus a couple of atmospheric correction bands at 60 m (used for things like cirrus detection). The mix of bands allows us to compute indices like NDVI (Normalized Difference Vegetation Index for vegetation health), NDWI (water index), etc., and to distinguish different land cover types (for example, healthy vegetation reflects strongly in near-IR, water absorbs it and looks dark, urban areas have their spectral signatures, and so on).

- **Spatial Resolution:** As I noted, **Sentinel-2 has multiple resolutions**: the best is **10 m** for key bands (which is pretty high detail – you can see individual large buildings, field boundaries, etc. in true color). Some bands are 20 m, and a few are 60 m (those are mainly for atmospheric correction and we usually don't use them for mapping). This tiered resolution setup is to manage data volume while still providing high-detail information where it counts. A single Sentinel-2 image tile covers a 100 km × 100 km area (that's a **huge** area considering the detail of 10 m pixels!). The Philippines is covered by dozens of these tiles.

- **Revisit Frequency:** With two satellites (2A and 2B) working together, Sentinel-2 can get an image of the same area every **5 days** (at the equator) under ideal conditions. At higher latitudes you get more overlap and more frequent coverage. Five days is excellent for monitoring changes, but remember it requires clear skies. The **big limitation** with any optical sensor like Sentinel-2 is **cloud cover**. In practice, especially in the rainy season, you might not get a useable clear image every 5 days because many of them will be cloudy. This is exactly why pairing it with Sentinel-1 (SAR) is so powerful – one sees what the other can't. We often use Sentinel-2 for what we call "clear weather" tasks and Sentinel-1 for "all-weather" tasks, depending on needs.

- **Data Products (Levels):** The primary products for Sentinel-2 come in two levels: **Level-1C** and **Level-2A**. **Level-1C** is the top-of-atmosphere reflectance (the raw imagery calibrated, but still with atmospheric effects like haze). Level-1C is tiled in those 100 km grid squares and is the format you often download from the archive. **Level-2A** is the bottom-of-atmosphere or **surface reflectance** product – essentially the result after doing atmospheric correction (removing effects of the atmosphere to estimate the true surface reflectance). Level-2A is considered an "analysis-ready" product because the data values correspond more closely to what's on the ground (you can compare across dates better, do quantitative analysis like indices without worrying about thin cloud or aerosol effects as much). Initially, users had to run atmospheric correction themselves (using tools like Sen2Cor), but now the European Space Agency actually produces L2A for most regions operationally (and certainly for recent years, all Sentinel-2 imagery in the archive over land is available as L2A). In this training, whenever possible, we use L2A because it saves us the step and generally gives better results for analyses like classification. However, be mindful: not all portals give you L2A by default – some might give L1C and you convert it. Google Earth Engine, for instance, offers both; you have to pick the collection you want.

- **Uses and Examples:** Sentinel-2 is a **workhorse for land monitoring**. If you want a **detailed land cover map**, Sentinel-2 is fantastic – you can differentiate forests, agriculture, water, urban areas, etc., especially if you use multi-date composites. It's widely used for **NRM (Natural Resource Management)** – e.g., mapping forests and detecting deforestation, monitoring crops throughout the season, assessing water quality in lakes (the color changes with chlorophyll or sediment), and even coastal applications (Sentinel-2 can see through shallow clear water to map coral reefs and seagrass beds up to a certain depth, which is very relevant to us in a country with so much coral reef area!). For **Climate Change Adaptation (CCA)** studies, Sentinel-2 provides baseline data to see changes over time – for instance, tracking how mangroves are migrating or how urban heat island areas expand (with some help from thermal data, but Sentinel-2 can map the urban surfaces). And in **DRR**, we use it to assess damage after events (like mapping where roofs were destroyed by a typhoon, if you have a clear-sky image shortly after an event, you can compare it to before). One limitation though: if a disaster (say a flood) is accompanied by clouds (as floods often are), Sentinel-2 might not get a clear view until days later, which is why Sentinel-1 is often the go-to for *immediate* disaster mapping. But Sentinel-2 can be used in the aftermath when weather clears, to assess things like vegetation stress after a drought or the extent of burn scars after a wildfire.

(Engagement:) Many of you might have worked with optical imagery before. **Anyone want to share a use-case or a challenge they faced with Sentinel-2?** (Invite one person if time allows; e.g., someone might mention cloud cover or data volume). Yes, the **cloud cover issue** is something we all struggle with – we'll show you techniques like cloud masking and using image composites in the hands-on sessions. And indeed, the **data volume** is large – one image tile can be 800 MB or more. That's why using platforms like Earth Engine or our local mirror (which I'll discuss later) can help manage that.

Alright, so we've covered the two sensors in detail – Sentinel-1 (radar) and Sentinel-2 (optical). At this point, you should have a sense of what each brings to the table. Next, I want to briefly explain how we **get these data** – the access methods – and then we'll look at some real-world examples in the Philippines.

Slide 7: Sentinel Data Products & Access *(Time: ~7 min)*
Speaker Notes:
On this slide, I've summarized **data product levels and how to access Sentinel data**:

- **Product Levels Recap:** As mentioned, **Sentinel-2 Level-1C** (TOA reflectance) and **Level-2A** (surface reflectance) are the main formats you'll encounter. If you download from the Copernicus Open Hub (also known as SciHub), you often get L1C by default; some newer hubs or DIAS platforms allow direct L2A downloads. For **Sentinel-1**, the go-to product is **GRD (Level-1)** which is geo-referenced backscatter intensity. If anyone needs phase data for advanced work, that's Sentinel-1 **SLC (Level-1 SLC)**, but that's specialized. There are also higher-level products like **analysis-ready SAR backscatter** (some platforms process GRD to radiometrically terrain-corrected gamma-nought) or **mosaics**, and for Sentinel-2 there are things like **level-3 composites** (e.g., annual cloud-free mosaics created by combining images). But those are typically created by value-added providers or platforms; Copernicus itself provides the level-1 and 2.

- **File Formats and Sizes:** Just a quick note – Sentinel-2 data come in tiles with multiple files (JP2 images per band, plus metadata). Sentinel-1 GRDs come as a zip with TIFF images for each polarization and an XML. These can be tens to hundreds of MB each (or more). So managing this data could be heavy if you download a lot.

- **Access Methods:** How do we get the data? There are several ways:

- **Copernicus Open Access Hub (SciHub):** This is the **official portal** by ESA. You can search for images by date, location, and download them. It requires a free login. It's reliable but can be slow – imagine everyone worldwide pulling data from it. Also, our internet bandwidth can be a bottleneck, especially for many GBs of data.

- **Copernicus DIAS (Data and Information Access Services):** The EU has cloud platforms (names like CREODIAS, Mundi, ONDA, etc.) where you can find Sentinel data. They often allow you to process data in the cloud or download via API. This is more for advanced users or if you have cloud computing resources; I just mention it for completeness.
- **AWS (Amazon Web Services) Open Data & Others:** Sentinel-2 (and some Sentinel-1) data are mirrored on AWS and on Google Cloud as public datasets. This means if you use those cloud services or something like the **Sentinel Hub** API, you can stream tiles without going to SciHub. Some third-party platforms (like EO Browser, Sentinel Hub Playground) let you easily preview and get small downloads of imagery.
- **Google Earth Engine (GEE):** I know many in the geospatial community here have started using Earth Engine. GEE **hosts a copy of Sentinel-1 and Sentinel-2 collections** and lets you query and process them through JavaScript or Python code. The huge advantage is you don't have to download raw data to your PC; you run code and it crunches on Google's servers, returning results (like a classification map or a chart). We will be using GEE in one of our hands-on sessions (for land cover classification with Random Forest, I believe). If you haven't used it, don't worry – we'll guide you. But those who have, you know it's a powerful tool to handle big EO data without local headaches.
- **CopPhil Mirror Site:** I'll talk more about this in detail at the end, but essentially, as part of this CopPhil program, a **Copernicus Mirror Site** has been set up in the Philippines. This is *huge* for us – it's the first in Asia. It means a local data center is storing Sentinel data, so we can download or access it much faster than pulling from Europe [6]. We'll see how you can use it later. It should drastically reduce download times and latency for heavy datasets.
- **PhilSA's Space Data Dashboard:** PhilSA's platform (Space+ Data Dashboard) also offers access to various datasets. I believe it's integrating an Open Data Cube on the back-end. It might not (yet) have every raw Sentinel scene available to manually download like SciHub does, but it provides **layers and data** that are derived from satellites (and possibly some download on request). We'll discuss that when we talk about PhilSA.

(Interactive prompt:) I'm curious, **how are you currently accessing satellite data?** Anyone using Earth Engine regularly? Or do you stick to downloading from providers (maybe the Sentinel AWS bucket or NASA's LandSat archive)? (Allow a couple of responses.) It sounds like we have a mix – some are using GEE for convenience; others mentioned issues with slow downloads from SciHub. Hopefully, the mirror site will help those doing direct downloads, and our training in GEE/Python will help others process data more efficiently.

- **Data Access Demo Idea:** Just to illustrate quickly, if I were to search for data *today*: say a recent Sentinel-2 image of Metro Manila, I could go to SciHub, define the date range and area, and I'd get a list of images, maybe one every few days, and I can download the zip file. On Earth Engine, I would just write a few lines of code to filter the collection by date and bounds and maybe cloud cover < 20%, and get a composite or median. So there are different approaches – each with pros/cons. Feel free to ask me later which method might be best for your use-case.

Alright, with data access covered, let's shift gear and talk about **use cases** – how all this theory about resolution and revisit actually benefits us on the ground. I'll give a few examples relevant to the Philippines in **DRR, CCA, and NRM**. And I encourage you to think about how you could apply these in your own projects or agency mandates.

Slide 8: Use Case – Disaster Risk Reduction (Flood Mapping) *(Time: ~7 min)*
Speaker Notes:
For **Disaster Risk Reduction (DRR)**, one of the clearest examples is **flood mapping during typhoons**. We

all know the Philippines faces frequent typhoons that cause heavy flooding – like *Typhoon Ulysses* (Vamco) in November 2020 which severely flooded parts of Luzon. So how can Sentinel data help?

- **Flood Extent Mapping with Sentinel-1:** During Typhoon Ulysses, much of Central Luzon was under thick cloud due to the storm. Traditional optical satellites couldn't see the ground. But **Sentinel-1 SAR** was used to **delineate flooded areas** even while the storm was ongoing. Radar imaging penetrates the clouds and provides data day or night, which is **critical in an emergency** because responders can't wait for clear skies. In that event, analysts took Sentinel-1 images from before and during the flood, and by comparing them (using techniques like change detection or simply thresholding the SAR backscatter), they generated flood extent maps within hours. These maps showed which communities were underwater, how far the flooding had spread.

- **Why it matters:** These **flood maps from SAR** give authorities a nearly real-time picture of the disaster. This is often **well before field reports** or aerial surveys can paint a full picture. In the case of Ulysses, such maps helped identify badly flooded barangays so that rescue teams and relief goods could be prioritized to those areas. In a country where floods can extend over vast rice fields and towns, having a satellite's eye view is incredibly valuable. And automating this using AI (like a flood detection model) can make it even faster – essentially providing **faster emergency response** and more targeted relief and recovery planning.

(Optional:) In fact, later in this course, we will do a **hands-on exercise** where we use a **U-Net deep learning model** on Sentinel-1 data to map floods (the case study is indeed based on a major typhoon flood in Luzon). That will be in Session 2 or 3. So you'll get to practice exactly how this works – leveraging the dual polarization VV/VH channels from Sentinel-1 to discriminate water vs. land. By the end, you'll see how an AI model can produce a flood extent map that you could potentially deliver to disaster managers.

- **Other DRR uses:** Floods are just one example. We also use Sentinel data for **storms and damage assessment** (e.g., using Sentinel-2 after a typhoon to see where vegetation has been stripped or roofs blown off, by comparing pre- and post-event images). Sentinel-1's interferometric capability allows **earthquake or landslide monitoring** – for example, detecting ground subsidence or uplift of just a few centimeters, which is useful for identifying unstable slopes or tracking post-earthquake ground deformation. And don't forget volcanoes: Interferograms from Sentinel-1 can show inflation of a volcano's surface, helping agencies like Phivolcs with an additional data source to assess volcanic activity. During the Taal Volcano eruption in 2020, SAR images were used to map the extent of ashfall and also the changes in the volcano's island before and after eruption.

(Engage:) Let me ask – **how many of you are involved in disaster management or have had to produce maps during disasters?** (Perhaps a few hands, given NAMRIA, PAGASA, etc., often support these efforts.) If you have, and haven't yet used SAR, I highly encourage you to explore it. The initial learning curve is worth the life-saving information it can provide. And with the tools and training from CopPhil, we hope you'll be equipped to do that.

Alright, that's DRR. Now let's move to a different but related theme: **Climate Change Adaptation**.

Slide 9: Use Case – Climate Change Adaptation (Drought & Environment) *(Time: ~7 min)*
Speaker Notes:
For **Climate Change Adaptation (CCA)**, the key is often **monitoring environmental changes over time**

and **predicting or preparing for climate-related impacts**. Let's talk about an example: **drought monitoring in agriculture**, which is a growing concern as weather patterns shift.

- **Drought Monitoring with Sentinel-2 NDVI:** In parts of the Philippines like Mindanao, droughts (whether from El Niño or changing climate trends) can stress crops and reduce yields. Satellite data can help detect early signs of drought stress by looking at vegetation health. **NDVI** (Normalized Difference Vegetation Index) derived from Sentinel-2 is a common indicator for this. By analyzing a **time series of NDVI images** over months and years, we can spot anomalies – for instance, if a normally green season shows much lower NDVI this year, that area might be undergoing drought stress. In our training, we have a case study on **drought monitoring in Mindanao's agricultural zones** (like Bukidnon) using **LSTM neural networks** on NDVI time series [7]. The idea is to use machine learning to capture the temporal patterns – LSTMs can "learn" seasonal cycles and then flag when the vegetation doesn't follow the normal pattern, indicating a possible drought [8]. This addresses CCA because it helps anticipate and respond to drought impacts on crops, enabling early interventions (like water management or aid to farmers) [8].

- **Why AI and time-series?** Because climate impacts often unfold over time, having models that look at sequences (like months of data) is crucial. An **LSTM (Long Short-Term Memory)** model is a type of recurrent neural network that is good at time series; it effectively can "remember" what happened in prior months and detect long-term dependencies [9]. For example, an LSTM could be trained on historical NDVI and rainfall data so that, given recent conditions, it might predict the likelihood of drought conditions developing. This is a more advanced use-case, but it shows how Copernicus data (the NDVI from Sentinel-2) combined with local data (maybe PAGASA's rainfall) can feed into climate resilience tools.

- **Coastal and Marine Monitoring:** Another CCA-related use case in the Philippines is **coral reef and coastal habitat monitoring**. As ocean temperatures rise, we're seeing more **coral bleaching** events. Sentinel-2, with its 10 m resolution and coastal bands, has surprisingly been used to monitor shallow coral reef health (clear water permitting). One of the CopPhil pilot projects is focused on **Coastal Marine Habitat** mapping [10] [11]. They use Sentinel-2 to derive things like **Satellite-Derived Bathymetry** (water depth) and classify **benthic habitats** (coral, seagrass, sand) to see changes over time [12]. By comparing images, we can detect bleaching (corals turn white – reflectance changes) or coral mortality. This is important for adaptation because healthy reefs protect coastlines from waves; if they degrade, communities become more vulnerable. So monitoring where bleaching is happening lets us pinpoint which areas might need protection or restoration.

- **Forestry and Land Use:** Climate adaptation also includes managing our forests and land use. Deforestation can exacerbate climate impacts (loss of carbon sinks, more runoff). Sentinel-2 is used to regularly map forests – identifying areas of illegal logging or burn scars from wildfires. With frequent imagery, the DENR or local governments can respond faster. Even urban expansion (which can create urban heat islands) is monitored with Sentinel-2; the data helps city planners incorporate green spaces to adapt to hotter temperatures.

(Engage:) Does anyone work on climate-related projects, like maybe with PAGASA or DENR on climate risk? If so, think about how these Earth observation tools could enhance your work – whether it's providing evidence of changes or feeding into models. And don't worry if the AI part (like LSTMs) sounds complex – we

will break it down in a later session. The key takeaway now is: **Sentinel data lets us observe climate impacts (droughts, coastal changes, etc.) systematically and thus plan adaptation strategies**.

Alright, let's move to the third theme, **Natural Resource Management**, which is about using EO data for sustainably managing our forests, agriculture, water, and so on.

Slide 10: Use Case – Natural Resource Management (Land Cover & Forests) *(Time: ~7 min)*
Speaker Notes:
For **Natural Resource Management (NRM)**, a fundamental need is a good **land cover map** – knowing what is where (forest, crops, urban, water, etc.) and how it's changing. The Philippines, through NAMRIA, has done national land cover mapping (e.g., 2010, 2015 land cover maps) often using satellite data (Landsat historically). Now with Sentinel-2's higher resolution and frequency, we can update and refine such maps more often and with better detail.

- **Land Cover Mapping with Sentinel-2:** One example we will look at is **land cover classification in Palawan** [13]. Palawan is known for its rich biodiversity but also faces pressures from development and agriculture, making it a prime case for NRM. Using Sentinel-2 imagery, we can classify the island's land cover into categories like forest, mangroves, agricultural land, built-up areas, and so forth. In this training, we actually have a hands-on exercise where participants will use **Google Earth Engine and a Random Forest classifier** to create a land cover map for a part of Palawan [13]. By using multi-month composites of Sentinel-2 (to get cloud-free views) and gathering some training samples, a model can be trained to identify different land cover types. The result is a map that can help local authorities in Palawan see where deforestation is happening, how much farmland vs. forest there is, etc. This directly supports NRM by informing policies – for example, if you know which areas of forest are left, you can prioritize those for conservation.

- **Forest and Crop Monitoring:** Beyond static maps, Copernicus data supports **continuous monitoring**. For instance, **forest cover change detection**: with frequent images, one can set up an alert system (if a patch of forest suddenly gets cleared in a new image, it flags an alert). Or **crop monitoring**: Sentinel-2 can monitor crop growth stages, which, when combined with yield models, helps in agricultural planning and food security (e.g., estimating rice yield, or detecting pest/disease outbreaks if a field's vegetation signal deteriorates unexpectedly). The CopPhil pilot I mentioned under Land Cover is actually broader – it's **Land Cover, Forest & Crop Mapping Service**, aiming to deliver layers like crop type maps and forest extent using both Sentinel-1 and 2 [14]. These will be open-source and regularly updated, providing detailed info for decision-makers [15].

- **Integration with Local Data:** Often, local datasets improve these efforts. For example, if NAMRIA has a good baseline map or ground reference points, we use those to train or validate our satellite-based maps. Or if the Department of Agriculture has field data about what crops are planted where, integrating that with Sentinel imagery yields more accurate classification. This highlights the earlier point: **local data + Sentinel = richer analysis**. We'll talk in a moment about where to get some of those local layers (like from NAMRIA's Geoportal or DOST projects).

- **Other NRM uses:** Natural resources also include water (monitoring reservoirs or surface water extent – Sentinel-1 is great at mapping water bodies even under clouds, Sentinel-2 is great when clear), and coastal resources (mangrove mapping, fishpond monitoring). There have been projects mapping all Philippine mangroves with Sentinel data to aid in their protection and restoration. For fisheries, knowing the extent of fishponds or coastal habitat helps in planning and sustainable use.

(Engage:) Many of you are likely involved in environmental monitoring. **Do you find that your agencies need more up-to-date land cover or resource maps?** (If someone from say DENR or NAMRIA is present, they might nod). With these satellite tools, we can shorten the update cycle – maybe from every 5 years to every 1–2 years or even real-time monitoring. One of our goals in this program is to empower you to create these maps or analyses yourselves using AI/ML, rather than relying solely on external maps.

That wraps up our use case examples. We saw how Sentinel-1 and 2 support **DRR (faster flood/disaster mapping)**, **CCA (monitoring droughts and environmental changes)** [8], and **NRM (mapping and monitoring resources like forests and crops)** [13]. I hope those gave you a clearer picture of why these satellites are so valuable.

(Transition:) Now, having understood the data and its uses, let's localize things further. We're going to talk about the **Philippine EO ecosystem** – basically, *who* in the Philippines is doing what in Earth Observation, and what platforms and programs exist that you can leverage. It's important to know the network of agencies and tools at your disposal, so you're not working in isolation. This also might introduce you to potential partners or data sources for your projects.

Slide 11: The Philippine EO Landscape – Key Agencies & Initiatives *(Time: ~5 min)*
Speaker Notes:
This slide is an overview of the **key players in the Philippines** when it comes to Earth Observation (EO) and geospatial data. We have a growing, vibrant ecosystem:

- **PhilSA (Philippine Space Agency)** – the lead government agency for all things space, including Earth observation.
- **NAMRIA (National Mapping and Resource Information Authority)** – the central mapping agency, caretaker of our national geospatial datasets.
- **DOST-ASTI (Advanced Science and Technology Institute)** – a research institute under DOST that runs a lot of tech projects, including remote sensing and AI initiatives.
- **PAGASA (Philippine Atmospheric, Geophysical and Astronomical Services Administration)** – the national weather and climate bureau, providing critical meteorological data.

Each of these, plus some special projects/platforms under them, forms the landscape. And they often collaborate. In fact, this CopPhil program itself is co-steered by **PhilSA and DOST**, reflecting a partnership between the space agency and the science & tech department [16].

What's encouraging is that the Philippines is increasingly becoming a **regional leader** in EO – not just consuming data but building infrastructure (like that mirror site) and expertise (like you all, through this training). The EU sees the Philippines as a pioneer for Copernicus outside Europe [17].

I will go through each agency and their relevant platforms in the next slides. As I do, think about which of these you interact with or could benefit from. For example, if you need a base map or an elevation model, do you go to NAMRIA? If you need satellite images, do you reach out to PhilSA or ASTI? If you need climate data, that's PAGASA, etc.

Let's start with **PhilSA** – the Philippine Space Agency.

Slide 12: Philippine Space Agency (PhilSA) *(Time: ~5 min)*
Speaker Notes:
PhilSA is fairly new – it was established by the Philippine Space Act (Republic Act 11363) in 2019 and has been ramping up operations since 2020. Despite being new, it's taken on a central role for EO in the country. A few points about PhilSA:

- **Mandate:** PhilSA is tasked to develop and promote the national space program. One of its key areas is **Space Applications**, which includes using satellites for earth observation. They inherit some responsibilities from older initiatives (like DOST's collaborations on the Diwata micro-satellites), and are building new ones. Essentially, PhilSA coordinates acquiring, archiving, and disseminating satellite data for the Philippines, among other space science work.

- **Copernicus Cooperation:** PhilSA is the main local partner for the EU's Copernicus program here. So the **CopPhil project** that funds this training is largely implemented with PhilSA. They co-chair the program's steering with DOST. What does that mean for you? It means PhilSA is actively working to make Copernicus data accessible and useful nationally. They host the infrastructure like the **Copernicus Mirror Site** (likely at their facility) and are involved in developing **pilot services** using Copernicus data (e.g., land cover maps, disaster apps as we discussed) [18] .

- **Space Data Dashboard (Space+):** One of the cool platforms PhilSA has developed is the **Space Data Dashboard (SDD)**, often called "Space+". This is a **web-based platform** intended to **democratize access to space data** for both institutions and citizens [19] [20] . It's built with open-source tech (they use OpenDataCube, TerriaJS, etc. under the hood) [21] . Through the dashboard, you can **visualize geospatial datasets** (both spatial and non-spatial) and download them. It includes data like satellite images and derived products. For example, they may have direct downloads for certain imagery or ready maps (the paper about it mentions it offers **direct downloads of various space-derived datasets** [22]). The goal is to **empower government units and the public** by making data easy to access, so decisions can be data-driven [20] . Think of it as the Philippines' own little "geoportal for satellite data". If you haven't seen it, we encourage you to check it out (spacedata.philsa.gov.ph is the link). It's relatively new – I believe an enhanced version was launched in August 2024 [23] .

- **Other PhilSA Data/Services:** PhilSA also has a role in receiving data from our own satellites (like Diwata-2 and the upcoming MULA Earth Observation satellite). They have ground stations that capture satellite data. As those come online, the Space Data Dashboard could also serve local satellite imagery. Additionally, PhilSA is building local expertise – so they have training programs (some of you might have attended a PhilSA webinar or training on remote sensing). They also provide advisory for government projects on integrating satellite data.

(Engage:) For those of you in government agencies, PhilSA can be a partner. **Have any of you interacted with PhilSA or used the Space Data Dashboard yet?** (If yes, maybe someone mentions it; if not, say it's worth exploring). If you have any trouble accessing data, PhilSA can often assist or point you to the right resource. They're here essentially to make space data work for the nation.

Okay, next, let's talk about **NAMRIA** – a more established agency that many of you likely know.

Slide 13: NAMRIA and the Philippine Geoportal *(Time: ~5 min)*
Speaker Notes:
NAMRIA (National Mapping and Resource Information Authority) has been around for decades under the Dept. of Environment and Natural Resources (DENR). They are the ones who produce our official maps and maintain national geospatial databases. How do they fit into EO?

- **Base Maps and Surveys:** NAMRIA produces the base topographic maps of the country, bathymetric maps, etc. They maintain the **Philippine Geodetic Reference System** (all those survey benchmarks) and are the go-to for accurate baseline data like administrative boundaries, elevation models, coastlines, etc. While they might not operate satellites, they use EO data (like Landsat, etc.) to update these products.

- **Land Cover Mapping:** NAMRIA is known for producing official **Land Cover maps** of the Philippines (for years like 2003, 2010, 2015, etc.). They typically use remote sensing and GIS for that. For example, the 2015 land cover dataset was made using Landsat-8 imagery classification. These land cover maps are very useful as training data or reference for AI models. They categorize the country into forest, mangrove, agriculture, built-up, etc., and are used in environmental planning. If you're doing an EO project and need "ground truth" or labels, NAMRIA's land cover is a great starting point – though note it might be slightly outdated or coarse in some areas, but it's nationally consistent.

- **Hazard and Resource Maps:** Through collaborations with other agencies, a lot of **hazard maps** and resource maps end up being accessible via NAMRIA. For instance, the Mines and Geosciences Bureau (MGB) creates landslide and flood susceptibility maps; NAMRIA helps in hosting some of those data. The **Geoportal** has layers like active fault lines (from Phivolcs), flood hazard maps, etc. So rather than chasing each agency, you can often find these in one place.

- **Philippine Geoportal:** The **Philippine Geoportal** (geoportal.gov.ph) is NAMRIA's public platform for sharing geospatial data. It's essentially a map viewer and data catalog. Users can browse layers, overlay them, and download if available (some are open, some might require permission). The geoportal includes layers such as:

- Administrative boundaries (regions, provinces, etc.).
- Topographic maps and satellite image basemaps.
- The national land cover dataset.
- Various hazard maps (flood, landslide susceptibility).
- Environmental data like forest cover, protected areas, and more.

If you haven't used it yet, do check it out. It can save you time in hunting data – for example, instead of manually georeferencing a PDF map of flood hazards for your province, you might find a ready GIS layer on the Geoportal.

- **Importance in EO/AI:** For AI and EO work, NAMRIA's data are valuable for **training and validation**. Suppose you want to train a model to classify forests in Sentinel-2 images – you can use NAMRIA's land cover map to extract training points labeled "forest" and "non-forest". Or if you're mapping flood extents from SAR, you can compare your results to NAMRIA/MGB's flood hazard zones to see if floods occurred in high-risk areas. Essentially, they provide the context and baseline.

(Engage:) I suspect many of you have downloaded something from the NAMRIA geoportal before. **Anyone want to share a quick experience?** (Maybe someone can say they got admin boundaries or something). If not, I'll just emphasize: make use of these national datasets. They are a public good that can strengthen your EO analyses.

Now, moving on to **DOST-ASTI**, which brings in the tech and R&D side of things.

Slide 14: DOST-ASTI and EO/AI Initiatives (DATOS, SkAI-Pinas) *(Time: ~5 min)*
Speaker Notes:
DOST-ASTI (Advanced Science and Technology Institute) is under the Department of Science and Technology. They are essentially the ICT and electronics R&D arm of DOST, and they manage a lot of the country's science infrastructure (networks, computing, etc.). ASTI has been very active in remote sensing and lately in AI. Let's break down their projects mentioned:

- **DATOS Project:** *DATOS* stands for **Remote Sensing and Data Science Help Desk**. This project was initiated around 2017 by ASTI. The concept was to create a team that can quickly harness satellite data and other info to support disaster management and other government needs. Think of them as a special unit of "geospatial first responders." For example, after a typhoon or an earthquake, the DATOS team would process satellite images (Sentinel, PlanetScope, etc.) to produce maps of affected areas, and provide those to agencies like NDRRMC. They also entertain requests – if some local government or relief agency asks, "Can we get a map of flooding in our area?", DATOS can help generate those using remote sensing and AI tools. Over time, DATOS has built up methodologies for floods, burn scars, damage assessments, etc. If you've seen those maps on social media after disasters with ASTI or DOST logos, that's likely DATOS. For you all, DATOS can be an ally – if you need some quick analysis or want to collaborate on applying AI to disasters, they have experience. Also, some outputs from DATOS are available publicly (they sometimes publish maps via DOST-ASTI channels).

- **SkAI-Pinas:** Pronounced "Sky Pinas," this stands for **"Philippine Sky Artificial Intelligence Program"**. It's a **flagship AI R&D program** funded by DOST. The idea behind SkAI-Pinas is to **democratize AI** in the Philippines, especially for big data like remote sensing [24]. It's like an umbrella program under which various projects fall – including those building datasets, AI models, and infrastructure for AI in the country. ASTI leads it, but it involves collaborations with universities and other institutes. A major challenge it addresses is that while AI is booming, many organizations here lack access to the tech or know-how. SkAI-Pinas aims to fill that gap, so AI becomes accessible "for every Filipino," especially in solving local problems [25]. They have components dealing with automated data labeling, with deploying AI for agriculture, disaster, etc. If I recall, one component called **ASTI-ALaM** (Automated Labeling Machine) deals with creating tools to label imagery efficiently – which is crucial for training AI models (they even exhibited some of this at science fairs). In summary, SkAI-Pinas is pushing the frontier of AI in EO for the Philippines.

- **Relation between DATOS and SkAI-Pinas:** DATOS is more of an operational help desk; SkAI-Pinas is an R&D program. But they complement each other – lessons from disaster mapping feed into developing better AI models, and AI models developed can be used by DATOS for faster mapping.

(Engage:) This is quite forward-looking. **Are any of you involved in SkAI-Pinas or have attended their events?** They hold an annual congress and trainings. If not, and if you're interested in AI for EO, it's

something to watch or even participate in, because they often open opportunities for collaboration, pilot projects, etc.

We have two more acronyms under ASTI: **DIMER and AIPI**, which are actually part of these AI initiatives. They're important for making AI tools usable by end-users, so let's discuss those next.

Slide 15: DOST-ASTI's DIMER and AIPI Platforms *(Time: ~5 min)*
Speaker Notes:
Continuing with ASTI's innovations, we have **DIMER** and **AIPI** – these are platforms being developed to bridge the gap between AI models and users who need them:

- **DIMER (Democratized/Decentralized Intelligent Model Exchange Repository)** – You can think of DIMER as a **repository or "store" for AI models**. The aim is to **lower barriers to AI adoption** by providing a collection of **pre-trained, ready-to-use AI models** for various applications [26] [27]. For instance, say a local government unit wants to use AI to map floods but they don't have data scientists – they could go to DIMER, find a "flood mapping model" that's been trained on Philippine data, and download or utilize it. The models in DIMER are **modular and tailored to local needs** [28] – examples might include models for crop classification, building detection, yield prediction, etc., aside from flood mapping. DIMER was born from the ASTI-ALaM project (the labeling machine project), focusing on sharing the **"brains"** (the models) developed in programs like SkAI-Pinas [26]. The idea is similar to an app store but for AI models: one can **share, access, and even improve models** via this platform [29]. They call it "Democratized" or sometimes "Decentralized" Intelligent Model Exchange – meaning it's distributed and open. By providing these models, DIMER effectively **cuts down the time** and expertise needed to deploy AI – users don't have to start from scratch, they can build on existing work [30]. It's still in development, but ASTI's director has expressed that they see it as a hub that will empower organizations across PH to integrate AI readily [31] [32].

- **AIPI (AI Processing Interface)** – If DIMER provides the AI models (the "brains"), **AIPI provides the "muscle" or interface to use those models** [33]. AIPI is essentially a platform or API that lets you **run AI models on EO data on-demand** [34] [35]. Think about it: having a model file is one thing, but if you don't have a powerful computer or the coding ability, how do you apply it to your own data? AIPI aims to solve that. It might work like this: you log into a web portal, upload or point to an image (say a new Sentinel-1 image of your province), select a model from the library (for floods, for example), and the interface will run the model on the image and give you the output (like a flood map) [36]. All the heavy lifting happens on the server side, where ASTI presumably has GPUs or HPC resources. This means even a small LGU office with just a laptop and a slow internet can still leverage a state-of-the-art AI model via AIPI – they don't need to install special software or have big computing power [33]. In summary, AIPI is about **model serving and deployment** – making it easy to plug AI into operations. It's under the SkAI-Pinas umbrella as well, complementing DIMER [36].

- **Why these matter for you:** If you're thinking ahead after this training – "How can I use AI models in my own work without always coding from scratch?" – DIMER and AIPI could be the answer. For example, maybe after this training, ASTI might put the flood U-Net model on DIMER. Then during an actual flood, you could go to AIPI, feed in the latest Sentinel-1 image, and get a flood map out, without having to retrain anything. That's the vision: **making AI accessible even to those who aren't AI experts** [33]. It effectively democratizes the tech beyond just those who attend specialized trainings.

(Engage:) These platforms are still evolving. **If you have ideas or needs**, I'm sure the ASTI team would welcome feedback. For instance, "We need a model that can detect coral reef damage" or "We have drone imagery of rice fields, can we have an AI for that?" – those could become entries in DIMER. The beauty is that it encourages **sharing and collaboration** – models built by one agency or university can benefit others.

So, tying up ASTI's section: with **DATOS**, **SkAI-Pinas**, **DIMER**, and **AIPI**, DOST-ASTI is providing both the **services and the infrastructure** to push EO and AI integration in the Philippines. Keep an eye on them, because they are essentially building the tools that might become your daily drivers in a few years.

Lastly, let's cover **PAGASA**, our weather bureau, which is another crucial piece of the puzzle.

Slide 16: PAGASA – Weather, Climate and EO *(Time: ~3 min)*
Speaker Notes:
PAGASA (Philippine Atmospheric, Geophysical and Astronomical Services Administration) might not be an EO agency per se, but it's the authoritative source for **weather and climate data** in the country, which often go hand-in-hand with satellite EO projects.

- **Weather Data:** PAGASA provides all the weather forecasts, typhoon warnings, rainfall measurements, etc. They have a network of ground stations (rain gauges, radars, etc.) and also receive data from weather satellites (like Himawari-8 for cloud imagery). If you are doing any project involving rainfall, flooding, drought, storms – PAGASA's data is indispensable. For example, if you map a flood with Sentinel-1, you'd likely want to know how much rain fell in that area – PAGASA's rainfall data or Doppler radar can tell you. If you're monitoring drought via NDVI, you'd correlate that with PAGASA's records of rainfall deficits or temperature anomalies.

- **Climate Data and Projections:** For climate change adaptation work, PAGASA has historical climate datasets and future projections (they've done downscaled climate models for the Philippines). If you want to see how temperature or rainfall patterns have changed over decades, or what's expected in the 2040s, PAGASA has studies on that. Integrating those with EO can give deeper insight – e.g., combining land cover change (from satellites) with climate trends to identify emerging hotspots of vulnerability.

- **Meteorological Satellites:** While our focus is on Sentinel, note that PAGASA uses other satellites for weather (like Japan's Himawari for cloud imagery, which is available every 10 minutes). These can be complementary to our analysis – e.g., Sentinel-1 might show a flood, and Himawari imagery can confirm when the clouds cleared or how the typhoon moved. There's also a Copernicus service called **GloFAS** for flood forecasting and **SWICCA** for climate, etc., which PAGASA might tap into.

- **Use in AI/ML:** In advanced applications, you might integrate weather data into machine learning models. For instance, a flood prediction model might take as input both the satellite-derived soil moisture and PAGASA's forecast rainfall. Or a crop yield model might use PAGASA's sunshine duration data along with NDVI. So, remember that EO doesn't exist in a vacuum; ground and atmospheric data from agencies like PAGASA enrich any analysis.

(Engage:) **Anyone here from PAGASA or collaborating with them?** If so, you know that they're quite open to collaboration and they publish monthly climate bulletins, etc., that can be very useful. If not, at least be

aware that when you need climate or hazard info, PAGASA is the go-to. For example, if you develop an AI model that predicts drought, you'd likely validate it against PAGASA's drought index data.

So that covers the major agencies. The take-home message is: **we have a supportive ecosystem** – PhilSA for satellite access and space tech, NAMRIA for base maps and geoportal data, DOST-ASTI for advanced tools and R&D in AI, and PAGASA for weather/climate context. And these groups are increasingly working together (for example, PhilSA and ASTI are both under DOST umbrella for some projects, and NAMRIA data feeds into everyone's work).

Before I move on, I want to highlight again the importance of **local datasets complementing Sentinel data**. All these agencies produce data that you can layer with your Sentinel analyses – whether it's a land cover map to mask out urban areas, or a PAGASA rainfall map to validate a flood model. By combining **global data (Sentinel)** with **local data (Philippine maps, in-situ measurements)**, you get far more insight. For instance, a mangrove extent map from Sentinel-2 becomes more powerful when you intersect it with NAMRIA's cadastral maps (to see who manages that land) and PAGASA's sea level rise scenarios (to see which mangroves will be impacted). So always think of integration.

Now, to wrap up our session, we'll shift to an **activity/walkthrough**. I've talked about the CopPhil Mirror Site and the Digital Space Campus – now I'll show you what those look like and how to access them, since they will be valuable throughout this course and beyond.

Slide 17: CopPhil Mirror Site – Local Copernicus Data Access *(Time: ~5 min)*
Speaker Notes:
Here we introduce the **CopPhil Mirror Site**, which I've mentioned a few times. This is quite exciting – it's a new infrastructure in the Philippines as part of the CopPhil project.

- **What it is:** The Copernicus Mirror Site is essentially a **local data center** that stores Copernicus satellite data (like Sentinel imagery) here in-country. It's actually the **first Copernicus data hub in Asia** [37] [38]. It was officially launched during the "First Light" event in October 2024 at PhilSA [39] [6]. The mirror site is coupled with an **ad hoc cloud environment** – meaning there's also computing infrastructure alongside the storage [6]. In simpler terms, we now have a "copy" of the Sentinel archive (perhaps focused on Philippine and regional data) hosted by PhilSA/partners, with cloud servers to process that data.

- **Why it matters:** Before this, whenever we wanted Sentinel data, we'd typically have to download from Europe (ESA's servers or AWS in the U.S.). That can be slow (we've all experienced the pain of a download failing at 90% after hours!). With the mirror site, access becomes **faster and more reliable** within the Philippines. It reduces latency and dependency on international bandwidth. During disasters, this is crucial – if an undersea internet cable is down, local agencies can still get their satellite images from the mirror. This mirror site effectively **facilitates easier and quicker access to satellite data for users across the Philippines** [6].

- **How to access:** Now, this part is evolving. The mirror site might be integrated with platforms like the Space Dashboard or might have its own portal/API. For this training, you'll likely get access through the **Digital Space Campus** for specific datasets. If you are a developer, in the future you might have API endpoints or a web interface to query the mirror for images by date/area (similar to how you'd query the Copernicus Open Hub). I don't have a live demo to show in this script, but I can describe:

For example, one could log into the mirror site portal, search for “Sentinel-2 image on 2025-10-10 over Luzon”, and immediately download from the local server at high speed.

- **Demonstration:** I’ll now quickly navigate to the mirror site interface (if available) to show you. *(At this point, in a real session, the trainer might switch to a browser and show the interface, or a screenshot on the slide).* You can see it has a search bar for satellite data. I’ll enter an example query – say Sentinel-1, April 2025, Region 3 (Central Luzon). It returns a list of scenes. I can click one and hit download – notice how quickly the transfer starts (since it’s local). That’s a big improvement. There’s also an option to load the data into a cloud processing environment directly (if we have an account for the cloud, one could spin up a Jupyter notebook server near the data). This is part of that “cloud environment” built with the mirror.

- **Who can use it:** The mirror site is primarily for Philippine stakeholders – that means you! It’s intended to build our national capacity. During this training we’ll provide you with any needed credentials or links to access specific data from it. After the training, I anticipate that PhilSA will have a mechanism for agencies or researchers to request access if they want to use it regularly. We encourage you to do so rather than always relying on foreign servers – it also justifies the investment and helps improve the service when more users use it.

(Encourage participants:) If you have issues accessing data during exercises, let us know – maybe we can get it through the mirror site for you. And going forward, think of the mirror as your first stop for Copernicus data to support your projects.

Now, the other resource – the **CopPhil Digital Space Campus**, which is where all our training goodies are stored.

Slide 18: CopPhil Digital Space Campus – Training Materials & Community *(Time: ~7 min)*
Speaker Notes:
Finally, let’s talk about the **Digital Space Campus**. This is an online platform designed to support your learning not just in these four days, but even **after** the training.

- **What is it:** The Digital Space Campus is basically a **Learning Management System (LMS)** set up for CopPhil [40]. Think of it like an online portal where courses, modules, and resources are organized for self-paced access. It’s a bit like an online university for Earth Observation in the Philippines, powered by Copernicus and PhilSA.

- **Training Materials Repository:** One key feature – **all the materials from this training will be available there** [41]. That includes the slide presentations, lecture notes or scripts, sample code (Colab notebooks, etc.), datasets used in exercises, recorded lectures if any, etc. So if a month from now you want to revisit the flood mapping exercise we’ll do, you can log in to the Digital Campus and get the notebook and data again [41]. Or if you want to share something with a colleague who couldn’t attend, the platform ensures they can also benefit by accessing it later [42]. In other words, it’s not “one-and-done” – the content lives on for you to reuse.

- **Structured Courses & Modules:** The Campus organizes content into courses and modules [43]. Our **AI/ML EO training** will be listed as a course you can enroll in. Each session like today’s might be a module within that course. Modules can contain text explanations, videos (for example, a welcome message from the EU Ambassador was mentioned – perhaps they put that video there), and even quizzes or exercises [44]. It's like an interactive textbook plus classroom. You can **progress at your own pace** – so if you want to jump ahead to a later module or re-do an earlier one, you can. They may even offer **certificates or badges** for completion of modules (common in MOOCs), though we'll see if that's implemented [45].

- **Continuous Updates:** Importantly, the Digital Campus is meant to be a **living repository** [46]. The field of AI/ML in EO is evolving fast (as we all know – new models, new satellites). The platform will allow adding new case studies, new data, updated code over time [46]. For example, if next year a new Sentinel satellite is launched or a new deep learning algorithm becomes popular, the CopPhil team can add a lesson or module about it [47]. By being connected to this Campus, you'll have a way to keep your skills up-to-date **even after** this live training ends [48]. We encourage you to periodically log in and see what's new – it might be a new tutorial on something like using a Transformer model for land cover, or a new dataset on the platform.

- **Community Interaction:** A great feature of many LMS platforms (and expected here) is **forums or discussion boards** [49]. You can ask questions – for instance, *"Has anyone tried applying that drought monitoring LSTM to another province?"* or *"I encountered an error in the flood mapping code, any advice?"* – and either the trainers or your peers can respond [49]. It's a bit like a specialized StackExchange or Facebook group, but within the CopPhil community. This can grow into a support network for all of you. Additionally, announcements for **upcoming events** (like hackathons, webinars, maybe even job opportunities) might be posted there [50]. So it's worth checking in to not miss those opportunities.

- **Access & Navigation:** By Day 4 of this training (or maybe earlier), you will receive instructions on **how to create your account** on the Digital Space Campus and navigate it [51]. Some of you might have already been given login info; if not, it's coming. The interface is user-friendly: you log in, see the courses available, enroll in this one (and you might see others like "Land Cover Monitoring 101" etc. which you can also explore). You can download materials – for example, all these slides as PDF, the code notebooks as .ipynb, and data files. Perhaps start by grabbing whatever interests you – like the flood mapping Colab notebook – and then you can also look at **other courses** that might complement this one [52]. I know they have courses on **Land Cover, Forest, Crop monitoring** which are very relevant and can deepen some concepts we touch on [52].

- **Sustainable Learning:** The big picture is, the Digital Campus embodies the idea that **learning doesn't stop when the live sessions end** [53]. You'll have this as a springboard for continuous, self-paced development. You can also **share it with colleagues** who maybe couldn't join us live – they might be able to follow a substantial part of the course online later [54]. We strongly encourage you to not treat the end of Day 4 as the end of your journey. Instead, think of it as "graduating" to the Digital Campus where you can further practice, maybe take on advanced modules, and engage with the community.

(Show platform if possible:) Let me quickly show you the Digital Campus homepage. *(Trainer might show a browser or screenshot of the login page or course dashboard.)* You see it's branded with CopPhil and PhilSA. Once you log in, you have a dashboard of courses. Here's our course – inside it, modules are listed: Session 1, Session 2, etc., each with materials. For example, clicking Session 1 module might show a summary of today's lesson, downloadable PDF of slides, maybe an interactive quiz to reinforce key points, and links to

resources like the CopPhil website or references we cited. It's pretty neat. And if you finish modules, it might show a completion bar.

(Engage:) Please do make use of this platform. We'll have a short Q&A about it on Day 4 to ensure everyone is able to access it. If you encounter any trouble signing up or finding things, let us know – we have support staff who can assist. Also, if you have suggestions for content you'd like to see added in the future, that feedback is welcome too.

Slide 19: Conclusion & Questions *(Time: ~3 min)*
Speaker Notes:
We're almost at the end of Session 1. To **recap** in a few sentences: We took a deep dive into **Copernicus Sentinel-1 and 2 data**, learning about their characteristics – radar vs optical, spatial/spectral/temporal details – and the types of products available. We discussed how to get those data and how these satellites are freely available for our use [4]. We then explored real **use cases in the Philippines**: using Sentinel-1 for rapid flood mapping (DRR), Sentinel-2 for monitoring drought and environment changes (CCA) [8], and both for land cover and resource management (NRM) [13]. We identified the **key agencies and platforms** in our local EO ecosystem – PhilSA, NAMRIA, DOST-ASTI, PAGASA – and saw how their efforts (like PhilSA's Space Data Dashboard, ASTI's AI projects, NAMRIA's Geoportal, etc.) complement the use of Copernicus data. Finally, we introduced you to the **CopPhil Mirror Site** (your faster source of Sentinel data) [6] and the **Digital Space Campus** (your hub for training materials and continuous learning) [41] [43].

I want to emphasize that you now have at your fingertips both **world-class data** (Copernicus satellites imaging the whole globe) and a **national support system** (local data, infrastructure, and people) to make the most of that data. The combination is powerful. Over the next days, we'll equip you with the AI/ML techniques to turn that data into insights and solutions for DRR, CCA, and NRM challenges.

Before we close, let me ask: **Do you have any questions about what we covered in this session?** It could be anything – maybe you want clarification on Sentinel-2's bands, or how to access the mirror site, or who to contact at NAMRIA for certain data. Feel free to ask. *(Pause and address questions. If none forthcoming, you might prompt one: "For example, someone might wonder how cloud masking in Sentinel-2 works, or how often the Space Dashboard updates its data. I can clarify those…") *

If questions arise later, you can also post them on the Digital Campus forum or bring them up tomorrow – I'll be happy to follow up.

(Engagement & Reflection): To wrap up, I have a couple of reflection questions for you to think about (you don't have to answer out loud now, but keep them in mind): - *Which Sentinel data (1 or 2) do you think will be most immediately useful in your current work, and for what purpose?* (This helps you focus on what to pay extra attention to in the coming hands-on sessions.) - *Is there a local dataset from PhilSA/NAMRIA/PAGASA you haven't used yet that you think could really enhance your projects if combined with EO?* (Maybe after today you realized, "Oh, I should use NAMRIA's land cover as training data," etc.)

I encourage you to discuss these with colleagues during breaks – sometimes peer ideas spark new projects.

Alright! If there are no further questions, we'll conclude Session 1. You've been a great audience – thank you for your attention and participation. We'll take a short break now (if scheduled) and then move on to Session 2, where we'll start diving into the **core concepts of AI/ML** for EO. That's where we connect this data knowledge with machine learning techniques. So, see you shortly, and don’t wander off too far – exciting stuff ahead!

(End of Session 1.)

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